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Journal of Hearing Science®

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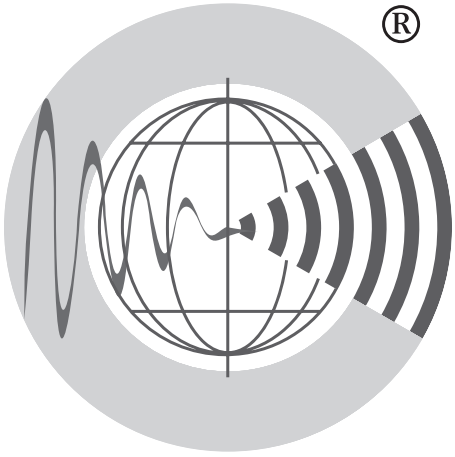

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Dear Colleagues,

We are pleased to present the latest issue of the Journal of Hearing Science, featuring a diverse array of research articles that advance our understanding in audiology and related disciplines.

The lead article explores the impact of background noise on wideband absorbance (WBA) measurements. As one of the newest tools in audiology, WBA assesses the efficiency of the middle ear in transmitting sound across a broad frequency spectrum. Unlike traditional tympanometry, which evaluates middle ear function at a single frequency, WBA offers a comprehensive analysis, enhancing the detection and differentiation of various middle ear pathologies, including otitis media, otosclerosis, and tympanic membrane perforations.

Other featured studies include the development of Tamil sentences for speech-in-noise tests tailored to various age groups, preliminary findings on prehabilitation in ENT with a focus on the clinical pharmacist's role during the perioperative period, and the introduction of the Swallowing Disorder Scale (SDS), a new Polish-language questionnaire designed for otolaryngology-phoniatry practice.

Additionally, this issue presents the books of abstracts from several significant conferences: the 2nd International Pediatric Audiology Congress (IPAC 2025) in Istanbul, Turkey; the XIII Otorhinolaryngology International Academic Conference (ORLIAC) in Warsaw, Poland; and the 3rd World Tinnitus Congress alongside the XIV International Tinnitus Seminar, also held in Warsaw. These compilations provide a comprehensive overview of current research and developments presented at these esteemed gatherings.

With kind regards and greetings,

Prof. Henryk Skarzynski, M.D., Ph.D., Dr. h.c. multi

Original articles

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E Preparation of manuscript
F Literature analysis/search
G Funds collection

IMPACT OF BACKGROUND NOISE ON WIDEBAND ABSORBANCE FINDINGS

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Abstract

Introduction: Measuring wideband absorbance (WBA) in noisy environments can potentially lead to inaccurate results due to noise contamination. However, research investigating the effect of background noise on WBA is scant. This study aimed to evaluate the effects of increasing levels of background noise on WBA results.

Material and methods: A non-randomised, cross-sectional, repeated measures design was used. Participants were 50 adults who passed otoscopic examination, pure tone audiometry, and tympanometry screening in their right ear. WBA was measured using an Interacoustics Titan immittance device under four broadband noise conditions: quiet (no applied noise), 55 dBA, 65 dBA, and 75 dBA.

Results: Increasing noise levels were associated with decreasing mean absorbance at 0.25–2.5 kHz with the greatest difference of 0.049 (normalised difference of 7.76%) found between the quiet and 75 dBA noise conditions at 1 kHz. Conversely, increasing noise levels were associated with increasing mean absorbance at high frequencies (4–8 kHz) with the greatest difference of 0.035 (normalised difference of 12.9%) found between the quiet and 75 dBA noise conditions at 5 kHz.

Conclusions: The present study found statistically significant differences in WBA findings with increasing broadband noise levels of up to 75 dBA. However, the WBA differences were too small to be of clinical significance.

Keywords: wideband absorbance • background noise • adults

WPŁYW SZUMU TŁA NA WYNIKI POMIARÓW ABSORBANCJI SZEROKOPASMOWEJ

Streszczenie

Wprowadzenie: Pomiar absorbancji szerokopasmowej (WBA) w hałaśliwym otoczeniu może potencjalnie prowadzić do niedokładnych wyników z powodu zanieczyszczenia hałasem. Jednak badania analizujące wpływ szumu tła na WBA są nieliczne. Niniejsze badanie miało na celu ocenę wpływu rosnącego poziomu szumu tła na wyniki WBA.

Materiał i metody: Zastosowano nierandomizowane, przekrojowe badania powtarzanych pomiarów. Uczestnikami było 50 dorosłych osób, którym wykonano następujące badania: otoskopię, audiometrię tonalną i tympanometrię w prawym uchu. WBA mierzono za pomocą urządzenia Interacoustics Titan przy czterech poziomach hałasu szerokopasmowego: cichym (bez zastosowanego hałasu), 55 dBA, 65 dBA i 75 dBA.

Wyniki: Wzrost poziomu hałasu wiązał się ze spadkiem średniej absorbancji na częstotliwościach 0,25–2,5 kHz, przy czym największą różnicę, wynoszącą 0,049 (znormalizowana różnica 7,76%), stwierdzono pomiędzy poziomem cichym i dla hałasu wynoszącego 75 dBA dla częstotliwości 1 kHz. I odwrotnie, wzrost poziomu hałasu wiązał się ze wzrostem średniej absorbancji na wysokich częstotliwościach (4–8 kHz) z największą różnicą 0,035 (znormalizowana różnica 12,9%) stwierdzoną między poziomem cichym i dla hałasu wynoszącego 75 dBA dla częstotliwości 5 kHz.

Wnioski: W niniejszym badaniu stwierdzono różnice istotne statystycznie w wynikach WBA wraz ze wzrostem poziomu hałasu szerokopasmowego do 75 dBA. Różnice WBA były jednak zbyt małe, aby mieć znaczenie kliniczne.

Słowa kluczowe: absorbancja szerokopasmowa • szum tła • dorośli

Key for abbreviations	
NICU	neonatal intensive care unit
nil	nothing
pers comm	personal communication
SNR	signal-to-noise ratio
WBA	wideband absorbance
WBR	wideband reflectance

Introduction

Wideband absorbance (WBA) is an emerging clinical tool utilised to detect outer- and middle-ear dysfunctions [1]. Essentially, it is used to evaluate the function of the outer and middle ears by measuring the proportion of acoustic energy absorbed by the middle ear across the frequency spectrum (200–8000 Hz) [2]. Middle-ear disorders such as otitis media with effusion, otosclerosis, tympanic-membrane perforations, cholesteatoma, and ossicular-chain disorders disrupt the dynamics of the middle ear, which, in turn, impacts how sound is absorbed by the middle ear [3–5]. Merchant et al. and Masud et al. suggest that WBA can also be utilised as a fast and non-invasive screening tool to detect semicircular canal dehiscence [6–7].

Measuring wideband absorbance in noisy environments can potentially lead to inaccurate results due to noise contamination. Liu et al. [8] remarked that the accuracy of WBA measurements depends on the signal-to-noise ratio (SNR) of the measurement. They raised concerns that transient physiological noise produced by the subject, or noise from the environment, may be recorded by the probe microphone and thus reduce the SNR, particularly at low frequencies. However, the authors did not systematically investigate the impact of these types of noise on WBA.

In pediatric applications of wideband acoustic immittance measures, Hunter and colleagues reported that noise can lead to unreliable results [9]. The authors stressed the importance of having a quiet child in a quiet environment in order to achieve accurate and reliable WBA results. However, there are situations where WBA is measured in less-than-ideal noisy environments. For example, Shahnaz measured WBA in neonates cared for in a neonatal intensive care unit (NICU) [10]. He reported that high ambient noise levels in the NICU of up to 65 dBA produced unreliable WBA results at frequencies below 400 Hz. He then discarded the WBA data below 400 Hz and analysed the data between 450 and 6000 Hz, because in that frequency range the WBA results were reliable and had clearly identifiable peaks and troughs.

Gouws and colleagues investigated the use of wideband reflectance (where the WBR is defined as 1 – WBA) with preterm neonates within a noisy NICU environment [11]. They found that ambient and physiological noise introduced large variability into the WBR data. Though the authors strove to maintain low noise levels during testing, they could not improve the SNR in their WBR measurements. They suggested that excessive noise could have elevated the WBR values, mainly at low frequencies. However, they did not measure the ambient noise levels inside the NICU.

Although previously reported wideband acoustic immittance measurements were affected by a combination of background and physiological noise in infants, it has not been demonstrated whether background noise contributes significantly to variability in WBA. The present study attempts to address this issue by examining the effect of different background noise levels on WBA obtained from normally-hearing adults, who have relatively low physiological noise compared to infants.

Material and methods

Ethical clearance for this study was obtained from the University of Queensland Health and Behavioural Sciences, Low and Negligible Risk Ethics Sub-Committee (approval number 2019000817). Participants were students at the University of Queensland and their friends. Written consent from all participants was obtained before testing began.

Research design

This study employed a non-randomised, cross-sectional, repeated-measures design. A Master of Audiology student (JP), who received intensive training from an experienced audiologist (JK) in conducting hearing tests including wideband absorbance measurements, conducted all assessments in a sound-treated booth with an ambient noise level of less than 30 dBA as measured using a Brüel & Kjær Type 2250 sound level meter.

Participants

Initially, 59 participants were recruited. To be included in the study, participants had to pass a battery of basic tests including otoscopy, pure-tone audiometry, and tympanometry in the right ear. The pass criteria for these tests are depicted in the test procedure section. Eventually, 50 adults (27 males, 23 females) were included in the study, within the age range of 18–46 years (mean age of 27.6 years). The remaining 9 adults did not meet the pass criteria and were excluded from the study.

Test procedure

Audiological assessments were conducted on the participant's right ear only. The test battery consisted of otoscopy, pure-tone audiometry, tympanometry, and wideband absorbance measures at ambient pressure (i.e., no external pressure was applied to the ear canal). Otoscopy was performed using a Welch Allyn otoscope to examine the ear canal and eardrum for signs of abnormalities.

Pure-tone audiometry was conducted using a GSI AudioStar Pro audiometer with Telephonics TDH-39 headphones. Air-conducted hearing thresholds at octave-band frequencies between 250 and 8000 Hz were obtained using a modified Hughson–Westlake procedure [12]. Bone-conducted hearing thresholds were assessed at octave-band frequencies between 500 and 4000 Hz using a Radio-ear B71 bone conductor. The pass criteria were: (1) all hearing thresholds must be ≤ 15 dB HL, and (2) air-bone gaps must be < 15 dB at all test frequencies [13].

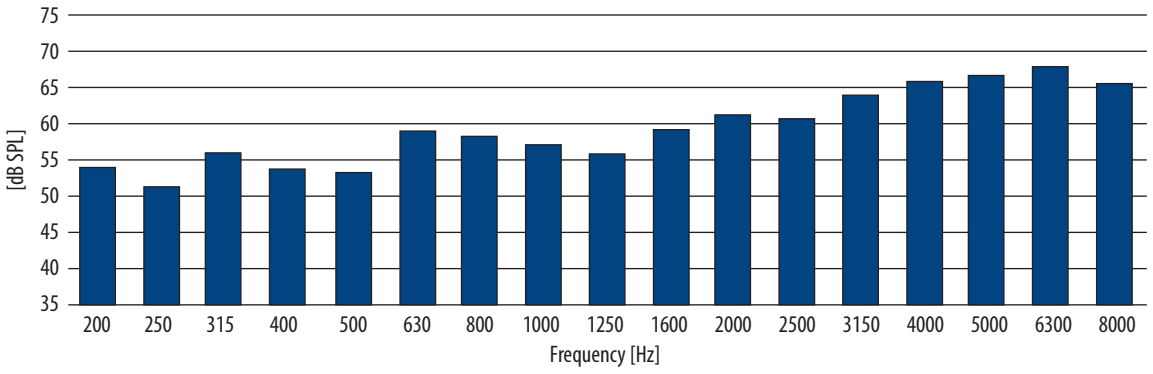

Figure 1. Spectrum of broadband noise at 75 dBA as measured at the ear position using a B&K Type 2250 sound level meter

Tympanometry was performed using an Interacoustics Titan immittance device connected to a laptop computer via the NOAH (ver. 4) software platform. Calibration was performed daily using a 2 cm^3 coupler. A suitably sized rubber probe tip was selected and fitted onto the probe before being placed in the participant's ear canal. During the test, a probe tone of 226 Hz was delivered to the ear at 85 dB SPL while the pressure was varied from +200 to –400 daPa at a rate of 400 daPa/s. A tympanogram was obtained of admittance (in mmho) against ear canal pressure (in daPa). The pass criterion was a single-peaked tympanogram with static admittance between 0.3 and 1.6 mmho, and tympanometric peak pressure between +50 and –100 daPa [14,15].

Testing WBA in quiet and noisy conditions

Participants were required to sit on a comfortable chair in a sound-treated booth, with their right ear facing a Dali 2b loudspeaker, which was situated 1 m from the ear (determined using a measuring tape). The WBA test was performed immediately after tympanometry without changing the probe seal. The test was initially performed in quiet (no applied noise). WBA measures were obtained using the same Interacoustics Titan device (IMP440/WBT440 impedance module). Testing began when the probe light turned green, indicating an adequate probe seal for testing. Measurements were obtained by recording acoustic responses to wideband clicks presented at 65 dB nHL at a rate of 21.5 clicks/s under ambient pressure conditions (i.e., no pressure applied to the ear canal). WBA was measured at 1/24-octave-band frequencies between 226 and 8000 Hz, where the value of each point was calculated based on the average response of 32 clicks. During the WBA test, the tester checked for any probe leak which would result in increased absorbance (> 0.29) at low frequencies (250–500 Hz) [16]. If acoustic leakage was suspected, the probe was removed, then re-inserted to ensure an adequate seal was obtained, and the test was repeated.

For testing in noise, a Dali 2b loudspeaker connected to a GSI Audiostar clinical audiometer played broadband (white) noise to the participant's right ear, which was situated 1 m from the loudspeaker. White noise was used because it has an equivalent acoustic spectrum to the WBA click stimuli, allowing changes in absorbance across the entire frequency range (200–8000 Hz) to be observed. Noise levels of 55 dBA, 65 dBA, and 75 dBA were used to investigate the impact of background noise on WBA. The noise levels were measured using a Brüel and Kjær Type 2250 sound level meter, which was mounted on a tripod at the place previously occupied by the participant's right ear, with the microphone directed to the loudspeaker (0° azimuth). **Figure 1** shows the spectrum of the broadband noise at 75 dBA as measured using the sound level meter. The spectrum was consistent with the loudspeaker's documented frequency response between 200 and 8000 Hz. The spectrum shows a moderate rising slope as a function of frequency.

Prior to WBA testing in background noise, a foam ear plug was inserted into the participant's left ear to avoid a possible noise suppression effect on the measurement [17]. WBA testing in noise began at 55 dBA and the entire test procedure was then repeated with noise levels of 65 dBA and 75 dBA. This order of testing with increasing background noise level was adopted as there is presently no clear evidence of an order effect for noise levels on WBA measures.

Data analysis

WBA was measured as a function of frequency from 226 to 8000 Hz at 1/24-octave-band steps. For analysis, the WBA data were converted to 1/3-octave bands between 250 and 8000 Hz. Because the WBA data at 315 Hz, 5000 Hz, 6300 Hz, and 8000 Hz were not normally distributed, a square-root transformation was applied to these variables to achieve normality. The results of Shapiro–Wilk tests applied to all WBA data (transformed and non-transformed) indicated that they were normally distributed at all frequencies and noise conditions ($p > 0.05$). A repeated-measures analysis of variance (ANOVA) was applied to the data, with WBA being the dependent variable, and frequency, noise level, and gender being the independent variables. The Greenhouse and Geisser approach was used to compensate for the violation of compound symmetry and sphericity [18]. A significance level of 0.05 was used for all analyses.

Results

Figure 2 displays the mean WBA plotted against 1/3-octave-band frequencies between 250 and 8000 Hz for the

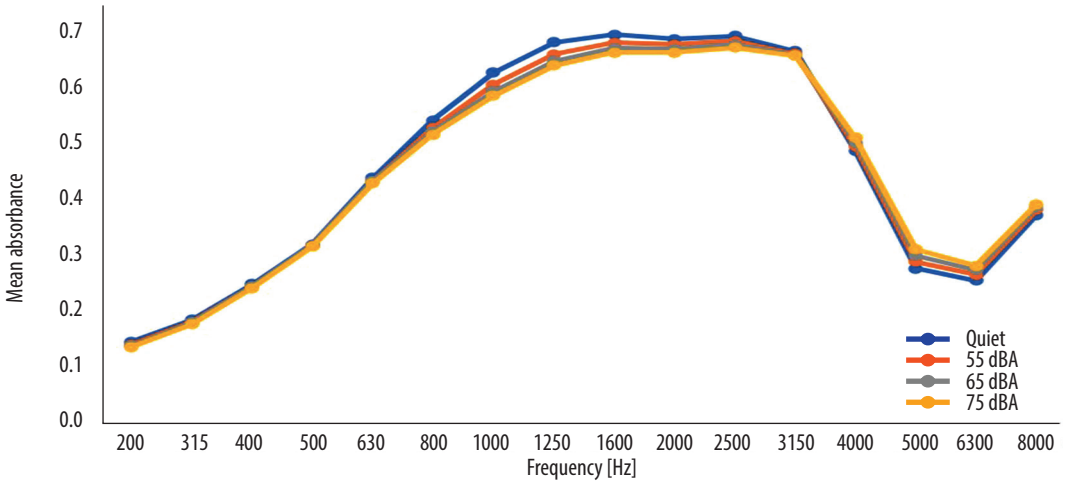

Figure 2. Mean WBA from 250 to 8000 Hz for four noise levels (quiet, 55 dBA, 65 dBA, and 75 dBA)

four noise levels (quiet, 55 dBA, 65 dBA, and 75 dBA). Mean WBA results at 250–630 Hz were about the same across all noise conditions. There was a trend of decreasing mean WBA with increasing noise levels at 800–3150 Hz. In contrast, an opposite trend was observed in which mean WBA increased with increasing noise levels at 4000–8000 Hz.

A repeated-measures ANOVA of the WBA data showed a significant frequency effect $F(1.58, 75.98) = 93.53$, $p < 0.001$; noise effect $F(1.25, 59.81) = 36.01$, $p < 0.001$; gender effect $F(1, 48) = 6.604$, $p = 0.013$, and frequency × noise interaction effect $F(2.84, 136.39) = 35.35$, $p < 0.001$. However, the frequency × gender $F(1.58, 75.98) = 1.18$, $p = 0.304$; noise × gender $F(1.25, 59.81) = 1.05$, $p = 0.326$, and frequency × noise × gender interaction effects $F(2.84, 136.39) = 0.864$, $p = 0.456$, were not significant.

Further ANOVA analyses were performed with WBA as the dependent variable and noise and gender as independent variables to determine the noise and gender effects at each frequency. As **Table 1** shows, noise had a significant effect on WBA at all frequencies ($p < 0.05$) except for 400 Hz, 500 Hz, and 630 Hz. Gender had a significant effect on WBA mainly at low frequencies. However, the noise × gender interaction effect was significant only at 5000 Hz $F(1.21, 58.10) = 3.909$, $p = 0.045$.

Table 2 shows the results of post-hoc pairwise comparisons with Bonferroni adjustments between the different noise conditions at each frequency. The results indicate significant differences in mean WBA between any two noise conditions at 800–2500 Hz and 4000–8000 Hz, with the greatest difference being between the quiet and 75 dBA conditions. The mean WBA in the quiet condition was greater than that in the 75 dBA noise condition between 250 and 3150 Hz, whereas an opposite trend was observed at 4000–8000 Hz. Difference in mean WBA between the quiet and 75 dBA noise condition varied between 0.009 and 0.049 at 250–3150 Hz, and from –0.021 to –0.035 at 4000–8000 Hz. The normalised difference – defined as (mean WBA in quiet – mean WBA in 75 dBA noise)/mean WBA in quiet × 100% – varied between 1.44 and 7.52% at 250–3150 Hz, and between –5.02 and –12.94% at 4000–8000 Hz.

Discussion

Effect of background noise on WBA

The primary aim of the present study was to investigate the effects of increasing levels of background noise on the WBA obtained from normal-hearing adults. The results showed significant differences in mean WBA across all frequencies, except for 400–630 Hz, as the background noise increased from 55 to 75 dBA. We observed a trend of decreasing mean WBA at 250–3125 Hz (excluding 400–630 Hz), and increasing mean WBA at 4000–8000 Hz, with increasing background noise levels of up to 75 dBA. This pattern of results is not expected because we would have expected mean WBA to decrease with increasing noise levels across most frequencies. The reason for the increase in mean absorbance at 4000–8000 Hz with increasing noise level is not clear. We speculate that during the measurements, sound waves reflected by the middle ear were recorded by the probe microphone and may have been contaminated by the high levels of broadband noise, leaking through the probe tube and eartip. Further research using lower noise levels (< 55 dBA) may be required to test this hypothesis.

Our experience measuring WBA in noisy conditions revealed that the WBA curve within the measurement software was unstable during the signal averaging process. The Interacoustics company (pers comm, 22 October, 2019) state that the WBA algorithm includes a noise rejection mechanism, whereby any click response that substantially deviates due to noise contamination is automatically discarded. Additionally, the clicks are high-pass filtered to remove low-frequency noise. The Titan WBA algorithm employs a synchronous-averaging approach using 1024-sample blocks. According to Interacoustics, steady-state broadband noise is averaged out, but this may require a long measurement time.

Table 1. Summary of ANOVA results showing the significance level of the effects of noise, gender, and their interaction on the WBA measurements

Frequency [Hz]	Noise	Gender	Noise × Gender
250	$p < 0.001$	$p = 0.005$	#
315	$p = 0.002$	$p = 0.010$	#
400	#	$p = 0.010$	#
500	#	$p = 0.006$	#
630	#	$p = 0.022$	#
800	$p < 0.001$	#	#
1000	$p < 0.001$	$p = 0.023$	#
1250	$p < 0.001$	#	#
1600	$p < 0.001$	#	#
2000	$p < 0.001$	$p = 0.035$	#
2500	$p < 0.001$	#	#
3150	$p < 0.001$	#	#
4000	$p < 0.001$	$p = 0.035$	#
5000	$p < 0.001$	#	$p = 0.045$
6300	$p < 0.001$	#	#
8000	$p < 0.001$	#	#

Note: # indicates not significant ($p > 0.05$)

Table 2. Summary of significant pairwise comparisons (with Bonferroni adjustments) of the WBA values across four noise conditions. 1, 2, 3, and 4 indicate quiet, 55 dBA, 65 dBA, and 75 dBA noise conditions, respectively

Frequency [Hz]	Significantly different noise conditions	Difference in mean WBA between quiet and 75 dBA noise conditions	Normalised difference [%]
250	1–2, 1–3, 1–4, 2–4, 3–4	0.011	7.52
315	1–2, 1–4, 3–4	0.010	5.74
400	nil	0.011	4.28
500	nil	0.009	2.84
630	nil	0.014	3.27
800	1–2, 1–3, 1–4, 2–3, 2–4, 3–4	0.033	5.94
1000	1–2, 1–3, 1–4, 2–3, 2–4, 3–4	0.049	7.76
1250	1–2, 1–3, 1–4, 2–3, 2–4, 3–4	0.048	6.93
1600	1–2, 1–3, 1–4, 2–3, 2–4, 3–4	0.033	4.75
2000	1–2, 1–3, 1–4, 2–3, 2–4, 3–4	0.023	3.35
2500	1–2, 1–3, 1–4, 2–3, 2–4, 3–4	0.022	3.17
3150	1–2, 1–3, 1–4, 2–3	0.010	1.44
4000	1–2, 1–3, 1–4, 2–3, 2–4, 3–4	–0.024	–5.02
5000	1–2, 1–3, 1–4, 2–3, 2–4, 3–4	–0.035	–12.94
6300	1–2, 1–3, 1–4, 2–3, 2–4, 3–4	–0.028	–11.25
8000	1–2, 1–3, 1–4, 2–3, 2–4, 3–4	–0.021	–5.74

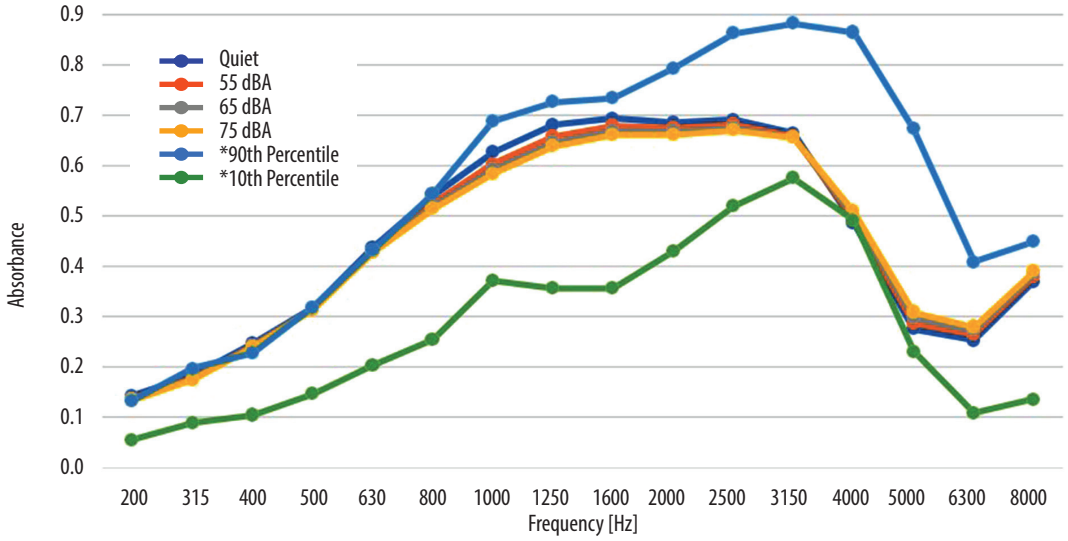

Figure 3. Mean WBA curves for quiet, 55 dBA, 65 dBA, and 75 dBA as determined here (central overlaid lines) lie within the 10th and 90th percentile of normative data (green and blue lines) as determined by Liu et al. [8]

Alternatively, blocks affected by transient noise can also be distinguished from the remaining blocks and discarded.

The spectrum of broadband noise used in the current study might have played a role in the increased WBA levels at high frequencies. The broadband noise spectrum of **Figure 1** suggests that the noise at high frequencies (4000–8000 Hz) is approximately 10 dB higher than at low frequencies. Whether this high-frequency weighting could have contributed to greater noise effects in the WBA measurements requires further investigation.

The sound attenuation capability of the rubber eartips used in the present study is unknown. Vander Werff et al. [19] noted greater differences in test–retest results for rubber tips than for foam tips. However, to date there have been no reference standards for identifying acoustic leaks in WBA testing [20]. Interacoustics (pers comm, 22 October, 2019) additionally noted a lack of published data on the sound attenuation capabilities of the probe tube or eartips. However, they expressed greater concern about physiological noise generated by patients and noise due to probe-tube and shoulder-box movements as being much more influential in measurements. In the present study, great care was taken to instruct the participant to remain still and avoid head or jaw movements during testing.

Although the mean WBA changed significantly with increasing broadband noise levels at all frequencies (except 400–630 Hz), normalised differences in mean WBA between the quiet and 75 dBA conditions were small (≤ 12.9%). This indicates that WBA findings are robust against high levels of broadband noise up to 75 dBA. We observed that mean WBA curves for the four conditions (quiet, 55 dBA, 65 dBA, and 75 dBA) were generally within the 10th–90th percentile of normative data determined by Liu et al. [8] (see **Figure 3**). From a clinical perspective, the changes in WBA due to broadband noise of up to 75 dBA are unlikely to affect clinical decisions except where WBA results are borderline pathological.

Strengths and limitations

The present study is the first to investigate the effects of increasing broadband noise levels on WBA measurements in normal-hearing adults. It provides valuable information on the reliability of the WBA measurements under various background noise conditions (quiet, 55 dBA, 65 dBA, and 75 dBA). In essence, the present study provides evidence that WBA measures are robust against external broadband noise of up to 75 dBA.

Several limitations may have affected our findings. First, it would have been preferable to use flat spectrum noise for the different conditions, rather than the weighted-noise spectrum that was used here. Hence, the present results may not be readily generalised to WBA measurements in other noise environments, such as four-speaker babble noise.

Second, the present study did not compare the effects of different types of probe tips (e.g., rubber versus foam eartips) on the broadband noise received during WBA measurements. Further research is required to identify different types of probe tips and methods that ensure optimal coupling between the probe tip and the ear canal. Such research should also identify whether the specific choice of probe tips leads to greater attenuation of external noise.

Third, the present study employed only one WBA measuring device of one specific make. Presently, various methods exist for measuring WBA and each method has its own inherent variability, which affects the accuracy of the WBA measurement [21]. Given that different WBA measurement systems have different algorithms for noise rejection and signal averaging, our results may not apply to other WBA measuring devices.

Lastly, the present study tested the effect of external broadband noise on WBA only with adult listeners. The results may therefore not be readily generalised to younger populations.

Conclusions

The present study provides evidence that WBA obtained from healthy adults are robust against high levels of external broadband noise of up to 75 dBA. However, the changes in WBA caused by the noise were too small to be of clinical significance. Additional research is needed to extend the findings to pediatric populations.

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DEVELOPMENT OF SENTENCES FOR A TAMIL SPEECH-IN-NOISE TEST: LISTS FOR CHILDREN, YOUNGER ADULTS, AND OLDER ADULTS

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Abstract

Introduction: The present study aimed to develop and standardize sentences for speech-in-noise tests in the Tamil language for children, younger adults, and older adults.

Material and methods: A set of 300 sentences in Tamil was taken from the *Production of Language Training Materials in Major Indian Languages* (Karanth et al., 2010) and recorded. These sentences were rated by five native Tamil-speaking speech-language pathologists based on naturalness, predictability, and identifiability. Sentences rated by at least 80% of the raters for high naturalness, low predictability, and high identifiability were selected, resulting in 147 sentences for further use. These sentences were mixed with speech-shaped noise at varying signal-to-noise ratios (SNRs), ranging from +5 to –10 dB in 2.5 dB steps. Speech perception in noise was assessed in 90 normal hearing participants (30 children, 30 younger adults, and 30 older adults). The SNR-50 values – representing the SNR at which 50% of the words were correctly identified – was evaluated.

Results: Perceptual SNR-50 values were calculated for each list, based on the perceptual score obtained by each participant (separately for children, younger adults, and older adults). Statistical analysis determined that some lists had significantly different perceptual scores and were excluded. Seven lists were finalized for each age group, with mean SNR-50 values of –4.76 dB for children, –4.66 dB for younger adults, and –4.65 dB for older adults. Tests confirmed reliability and validity.

Conclusions: The study found that speech identification scores decreased with poorer SNR levels, with significant differences in SNR-50 values across children, younger adults, and older adults. Separate, equivalent test lists were created for each age group. The test materials showed high test–retest reliability and internal validity, making it possible to distinguish between individuals with normal hearing and those with hearing loss.

Keywords: speech in noise test • Tamil language • sentence development • SNR-50 values

OPRACOWANIE LIST ZDAŃ DO TAMILSKIEGO TESTU MOWY W SZUMIE: DLA DZIECI, MŁODSZYCH DOROSŁYCH I STARSZYCH DOROSŁYCH

Streszczenie

Wprowadzenie: Niniejsze badanie miało na celu opracowanie i standaryzację zdań do testów mowy w szumie w języku tamilskim dla dzieci, młodszych dorosłych i starszych dorosłych.

Materiał i metody: Zestaw 300 zdań w języku tamilskim został zaczerpnięty z *Production of Language Training Materials in Major Indian Languages* (Karanth et al., 2010) i nagrany. Pięciu logopedów, dla których język tamilski jest językiem rodzimym, oceniło zdania pod kątem ich naturalności, przewidywalności i identyfikowalności. Do dalszych prac wybrano 147 zdań, które przez 80% oceniających zostały uznane jako zdania o wysokiej naturalności, niskiej przewidywalności i wysokiej identyfikowalności. Zdania te zostały zmieszane z szumem o widmie mowy o różnym stosunku sygnału do szumu (SNR), w zakresie od +5 do –10 dB w krokach co 2,5 dB. Percepcja mowy w szumie została oceniona u 90 normalnie słyszących uczestników (30 dzieci, 30 młodszych dorosłych i 30 starszych dorosłych). Oceniono wartość SNR-50 oznaczającą SNR przy prawidłowej identyfikacji 50% słów.

Wyniki: Wartości SNR-50 obliczono dla każdej listy na podstawie wyniku uzyskanego przez każdego uczestnika (oddzielnie dla dzieci, młodszych dorosłych i starszych dorosłych). Analiza statystyczna wykazała, że dla niektórych list uzyskano znacząco różne wyniki, więc listy te zostały wykluczone. Ostatecznie utworzono po siedem list dla każdej grupy wiekowej, ze średnimi wartościami SNR-50 wynoszącymi –4,76 dB dla dzieci, –4,66 dB dla młodszych dorosłych i –4,65 dB dla starszych dorosłych. Testy potwierdziły rzetelność i trafność list.

Wnioski: Badanie wykazało, że wyniki identyfikacji mowy spadały wraz z niższymi poziomami SNR, ze znacznymi różnicami w wartościach SNR-50 u dzieci, młodszych dorosłych i starszych dorosłych. Dla każdej grupy wiekowej utworzono oddzielne równoważne listy testowe. Materiały testowe wykazały wysoką rzetelność i trafność wewnętrzną w zakresie rozróżniania osób z prawidłowym słuchem i osób z ubytkiem słuchu.

Słowa kluczowe: test mowy w hałasie • język tamilski • rozwój zdań • SNR-50

Introduction

In everyday life, speech signals are rarely identified under optimal listening conditions. Environmental factors such as background noise, reverberation, and hearing loss often impair the speech recognition, requiring increased cognitive effort to comprehend degraded signals [1]. Speech perception is a complex process involving the interpretation of language sounds by extracting acoustic and phonemic information, which is then used for higher-level language processing, such as word recognition [2]. Real-world environments often introduce overlapping or simultaneous auditory stimuli, further challenging the auditory system [3].

Understanding speech in the presence of background noise constitutes a great challenge for any listener, especially those suffering from hearing loss. Because of the challenge this task poses, its assessment can provide good insight into an individual's ability to cope with typical everyday listening environments, which are often noisy [4]. Methods to evaluate and forecast this ability have garnered significant attention in research over the past several decades.

One test that simulates speech comprehension in real-life situations is the speech-in-noise (SIN) test. The SIN test helps audiologists identify individuals who have difficulty understanding speech in noise and describes the amount of difficulty and benefit provided by amplification [5].

Demand for culturally and linguistically appropriate SIN test materials has led to their development in several languages, including Mandarin [6], Persian [7], Kannada [8], and Oriya [9]. Research supports the importance of linguistic and cultural relevance in SIN testing. Studies by Ghosh et al. [10] and Wang et al. [11] demonstrate that speech perception is significantly enhanced when individuals are assessed using materials in their native language, underscoring the need to tailor speech-in-noise tests to the linguistic and cultural contexts of the population.

Despite Tamil being one of the most widely spoken Dravidian languages, there is no standardized speech-in-noise test material available for its speakers. Tamil's distinctive linguistic and phonetic characteristics, including unique vowel–consonant combinations and syllabic structures, highlight the need for specialized tailoring speech-in-noise materials to ensure accurate evaluation and diagnosis. Currently, assessments for Tamil speakers often rely on tools developed for other languages, which may fail to address their specific challenges in noisy environments.

This gap limits the audiologist's ability to provide culturally and linguistically appropriate interventions for Tamil speakers, increasing the risk of misdiagnosis or ineffective rehabilitation strategies that might adversely impact communication and quality of life. Moreover, incorporating Tamil into speech-in-noise research broadens our understanding of how linguistic diversity affects auditory processing. By developing speech-in-noise materials tailored to Tamil, this study addresses a critical linguistic gap, enhances diagnostic precision, and supports culturally relevant auditory assessments. This initiative not only benefits Tamil-speaking populations but also promotes the inclusion of underrepresented languages in global audiological research.

This study aims to develop and standardize SIN test materials in Tamil for three groups: children, younger adults, and older adults. By designing and validating age-specific test lists with reliable and accurate data, the study seeks to enable accurate audiological assessments, ensure precise diagnosis, and support effective intervention strategies for Tamil-speaking individuals facing speech perception challenges in noisy environments.

Material and methods

Selection and recording of test stimuli

Three hundred sentences in Tamil were selected from a UNICEF-funded document [12]. A native female Tamil speaker with normal voice characteristics was recorded using Praat v. 5.3.53 (sampling rate 44.1 kHz) in a sound-treated room. Each sentence was saved in WAV format.

Familiarity rating of sentences

Five native Tamil-speaking speech-language pathologists rated the 300 sentences on identifiability, naturalness, and predictability [13]. Sentences rated by at least 80% of raters as highly natural, of low-predictability, and extremely identifiable were selected, resulting in 147 sentences, which were divided into 21 lists of 7 sentences each.

Adding noise to the signals

Speech-shaped noise (SSN) for each sentence was generated using the 'ssn' script of Praat. The script takes the average long-term average spectrum (LTAS) of a selection of sound objects and shapes white noise according to this average [14]. Each of the 21 sentence lists was then combined with speech-shaped noise at different signal-to-noise ratio (SNR) levels, ranging from +5 to –10 dB SNR in 2.5 dB steps using the 'Mix noise' script of Praat [15]. Speech-shaped noise was added to all the selected sentences at different SNR levels so that the first sentence in each list had the highest SNR and the last sentence had the lowest.

Participants

A normative research design was adopted, involving 90 participants with normal hearing sensitivity (PTA < 15 dB HL, SRT +10 dB of PTA; SIS > 90% according to ANSI S3.21, 2009). Participants were divided into three

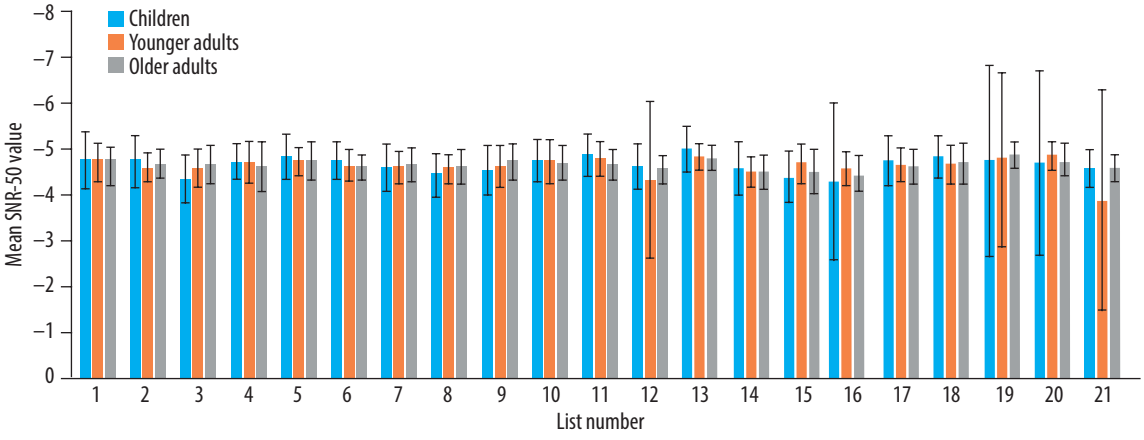

Figure 1. Mean overall SNR-50 values for children, younger adults, and older adults

groups: Group 1 consisted of 30 children aged 8 to 12 years; Group 2 consisted of 30 younger adults aged 18 to 24 years; and Group 3 consisted of 30 older adults aged 45 to 55 years. All participants had normal auditory processing abilities as assessed using the Screening Checklist for Auditory Processing (SCAP) [16] for children and the Screening Checklist for Auditory Processing in Adults (SCAP-A) [17] for younger and older adults. None of the participants reported any neurological, psychological, visual, or behavioral problems. All participants were native Tamil speakers. The study was approved by the institutional ethical board and informed written consent was obtained from each participant before the study began.

Procedure

Testing was conducted in an acoustically treated room meeting ANSI S 3.1 (1999) standards. Participants were seated comfortably in front of a laptop monitor and instructed to listen carefully to the sentences and repeat each word. Sentences were randomly presented to participants through Sennheiser HD 202 headphones connected to a personal computer (Dell Core i5 processor with Realtek high-definition audio card) using Alvin software (v. 3.2; Hillenbrand & Gayvert, 2005). Participants' responses were recorded via an omnidirectional microphone placed 10 cm from their mouths and each sentence was saved as a separate file for further analysis.

Scoring

Recorded responses were evaluated by native Tamil-speaking speech-language pathologists, who identified the keywords in each sentence. Correctly repeated keywords were scored as '1', while incorrectly repeated or omitted words were scored as '0'. Each sentence had four keywords, resulting in a maximum score of 4 per sentence. Perceptual scores for each participant were obtained from the recorded responses.

Data analysis

The SNR-50 value, representing the signal-to-noise ratio at which 50% of the words were correctly identified, was estimated using regression analysis. Responses for each list were analyzed using the Shapiro–Wilk test for normalcy, confirming a normal distribution. Parametric statistics were employed, with repeated measures ANOVA and Bonferroni's post-hoc analysis used to evaluate the equivalency of responses across lists. Test–retest reliability was assessed with repeated measures ANOVA, involving re-testing of 10 children, 10 younger adults, and 10 older adults after 3 months to prevent habituation to the test stimuli. Between-subject variability was measured using an independent sample *t*-test. Internal validity was determined by comparing the SNR-50 values for each list with the overall mean SNR-50 values.

Ethics

This study was conducted under the supervision of the BASLP Department of Vinayaka Mission Medical College, Karaikal.

Results

Calculation of SNR-50

The correct identification of keywords in each sentence for each participant was noted and tabulated separately. SNR-50 was calculated for each list based on the scores obtained by each participant using logistic regression with non-linear interpolation analysis. The 50th percentile, i.e., the point at which participants correctly identified 50% of the words, was interpolated from the standard curve (**Figure 1**).

Equivalency of the sentence lists

A repeated measures analysis of variance (ANOVA) with Bonferroni's multiple comparisons was used to compare the perceptual SNR-50 scores across different age groups. Results showed significant differences in perceptual scores for children [$F(1,29) = 3.09$; $p < 0.05$], younger adults [$F(1,29) = 4.38$; $p < 0.05$], and older adults [$F(1,29) = 2.83$; $p < 0.05$]. These results indicate that, of the 21 lists, some were easier, resulting in higher scores, while others were more difficult, resulting in lower scores.

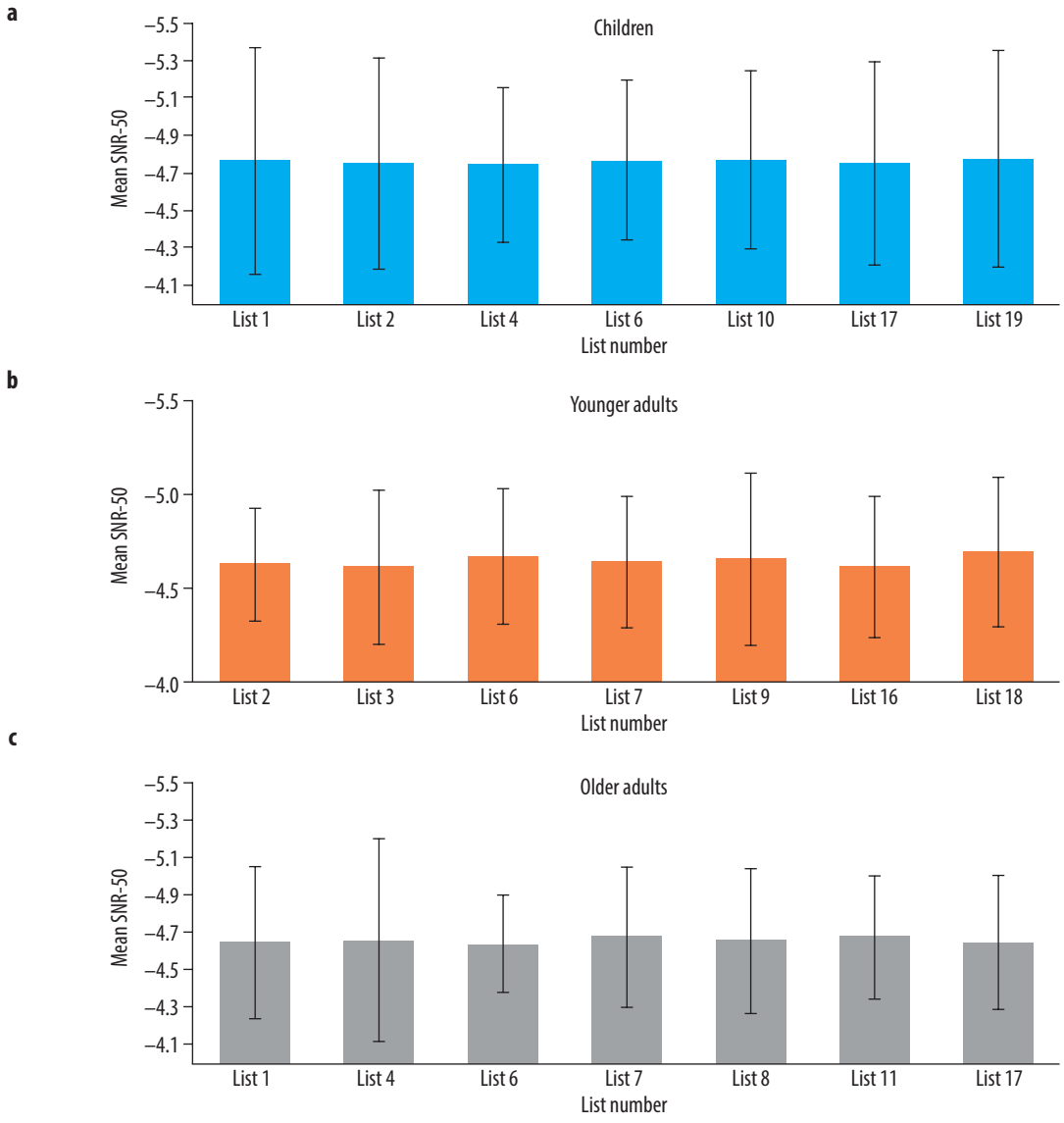

Figure 2. Mean SNR-50 scores for selected lists. **a**) for children; **b**) for younger adults; **c**) for older adults

Based on Bonferroni's multiple pairwise comparison for children, the analysis revealed that lists 5, 11, 13, and 18 were relatively simpler and had better perceptual SNR-50 scores. Lists 3, 7, 8, 9, 14, 15, 20, and 21 were harder to perceive, resulting in poorer SNR-50 scores. The remaining seven lists (1, 2, 4, 6, 10, 17, and 19) were further analyzed using repeated measures ANOVA, and showed no statistically significant difference between perceptual SNR-50 scores for any of the lists [$F(1,6) = 0.01$; $p > 0.05$]. These seven lists were selected for children.

For younger adults, lists 1, 4, 5, 10, 13, 17, and 20 were simpler and had better perceptual SNR-50 scores, while lists 8, 12, 14, and 21 were harder and resulted in poorer scores. The remaining seven lists (2, 3, 6, 7, 9, 16, and 18) were further analyzed, showing no statistically significant difference [$F(1,6) = 0.21$; $p > 0.05$]. These seven lists were selected for younger adults.

For older adults, lists 2, 3, 5, 9, 10, 13, 18, and 20 were simpler, with better perceptual SNR-50 scores. Lists 12, 14, 15, 16, and 21 were harder, resulting in poorer scores. The remaining seven lists (1, 4, 6, 7, 8, 11, and 17) were further analyzed, and showed no statistically significant difference [$F(1,6) = 0.09$; $p > 0.05$]. These seven lists were selected for older adults (**Figure 2**).

SNR loss

SNR loss was calculated for adults and children with normal hearing sensitivity by adapting the procedure suggested by Tillman and Olsen (1973). The SNR-50 score was obtained by multiplying 5 by 1.25 to get 6.25 (minus the total number of words repeated correctly). The SNR loss was calculated using the formula: for children, SNR loss was 6.25 – (–4.76); for younger adults, it was 6.25 – (–4.66); and for older adults, it was 6.25 – (–4.65).

Table 1. Paired sample *t*-test for test–retest reliability across children, younger adults, and older adults

Group	*df*	*t*	Significance (*p*)
Children	9	0.84	0.41
Younger adults	9	0.89	0.39
Older adults	9	0.88	0.40

Table 2. Repeated measure ANOVA (with Bonferroni's multiple comparisons) for children, younger adults, and older adults

Group	*df*	*F*	Significance (*p*)
Children	6	2.36	0.06
Younger adults	6	1.72	0.15
Older adults	6	2.36	0.06

Test–retest reliability

Test–retest reliability was measured using a paired sample *t*-test. Retesting was done for 10 children, 10 younger adults, and 10 older adults, 3 months after the original testing to avoid habituation effects. Results revealed no statistically significant difference between trials for children ($t = 0.84$, $p > 0.05$), younger adults ($t = 0.89$, $p > 0.05$), and older adults ($t = 0.88$, $p > 0.05$), indicating consistent responses across time (**Table 1**).

Validity of the tests

Internal validity was assessed by measuring the difference in SNR-50 values of each list compared to the overall mean SNR-50 values for each subject. The mean SNR-50 for the seven selected lists was calculated, and the SNR-50 value for each list was subtracted from the mean SNR-50 value. Differences in SNR-50 values were compared using repeated measures ANOVA, and showed no statistically significant differences between the 'difference SNR-50 values' for children [$F(1,29) = 2.36$; $p > 0.05$], younger adults [$F(1,29) = 1.72$; $p > 0.05$], and older adults [$F(1,29) = 2.36$; $p > 0.05$]. These results indicate that the selected lists were internally valid, and the responses obtained should be consistent (**Table 2**).

Discussion

This study has investigated speech perception in noise across three age groups – children (8–12 years), younger adults (18–25 years), and older adults (45–55 years) using Tamil speech-in-noise (SIN) test stimuli. By focusing on Tamil, a linguistically rich yet underrepresented language, the study addresses a significant gap in audiological research. Wang et al. [11] and Smits et al. [18] emphasized the need for culturally localized SIN tests, aligning with the study's aim to develop tailored assessments for Tamil speakers.

A systematic methodology was employed, beginning with the creation of 300 semantically and syntactically accurate Tamil sentences rated for familiarity by native Tamil-speaking speech-language pathologists. From this, 147 highly rated sentences were selected, divided into 21 lists of seven sentences each, and presented at varying signal-to-noise ratios (SNRs). This process reduced cognitive load and enhanced ecological validity, reflecting the emphasis of Zaar and Dau [19] on meaningful stimuli for accurate speech perception. Also, Bent and Bradlow [20] highlighted the limitations of generic SIN tools in accommodating linguistic diversity, which this study addressed.

Significant differences in perceptual SNR-50 scores across age groups revealed distinct auditory processing challenges, with older adults struggling more in noisy conditions. These findings align with Wang et al. [11], who reported similar declines among Mandarin speakers, and Pichora-Fuller et al. [21], who linked such difficulties to age-related cognitive and auditory declines. These results underscore the importance of age-specific assessments.

Seven statistically equivalent lists were identified for each age group using repeated measures ANOVA and Bonferroni multiple comparisons, ensuring that performance differences reflected auditory abilities rather than test variability. Smits et al. [18] stressed the importance of such equivalency for reliable clinical and research applications, achieved here through strict methodology.

Reliability was confirmed through a test–retest procedure 1 month after initial testing, and showed no significant differences in scores, affirming the stability of the materials. These findings are consistent with Ghosh et al. [10], who reported similar reliability with Malayalam SIN tests. Internal validity was also checked using repeated measures ANOVA and no significant differences in SNR-50 values across lists within each age group was found, ensuring the tool's precision.

The importance of culturally relevant SIN materials is evident. Ghosh et al. [10] showed how native-language stimuli enhance SIN performance by leveraging linguistic familiarity, while Mattys et al. [22] highlighted that familiarity with linguistic patterns reduces cognitive load and improves intelligibility in noise. By incorporating Tamil's unique linguistic characteristics, this study enabled accurate and meaningful assessments for Tamil speakers.

This study contributes to global evidence supporting age-specific and culturally sensitive SIN assessments. Wang et al. [11] and Smits et al. [18] emphasized adapting

SIN tools to linguistic and cultural contexts, and extending these methodologies to Tamil broadens audiological research and highlights the universality of SIN perception challenges.

By developing and standardizing SIN test materials in Tamil, this study addresses a gap in auditory assessment. It emphasizes the importance of culturally relevant tools for accurate diagnoses and effective interventions, advancing audiology, and supporting inclusivity in auditory healthcare. Future research could expand these findings by exploring broader age ranges, various Tamil dialects, and sociolinguistic factors affecting SIN perception, enhancing the clinical and research applications of SIN tools.

Conclusions

This study has developed and validated speech-in-noise (SIN) test materials for children, younger adults, and older adults, addressing a need for culturally and age-specific auditory assessments. Significant age-related differences in SIN perception underline the importance of tailored tools that account for linguistic and cognitive variations. Using a rigorous methodology, the study ensured the reliability, validity, and clinical relevance of the Tamil SIN tests, enhancing accuracy and minimizing cognitive load. By advancing culturally sensitive auditory assessments, this research provides a foundation for exploring Tamil dialects and sociolinguistic factors, promoting inclusivity and precision in auditory healthcare.

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Appendix

Tamil sentence lists for children (IPA format)

List 1

1. /kəɳɳɑ:dɪ/ /t̪əmlərɪl/ /t̪əɳɳi:r/ /ɪɾʉkkɪɾəɖʉ/
2. /mərət̪t̪ɪn/ /ɪləj/ /pɛɾɪɖɑ:gə/ /ɪɾʉkkɪɾəɖʉ/
3. /əɳɖə/ /nɑ:ʈkɑ:lɪ/ /ʊɖəjɳɖʉ/ /ɪɾʉkkɪɾəɖʉ/
4. /pəjjən/ /oɾʉ/ /pəlu:nəj/ /u:ɖʊgɪɾɑ:n/
5. /əʊərgəl/ /rəjɪlɪl/ /pəjəɳəm/ /sɛjɖɑ:rgəl/
6. /sɪɾɪjə/ /pərəʊəjgəl/ /ʊɑ:nət̪t̪ɪl/ /pərəkkəʊɪllərj/
7. /əɳɖə/ /pɛɳ/ /sɑ:ləjjɪl/ /nədəɳɖɑ:l/

List 2

1. /əʊərgəl/ /kɑ:l/ /pəɳɖʉ/ /ʊɪləjjɑ:/ /ɖʉgɪɾɑ:rgəl/
2. /ko:ʊɪl/ /mənɻjəj/ /əɖɪt̪t̪ʉ/ /koɳɖɪɾʉɳɖɑ:n/
3. /oɾʉ/ /mənɪɖən/ /səʈʈəjjəjp/ /po:ɖʉʊɑ:n/
4. /nɑ:j/ /t̪o:ʈʈət̪t̪ɪn/ /əɾʉge/ /ɪɾʉkkɪɾəɖʉ/
5. /pɑ:ppɑ:/ /pɑ:ləjk/ /kʊɖɪkkə/ /ʊəjkkəppəɖʉgɪɾəɖʉ/
6. /ɪɳɖək/ /kɪɳɳəm/ /əɖəjʊɪɖə/ /sɪɾɪɖɑ:gɪɾənɖəɖʉ/
7. /t̪oləjkkɑ:ʈtʃɪ/ /pɛʈʈɪ/ /pɛɾɪɖɑ:gə/ /ɪɾʉkkɪɾəɖʉ/

List 3

1. /əɳɖə/ /kʊɖəjjɪl/ /ʊɑ:jəjppəjəm/ /ɪɾʉkkɪɾəɖʉ/
2. /oɾʉ/ /pɛɳ/ /kəɖɪɖəm/ /ɛjʉɖɪɾʉkkɪɾɑ:l/
3. /oɾʉ/ /pɛɳ/ /t̪ʉɳɻjəjəj/ /t̪ʉʊəjppɑ:l/
4. /oɾʉ/ /sɪɾʉmɪ/ /t̪ələjjəj/ /ʊɑ:ɾɪjɪɾʉkkɪɾɑ:l/
5. /əʊər/ /kəʈʈəjjɪn/ /ʊɖəʊɪjɑ:l/ /nədəkkɪɾɑ:r/
6. /me:dʒəjjɪn/ /me:l/ /t̪əʈʈʉgəl/ /ɪllərj/
7. /ɪɳɖə/ /mərət̪t̪ɪl/ /pəɻəŋgəl/ /ɪɾʉgɪnɖʳənə/

List 4

1. /əʊəl/ /kɑ:lʉɾəjjəj/ /po:ʈʈʉ/ /ɪɾʉɳɖɑ:l/
2. /mərət̪t̪ɪn/ /ɪləj/ /pɛɾɪɖɑ:gə/ /ɪɾʉkkɪnɖʳənə/
3. /əʊən/ /mɪɖɪvəɳɖɪˑ/ /oʈʈɪk/ /koɳɖɪɾʉkkɪɾɑ:n/
4. /əʊən/ /pəl/ /t̪əjt̪t̪ʉk/ /koɳɖɪɾʉkkɪɾɑ:n/
5. /pəjjən/ /pɑ:bɑ:ʊʉkkʉ/ /pəɳɖʉ/ /koɖʉt̪t̪ɑ:n/
6. /dʒənnəl/ /kəɳɳɑ:dɪ/ /ʊɖəjɳɖʉ/ /ʊllərj/
7. /ko:ɻjʉm/ /kʊɾʊʊɪjʉm/ /ərɪsɪjəj/ /t̪ɪnnʉgɪnɖʳənə/

List 5

1. /pɑ:l/ /ʊɛllərj/ /nɪɾəmɑ:gə/ /ɪɾʉkkɪɾəɖʉ/
2. /əɳɖə/ /pɛɳ/ /ɪʊəlʉɖəjjə/ /əmmɑ:/
3. /ɛlɪgəl/ /roʈʈɪjəjjəj/ /t̪ɪnɖʳʉ/ /koɳɖɪɖʉgɪnɖʳənə/
4. /pəɳɖʉ/ /kʊɖəjjɪn/ /ʊl/ /ɪɾʉkkɪɾəɖʉ/
5. /pərəʊəj/ /dʒənnəl/ /ʊəɻjɑ:gə/ /sɛnɖʳəɖʉ/
6. /sɪɾʉmɪ/ /pəl/ /t̪ʉʊəkkəʊəjkkə/ /pəɖʉgɪɾɑ:l/
7. /əɳɖə/ /pəjjənɪn/ /səʈʈəj/ /əɻʉkkɑ:jɪɾɳɳɖəɖʉ/

List 6

1. /əɳɖə/ /pɛɳ/ /pɪnnɪ/ /koɳɖɪɾʉkkɪɾɑ:l/
2. /oɾʉ/ /pɛɳ/ /kəɖɪɖəm/ /ɛɻʉɖʉʊɑ:l/
1. /oɾʉ/ /pəjjən/ /pəlʉnəj/ /u:ɖʊgɪɾɑ:n/
3. /pʊt̪t̪ɑ:kkəm/ /pɛʈʈɪjɪn/ /me:l/ /ɪɾʉkkɪɾəɖʉ/
4. /əɳɖə/ /sɪɾʉmɪ/ /ʊi:ʈʈʉkkʉ/ /po:gɪɾɑ:l/
5. /pɛɳ/ /sɪɾʉmɪkkʉ/ /pu/ /koɖʉkkɪɾɑ:l/
6. /əʊəl/ /t̪i:kkʉtʃtʃɪjɑ:l/ /mɛɻʉguʊəɖɪjəjəj/ /e:t̪t̪ʳɪnɑ:l/

List 7

1. /kəɖəʊɪn/ /sɑ:ʊɪ/ /ʊələjət̪t̪ɪl/ /ɪɾʉkkɪɾəɖʉ/
2. /oɾʉ/ /mənɪɖən/ /kəɖəlɪl/ /ni:ɳɖʉʊɑ:n/
3. /oɾʉ/ /mənɪɖən/ /kəɖəlɪl/ /ni:ɳɖʉgɪɾɑ:n/
4. /oɾʉ/ /pɛɳ/ /t̪ʉɳɻjəjəj/ /t̪ʉʊəjkkɪɾɑ:l/
5. /oɾʉ/ /sɪɾʉmɪ/ /t̪ələjjɑ:jə/ /ʊəɾʉgɪɾɑ:l/
6. /pɛɳ/ /nɑ:t̪t̪ʳəkkɑ:lɪɾʉɳɖʉ/ /ki:ɻe/ /ʊɻʉɳɖɑ:l/
7. /sɪʊəppʉ/ /t̪əmlərɪl/ /ni:r/ /ɪɾʉkkɪɾəɖʉ/

Tamil sentence lists for younger adults (IPA format)

List 1

1. /əʋərgəl/ /kaːl/ /pəɳɖʉ/ /ʋɪləjjaː/ /ɖʉgɪraːrgəl/
2. /koːʋɪl/ /mənɻjəj/ /əɖɪʈʈʉ/ /koɳɖɪrʉɳɖaːn/
3. /oɾʉ/ /mənɪɖən/ /səʈʈəjjəjp/ /poːɖʉʋaːn/
4. /naːj/ /ʈoːʈʈəʈʈɪn/ /əɾʉge/ /ɪrʉkkɪrəɖʉ/
5. /paːppaː/ /paːləjk/ /kʊɖɪkkə/ /ʋəjkkəppəɖʉgɪrəɖʉ/
6. /ɪɳɖək/ /kɪɳɳəm/ /əɖəjʋɪɖə/ /sɪrɪɖaːgɪrəɳɖəɖʉ/
7. /ʈoləjkkaːʈtʃɪ/ /pɛʈtɪ/ /pɛrɪɖaːgə/ /ɪrʉkkɪrəɖʉ/

List 2

1. /mɪləgaːj/ /mɪgə/ /kaːɾəmaːgə/ /ɪrʉkkɪrəɖʉ/
2. /puːʋɪn/ /meːl/ /ʋəɳɖʉppuːtʃtʃɪ/ /ʲɪrʉkkɪrəɖʉ/
3. /pəjjən/ /oɾʉ/ /pəluːnəj/ /uːɖʊʋaːn/
4. /paːppaː/ /pʊʈɪjɪl//paːl/ /kʊɖɪkkɪrəɖʉ/
5. /pəjjən/ /ʋɪləjjaːʈtʉ/ /pomməjjəjjəj/ /ɪɻʉkkɪraːn/
6. /ɪʋən/ /əʋənəjʋɪɖə/ /kʊʈtəjjaːgə/ /ɪrʉkkɪraːn/
7. /əmmaːʋʉm/ /əppaːʋʉm/ /pəɖɪʈʈʉ/ /koɳɖɪrʉkkɪraːrgəl/

List 3

1. /əʋəl/ /kaːlʉɾəjjəj/ /poːʈtʉ/ /ɪrɯɳɖaːl/
2. /məɾəʈʈɪn/ /ɪləj/ /pɛrɪɖaːgə/ /ɪrʉkkɪnɖʳənə/
3. /əʋən/ /mɪɖɪvəɳɖɪˑ/ /oʈtɪk/ /koɳɖɪrʉkkɪraːn/
4. /əʋən/ /pəl/ /ʈəjʈʈʉk/ /koɳɖɪrʉkkɪraːn/
5. /pəjjən/ /paːbaːʋʉkkʉ/ /pəɳɖʉ/ /koɖʉʈtaːn/
6. /dʒənnəl/ /kəɳɳaːɖɪ/ /ʋɖəjɳɖʉ/ /ʋllədʉ/
7. /koːɻɪjʉm/ /kʊɾʊʊɪjʉm/ /əɾɪsɪjəj/ /ʈɪnnʉgɪmɖʳənə/

List 4

1. /əʋəlaːl/ /maːmbəɻəʈʈəj/ /pəɾɪkkə/ /mʊdɻjʉm/
2. /əɳɖə/ /mənɪɖən/ /kʊɳɖaːgə/ /ɪrʉkkɪraːn/
3. /oɾʉ/ /pɛɳ/ /kədɪɖəm/ /ɛjʉɖɪrʉkkɪraːl/
4. /pɛɳ/ /kɪɳəʈʈʳɪlɪrʉɳɖʉ/ /ʈənɳiːr/ /ɪrəjkkɪraːl/
5. /pəjjən/ /sʊʋəɾəj/ /ʈaːɳɖəʋəjkkə/ /pədʉgɪraːn/
6. /əɳɖə/ /kʊɻəɳɖəjkkʉ/ /ʋɖəlnələm/ /seːɾɪjɪləj/
7. /ɪɳɖə/ /ʋiːɖʉ/ /sɪrɪɖaːgə/ /ɪrʉkkɪrəɖʉ/

List 5

1. /ʈoləjkkaːʈtʃɪjɪl/ /pədəm/ /paːrʈʈʉ/ /koɳɖɪrʉʈʈəl/
2. /əɳɖə/ /mənɪɖərgəl/ /kʊɳɖaːgə/ /ɪrʉkkɪraːrgəl/
3. /oɾʉ/ /pəjjən/ /səʈʈəjjəj/ /poːɖʉʋaːn/
4. /əɖʉ/ /mɪɖɪvəɳɖɪ/ /oʈtɪk/ /koɳɖɪrʉkkɪrəɖʉ/
5. /pʊnəj/ /naːrkkaːlɪkkʉ/ /əɖɻɪl/ /ɪlləj/
6. /ɪɳɖə/ /səʈtəj/ /əɖəjʋɪɖə/ /niːləmaːkkɪrʉkkɪrəɖʉ/
7. /meːdʒəjjɪn/ /meːl/ /peːɳaː/ /ɪrʉkkɪrəɖʉ/

List 6

1. /əɳɖə/ /məɾəm/ /pɛrɪɖaːgə/ /ɪrʉkkɪrəɖʉ/
2. /oɾʉ/ /mənɪɖən/ /səʈtəjjəj/ /poːʈtɪrʉkkɪraːn/
3. /əʋəl/ /mɪɖɪvəɳɖɻjəj/ /oːɖɪkkoɳɖɪrʉkkɪraːl/
4. /ʈəmləɾɪlə/ /ʊl/ /ʈənɳiːr/ /ɪrʉkkɪrəɖʉ/
5. /ɪɖʉ/ /əʋəɾʉdəjjə/ /muːkkʉ/ /kənɳaːɖɪ/
6. /pəjjən/ /sɪrʉmɪjəjəjʋɪɖə/ /kʊɳɖaːgə/ /ɪrʉkkɪraːn/
7. /əɳɖə/ /pəjjən/ /kədəjkkʉ/ /poːgɪraːn/

List 7

1. /əɳɖə/ /sɪrʉmɪgəl/ /ʋəɾəjɳɖʉ/ /koɳɖɪrʉkkɪraːrgəl/
2. /oɾʉ/ /mənɪɖən/ /kədələɪl/ /niːɳɖɪrʉkkɪraːn/
3. /əʋəl/ /ʈən/ /kaːlgəlaːl/ /ʊɖəjkkɪraːl/
4. /əʋərgəl/ /miːɖɪvəɳɖɪgələj/ /oʈtɪkkoɳɖʉ/ /ɪrʉkkɪraːrgəl/
5. /əʋəl/ /peːɾʉɳɖɪl/ /pəjəɳəm/ /sɛjgɪraːl/
6. /sɪrʉmɪ/ /paːʋaːɖəj/ /əɳɻjəʋəjkkə/ /pədʉgɪraːl/
7. /sɪrʉmɪ/ /sɛɖɪgəlʉkkʉ/ /ʈənɳiːr/ /ʊtʈʳəʋəjkkəppədʉgɪraːl/

Tamil sentence lists for older adults (IPA format)

List 1

1. /əʋərgəl̪/ /kaːl/ /pəɳ̪ɖʉ/ /ʋɪl̪əjjaː/ /ɖʉgɪɾaːrgəl̪/
2. /koːʋɪl/ /mənɻjəj/ /əɖɪʈ̪ʉ/ /koɳɖɪɾʉɳ̪ɖaːn/
3. /oɾʉ/ /mənɪɖən/ /səʈ̪əjjəjp/ /poːɖʉʋaːn/
4. /naːj/ /t̪oːʈ̪əʈ̪ɪn/ /əɾʉge/ /ɪɾʉkkɪɾəɖʉ/
5. /paːppaː/ /paːləjk/ /kʊɖɪkkə/ /ʋəjkkəppəɖʉgɪɾəɖʉ/
6. /ɪɳ̪ɖək/ /kɪɳɳəm/ /əɖəjʊɪɖə/ /sɪɾɪɖaːgɪɾənɖ̪əɖʉ/
7. /t̪oləjkkaːʈ̪ʈʃɪ/ /pɛʈ̪ɪ/ /pɛɾɪɖaːgə/ /ɪɾʉkkɪɾəɖʉ/

List 2

1. /əɳ̪ɖə/ /kʊɖəjjɪl/ /ʋaːjəjppəjəm/ /ʲɪɾʉkkɪɾəɖʉ/
2. /oɾʉ/ /pɛɳ/ /kəɖɪɖəm/ /ɛjʉɖɪɾʉkkɪɾaː/
1. /oɾʉ/ /pɛɳ/ /t̪ʉɳɻjəjəj/ /t̪ʉʋəjppaː/
3. /oɾʉ/ /sɪɾʉmɪ/ /t̪əl̪əjjəj/ /ʋaːɾɪjɪɾʉkkɪɾaː/
4. /əʋər/ /kəʈ̪əjjɪn/ /ʊɖəʊɪjaːl/ /nəɖəkkɪɾaːr/
5. /meːdʒəjjɪn/ /meːl/ /t̪əʈ̪ʉgəl̪/ /ɪlləj/
6. /ɪɳ̪ɖə/ /məɾəʈ̪ɪl/ /pəɻəŋgəl̪/ /ɪɾʉgɪnɖ̪ʳənə/

List 3

1. /əʋəl̪/ /kaːlʉɾəjjəj/ /poːʈ̪ʉ/ /ɪɾɳ̪ɖaːl/
2. /məɾəʈ̪ɪn/ /ɪl̪əj/ /pɛɾɪɖaːgə/ /ɪɾʉkkɪnɖ̪ʳənə/
3. /əʋən/ /mɪɖɪvəɳɖɪˑ/ /oʈ̪ɪk/ /koɳɖɪɾʉkkɪɾaːn/
4. /əʋən/ /pəl/ /t̪əjʈ̪ʉk/ /koɳɖɪɾʉkkɪɾaːn/
5. /pəjjən/ /paːbaːʊʉkkʉ/ /pəɳ̪ɖʉ/ /koɖʉʈ̪aːn/
6. /dʒənnəl/ /kəɳɳaːɖɪ/ /ʊɖəjɳ̪ɖʉ/ /ʊl̪l̪əɖʉ/
7. /koːɻjʉm/ /kʊɾʊʊɪjʉm/ /əɾɪsɪjəj/ /t̪ɪnnʉgɪnɖ̪ʳənə/

List 4

1. /əʋəl̪aːl/ /maːmbəɻəʈ̪əj/ /pərɪkkə/ /mʊɖɻjʉm/
2. /əɳ̪ɖə/ /mənɪɖən/ /kʊɳɖaːgə/ /ɪɾʉkkɪɾaːn/
3. /oɾʉ/ /pɛɳ/ /kəɖɪɖəm/ /ɛjʉɖɪɾʉkkɪɾaː/
4. /pɛɳ/ /kɪɳəʈ̪ʳɪlɪɾʉɳ̪ɖʉ/ /t̪əɳɳiːr/ /ɪɾəjkkɪɾaːl̪/
5. /pəjjən/ /sʊʊəɾəj/ /t̪aːɳɖəʊəjkkə/ /pəɖʉgɪɾaːn/
9. /əɳ̪ɖə/ /kʊɻəɳ̪ɖəjkkʉ/ /ʊɖəlnələm/ /seːɾɪjɪləj/
7. /ɪɳ̪ɖə/ /ʋiːɖʉ/ /sɪɾɪɖaːgə/ /ɪɾʉkkɪɾəɖʉ/

List 5

1. /ʊɛl̪l̪əj/ /puːnəj/ /paːl/ /kʊɖɪʈ̪t̪əɖʉ/
2. /əʊəl̪/ /t̪ʉɳɻjəjəj/ /t̪ʉʊəjʈ̪t̪ʉk/ /koɳɖɪɾʉɳ̪ɖaːl/
3. /sɪɾʉmɪ/ /t̪ən/ /pəl̪l̪əjt̪/ /t̪eːjgɪɾaː/
4. /poːʈ̪ʉ/ /nɛʈ̪ʳɪjɪn/ /meːl/ /ɪɾʉkkɪɾəɖʉ/
5. /sɪɾʉmɪ/ /t̪ən/ /kəppɪl/ /kʊɖɪkkɪɾaː/
6. /sɪɾʉmɪ/ /t̪ən/ /pəl̪l̪ɪkkʉ/ /poːnaːl/
7. /sɪʊəppʉ/ /koːppəj/ /pɛɾɪɖaːgə/ /ɪɾʉkkɪɾəɖʉ/

List 6

1. /sɪŋgəm/ /oɾʉ/ /kəʈ̪ʉ/ /ʋɪlənŋgʉ/
2. /əɳ̪ɖə/ /naːrkkaːlɪgəl̪/ /ʊɖəjɳ̪ɖʉ/ /ɪɾʉkkɪnɖ̪ʳənə/
3. /pəʈ̪taːm/ /puːtʃtʃɪ/ /ʋələjjɪl/ /ɪɾʉkkɪɾəɖʉ/
4. /aːdʉ/ /ʊɛl̪l̪əj/ /neːɾəmaːgə/ /ɪɾʉkkɪɾəɖʉ/
5. /pəjjən/ /t̪aːl̪əj/ /kəɖɪɾɪkkəʊəjkkə/ /pəɖʉgɪɾaːn/
6. /kiːɻəj/ /ʊɪɻɳ̪ɖaːl/ /peːʈ̪ɪ/ /ʊɖəjɳ̪ɖʉʊɪɖʉm/
7. /ɪɾəʊɪl/ /əʊən/ /ɛɻʉɖɪ/ /koɳɖɪɾʉɳ̪ɖaːn/

List 7

1. /əɳ̪ɖə/ /pɛɳ/ /pɪnnɪ/ /koɳɖɪɾʉkkɪɾaːl̪/
2. /oɾʉ/ /pɛɳ/ /kəɖɪɖəm/ /ɛɻʉɖʉʊaːl̪/
3. /oɾʉ/ /pəjjən/ /pəlʉnəj/ /uːɖʊgɪɾaːn/
4. /pʊt̪t̪aːkkəm/ /pɛʈ̪ɪjɪn/ /meːl/ /ɪɾʉkkɪɾəɖʉ/
5. /əɳ̪ɖə/ /sɪɾʉmɪ/ /ʋiːʈ̪ʉkkʉ/ /poːgɪɾaːl̪/
6. /pɛɳ/ /sɪɾʉmɪkkʉ/ /pu/ /koɖʉkkɪɾaːl̪/
7. /əʊəl̪/ /t̪iːkkʉtʃtʃɪjaːl/ /mɛɻʉguʊəɖ̪ɪjəjəj/ /eːt̪t̪ʳɪnaːl/

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THE CLINICAL PHARMACIST'S ROLE IN THE ENT PERIOPERATIVE PERIOD: PRELIMINARY RESULTS FROM 30 PATIENTS

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Abstract

Introduction: Prehabilitation usually consists of several key elements: (1) elimination of addictions, e.g. smoking; (2) appropriate nutritional preparation for malnourished patients; (3) tailored physical exercise can help improve body efficiency; (4) consultation with a psychologist is important for oncological patients but also before any surgical procedure. The aim of the study is to set out the pre- and postoperative roles of the pharmacist in otolaryngological (non-oncological) procedures such as: (1) ventilation drainage; (2) sinus surgery; and (3) adenotonsillotomy, adenoidectomy, tonsillotomy. The study is based on medical histories and postoperative recommendations.

Material and methods: A non-invasive, retrospective study was conducted based on 30 anonymized patient records, which included initial diagnosis, subjective examination, interview, physical examination, final qualification, procedure description, applied treatment, test results and consultations, epicrisis, and recommendations. The study specifically analyzed patients who were on regular medication prior to surgery. The study was based on the analysis of medical histories and postoperative recommendations of 30 patients, 24 adults and 6 children. The study specifically analyzed patients who were on regular medication prior to surgery and excluded oncological diseases. The study was approved by the ethics committee.

Results: The data analysis documented key areas of the pharmacist's role. The most important interactions were detected after clarithromycin administration. The analysis also looked at diet after surgery, pain management, and choice of the safest treatment option following surgery: paracetamol.

Conclusions: Our conclusions emphasize the comprehensive role of the pharmacist within the interdisciplinary team, contributing to the recovery of patients after surgery. The collaboration of pharmacists with patients, doctors, and other health specialists is crucial for achieving the best therapeutic outcomes and ensuring optimal care.

Keywords: pharmacist • otolaryngology • pharmaceutical care • prehabilitation

ROLA FARMACEUTY KLINICZNEGO W OKRESIE OKOŁOOPERACYJNYM W OTORYNOLARYNGOLOGII: WSTĘPNE WYNIKI BADAŃ 30 PACJENTÓW

Streszczenie

Wprowadzenie: Prehabilitacja składa się zazwyczaj z kilku kluczowych działań: 1) eliminowanie nałogów, np. palenia tytoniu; 2) u pacjentów niedożywionych konieczne jest odpowiednie przygotowanie żywieniowe; 3) odpowiednio dostosowany wysiłek fizyczny może przyczynić się do poprawy ogólnej sprawności organizmu; 4) ważna jest konsultacja psychologiczna, zwłaszcza dla pacjentów onkologicznych, ale może być również istotna przed zabiegami chirurgicznymi. Celem badania było określenie przed- i pooperacyjnej roli farmaceuty w zabiegach z obszaru otorynolaryngologi (z wyłączeniem zabiegów z obszaru onkologii), takich jak: drenaż wentylacyjny i operacje zatok, a także adenotomia, adenoidektomia i tonsillotomia. Badanie oparto na wywiadach medycznych i zaleceniach okołooperacyjnych.

Materiał i metody: Nieinwazyjne, retrospektywne badanie przeprowadzono z wykorzystaniem zanonimizowanych kart historii choroby pacjentów, które zawierały następujące informacje: wstępna diagnoza, badanie podmiotowe, wywiad, badanie fizykalne, ostateczna kwalifikacja, opis procedury, zastosowane leczenie, wyniki badań i konsultacji, epikryza i zalecenia. Badanie opierało się na analizie historii choroby i zaleceń pooperacyjnych 30 pacjentów – osób dorosłych i dzieci. W badaniu przeanalizowano m.in. karty pacjentów, którzy przyjmowali regularne leki przed operacją. Pacjenci z chorobami onkologicznymi w zakresie otorynolaryngologii nie zostali uwzględnieni w analizie. Badanie uzyskało pozytywną zgodę komisji bioetycznej.

Wyniki: Analiza danych umożliwiła obserwację najważniejszych obszarów roli farmaceutów w opiece farmaceutycznej. Najważniejsze interakcje wykryto po podaniu klarytromycyny. Wyniki analizy obejmują również: analizę diety po operacji, plan leczenia bólu po operacji i wybór bezpieczniejszej opcji leczenia po operacji: paracetamolu.

Wnioski: Wnioski z analizy podkreślają wszechstronną rolę farmaceuty w interdyscyplinarnym zespole w opiece farmaceutycznej, która przyczynia się do prawidłowego powrotu do zdrowia pacjentów po operacji. Współpraca farmaceutów z pacjentami, lekarzami i innymi specjalistami jest kluczowa dla osiągnięcia najlepszych efektów terapeutycznych i zapewnienia optymalnej opieki farmaceutycznej w otorynolaryngologii.

Słowa kluczowe: farmaceuta • otorynolaryngologia • opieka farmaceutyczna • prehabilitacja

Introduction

Proper patient preparation for surgery is crucial in surgical procedures. The personalization of patient therapy and surgical care delivery is a key aspect of modern healthcare, significantly evolving alongside the multidisciplinary healthcare (MDH) approach. Clinical pharmacists have been successfully integrated into various healthcare systems worldwide. However, the role of clinical pharmacists in surgical care remains underexplored in the literature [1].

The role of a clinical pharmacist typically consists of several key components: (1) elimination of addictions, such as smoking, which is a risk factor for serious diseases and postoperative complications (e.g., wound infections, pneumonia, increased mortality); (2) nutritional optimization for malnourished or cachectic patients, as surgery in such individuals poses a higher risk of complications, although dietary interventions extend to a broader patient group; (3) tailored physical exercises to enhance overall fitness, including breathing exercises and functional training (e.g., getting out of bed post-surgery – even minor physical activity can support anabolic processes, aiding in weight recovery and wound healing); (4) psychological support, especially for oncological patients but also for all those undergoing surgery (to help them understand the treatment and alleviate preoperative and postoperative anxiety, ultimately improving well-being and treatment outcomes); (5) medication reconciliation: reviewing patients' medication history to prevent drug interactions and ensure the proper continuation or discontinuation of certain medications before surgery; (6) risk assessment: identifying medications that may increase surgical risks, such as anticoagulants, antiplatelets, or immunosuppressants, and recommending adjustments; (7) patient education: advising patients on which medications to take or avoid before surgery and explaining perioperative medication management; (8) optimizing therapy: ensuring patients are in optimal condition for surgery, such as managing blood glucose levels in diabetic patients or optimizing pain management strategies; (9) pain management: recommending appropriate analgesics while minimizing opioid use and reducing the risk of adverse effects; (10) infection prevention: ensuring the proper use of antibiotics for surgical site infection prophylaxis and treatment; (11) medication safety: monitoring for potential drug interactions and side effects due to new or adjusted postoperative medications; (12) patient discharge planning: providing counselling on medication adherence, tapering pain medications, and preventing complications at home.

The perioperative period encompasses both preoperative and postoperative phases, which may last from a few days to several weeks, depending on the complexity of the surgery. Pharmacists, as part of an interdisciplinary team, can play a significant role in preparing patients for surgery.

This study aims to set out the role of pharmacists in preparing patients for non-oncological otolaryngological procedures, including ventilation drainage, sinus surgeries, adenotonsillotomy, adenoidectomy, and tonsillotomy, as well as in the postoperative period based on medical history and postoperative recommendations.

Material and methods

This work is based on 30 patients (24 adult patients and 6 children). A retrospective study was conducted based on anonymized medical records from the International Center of Hearing and Speech. The study received approval from the Bioethics Committee (approval number: IFPS: KB/Statement No. 1/2023).

The initial analysis used 30 anonymized patient charts containing details on initial diagnosis, physical examination, patient interviews, final surgical qualification, procedure descriptions, treatments administered, diagnostic results, consultations, epicrises, and recommendations. This observational cross-sectional study employed a mixed-methods approach based on retrospective patient data analysis, incorporating quantitative data on medication usage and dietary adherence, as well as qualitative observations on patient compliance and pharmacist recommendations. The inclusion criteria included: (1) patients undergoing various otorhinolaryngological procedures (both adults and children, regardless of gender); (2) procedures: adenotomy, tympanotomy, septoplasty, and various sinus surgeries; (3) availability of detailed medical documentation, including blood test results, medication use, and postoperative recommendations; (4) no contraindications to surgery due to severe chronic diseases or acute conditions at the time of qualification. The exclusion criteria included: (1) significant allergies to administered drugs (e.g., penicillins, clindamycin); (2) uncontrolled chronic diseases (e.g., severe diabetes, hypertension); (3) factors affecting surgical safety, such as thrombosis risk or use of medications interacting with perioperative pharmacotherapy; (4) active infections, severe blood clotting disorders, or other conditions increasing the risk of complications.

Results

The retrospective analysis of anonymized patient records focused on medication usage before and after surgery. Postoperative prescriptions, dosages, potential drug

Table 1. Potential areas of activity of the pharmacist in ENT surgery

Possible pharmacist interventions	Examples of pharmacist's activities
Optimisation of pharmacological and non-pharmacological treatment of chronic patient conditions	Evaluation and optimization of nutrition, in cooperation with a dietician, including the assessment of the legitimacy of dietary supplements taken (e.g. in the case of otorhinolaryngological procedures in the preoperative period, e.g. fish oil or shark liver oil). Recommendation of weight loss programs, if indicated – weight reduction and introduction of effective methods of weight reduction. Optimization of pharmacological and non-pharmacological treatment in pharmacotherapy of chronic diseases such as diabetes, hypertension.
Developing a medication plan before surgery	Drug conciliation, including a review of herbal preparations, dietary supplements, and over-the-counter (OTC) and prescription medicines. As part of an interdisciplinary team, preparation of a plan for drugs used chronically in the days preceding surgery, including determining which drugs to take and which to withhold, adjusting doses, e.g. insulin. Stratification of the risk of postoperative thrombosis and associated recommendations for anticoagulant therapy, bridging, and/or prophylaxis. Assessment and plan for chronic pain, including optimization of the use of analgesics according to the WHO "analgesic ladder"; gradual reduction of doses; or identification of the need for alternative forms of medicine or routes of administration.
Planning of procedures aimed at reducing postoperative risks and complications	Developing a smoking cessation plan (e.g. in the area of otorhinolaryngology, especially before or after sinus surgeries, as external factors such as exposure to tobacco smoke, overuse of air conditioning, are factors that are unfavorable for the sinuses).
Patient education and counseling	Presentation of the possibility of postoperative pain and education on the appropriate and safe use of analgesics. Explanation of the prescribed medication regimen and education on the need to take medications, adherence to dosage (e.g., in the case of antibiotics, maintaining appropriate intervals in antibiotic intake); selection of the appropriate probiotic and/or prebiotic during antibiotic therapy.
Monitoring for adverse reactions in connection with the introduction of treatment	Monitoring of adverse reactions in such groups of drugs as: antibiotics, analgesics, drugs used in the prevention and treatment of hemorrhage. Reporting of the above-mentioned adverse reactions.
Monitoring the treatment of postoperative wounds	Proper care of the postoperative wound and patient education in this area. Recommendations on the use of appropriate dressings, wound disinfection products. Special attention should be paid to sinus surgeries (postoperative dressing is placed in the nasal cavity; education in breathing techniques when the dressing is in the nasal cavity).

interactions, and pharmacist recommendations were analyzed. **Supplementary Table 1** lists data on the 30 patients, including blood test results, surgery type and date, postoperative recommendations, sex, age at surgery, chronic medications, and drug allergies. It is divided into **Supplementary Table 1A** (24 adults) and **Supplementary Table 1B** (6 children). Detailed analysis was conducted on patients who were regularly taking medications preoperatively: 6 cases were selected for further review, as postoperative recommendations were often similar, making analysis of all 30 cases unnecessary. **Supplementary Table 2** details patient medication data, postoperative recommendations, preoperative medications, potential pharmaceutical interventions, and identified drug interactions or side effects. The supplementary tables are available for download from the "Journal of Hearing Science" website (www.journalofhearingscience.com).

In **Table 1** we set out categories of potential areas where the pharmacist could be involved in ENT surgery.

Discussion

There is limited research on prehabilitation in otorhinolaryngology, with most studies focusing on head and neck oncological diseases [2,3]. Prehabilitation is less emphasized in nasal, sinus, and ear surgeries. The reviewed cases highlight dietary factors influencing bleeding risk, such as fish oils, particularly in tonsil surgery. Certain studies dispute the importance of dietary modifications for postoperative recovery [5–7]. Smoking cessation is crucial for improved postoperative outcomes in sinus surgery [9,10]. Pharmacists can assist by educating patients on smoking cessation benefits and offering pharmacological support (e.g., cytisine or nicotine replacement therapy). Reducing antibiotic use is another area of pharmacist involvement. The National Antibiotic Protection Program highlights pharmacists' roles in hospital antibiotic stewardship teams, aiming to reduce antibiotic resistance [10,11]. Each patient's antibiotic therapy should be individualized.

The Polish Society of Clinical Pharmacy emphasizes the importance of drug reconciliation in improving patient

safety. Pharmacists help prevent pharmacotherapy errors, enhance patient communication, and identify potential drug interactions. In the preoperative period, the most important aspect is proper preparation of the patient. In the case of children and surgeries in the throat area, the most important thing is to limit dietary supplements (e.g. cod liver oil), which could affect the risk of postoperative bleeding. In the case of adults, who statistically take more medications chronically than children, consultation on discontinuing medications that could affect postoperative results is useful. Examples of such medications include painkillers, antiplatelet drugs (at the doctor's discretion), anticoagulants, and vitamins, especially A and E.

Probiotic and prebiotic use during antibiotic therapy is another area of pharmacist involvement, helping mitigate antibiotic-associated diarrhoea and restore gut microbiota [11–13]. Pharmacists can guide patients in selecting effective probiotic strains.

Pharmacists also play a key role in educating patients on correct medication use, storage, and administration. For instance, tranexamic acid may require guidance on proper handling (e.g., using a needle and syringe for administration). Postoperative pain management is another pharmacist area of interest. Paracetamol is the preferred analgesic, with a maximum daily dose of 4 g for adults and 10–15 mg/kg for children. NSAIDs are generally avoided due to their impact on platelet function, prolonged bleeding risk, and interactions with glucocorticoids, oral antidiabetic drugs, and β-blockers. The WHO analgesic ladder should guide escalation to stronger pain management when needed. Additionally, postoperative throat pain may require local anesthetics or voice-supportive treatments. Dietary recommendations include soft foods for 14 days post-surgery and avoiding spicy, hot, and hard foods.

Study limitations

The relatively small sample size (24 adult patients and 6 children) limits the generalizability of findings. The study focused on non-oncological ENT procedures, restricting its applicability to other areas, particularly head and neck oncology. Larger studies could provide broader insights into pharmacist involvement in ENT surgery. Additionally, the observational study design limits direct measurement of pharmacist interventions on recovery time, complication rates, and patient satisfaction. Future randomized controlled trials (RCTs) could offer a more rigorous assessment by incorporating control groups. Future research should also explore pharmacist-led interventions such as NSAID counselling, analgesic treatment plans, and drug reconciliation to reduce postoperative complications.

Conclusions

This study highlights various aspects of the pharmacist's role in perioperative pharmaceutical care, emphasizing their significance in ensuring safe and effective treatment (e.g. selection of antibiotic dose, justification for using antibiotics after surgery, supportive treatment with steroids). Pharmacists play an important role in drug interaction monitoring, reducing postoperative antibiotic use, and optimizing pain management. More prospective studies are needed to further define the pharmacist's role in non-oncological ENT procedures.

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Supplementary material

The supplementary tables (1A, 1B and 2) are available at https://www.journalofhearingscience.com/

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THE SWALLOWING DISORDER SCALE (SDS) AS A NEW POLISH-LANGUAGE QUESTIONNAIRE IN OTOLARYNGOLOGY-PHONIATRIC PRACTICE

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Abstract

Introduction: Assessment of swallowing function raises several multidisciplinary issues. In otolaryngology and phoniatrics practice, dysphagia often coexists with other laryngeal dysfunctions. The condition is often trivialised due to mild symptoms and the dominance of other dysfunctions. However, patient discomfort calls for screening and accurate diagnostic tools to determine the risk of further adverse effects. The aim of this study was to show the basic psychometric values of a new Swallowing Disorder Scale (SDS) questionnaire.

Material and methods: The study included 208 patients with functional voice disorders coexisting with dysphagia who attended a specialist for audiological-phoniatric consultations between 2021 and 2023. The diagnostic procedure included an interview, otolaryngological-phoniatric examination, functional endoscopic evaluation of swallowing, and surface electromyography of selected head and neck muscles. In addition, patients completed five Polish-language swallowing assessment questionnaires: the Visual Analogue Scale, the Dysphagia Handicap Index (DHI), the Eating Assessment Tool (EAT-10), the Reflux Symptom Index (RSI), and the authors' new Swallowing Disorder Scale (SDS).

Results: Results for the following instruments are reported: VAS, EAT-10, DHI, RSI, and SDS. The basic psychometric values of the SDS questionnaire was determined on a sample of 87 patients (56 females and 31 males). The results of the SDS questionnaire correlated significantly with the severity of dysphagia as rated by DSRS+ ($r = 0.61$; $p < 0.01$) and with SRS ($r = -0.74$, $p < 0.01$). No significant relationship was found between SDS questions 1–3 and the severity of dysphagia. Significant relationships were found for questions 4–6 of SDS ($r = 0.68$, $p < 0.01$) and 7–10 ($r = 0.77$, $p < 0.01$). Weak negative correlations with the SRS scale were observed also for the sum of SDS questions 1–3 ($r = -0.37$, $p < 0.05$).

Conclusions: The article has reviewed five Polish-language questionnaires and assessed their clinical value in diagnosing swallowing disorders. The review clearly demonstrates the need for tools to differentiate and make a preliminarily assessment of functional dysphagia. The SDS questionnaire appears to be a satisfactory tool for screening and differentiating patients with functional dysphagia. The SDS questionnaire allows the severity of swallowing disorders to be assessed.

Keywords: questionnaire • dysphagia • swallowing • functional dysphagia

SKALA ZABURZEŃ POŁYKANIA (SDS) JAKO NOWY POLSKOJĘZYCZNY KWESTIONARIUSZ W PRAKTYCE OTOLARYNGOLOGICZNO-FONIATRYCZNEJ

Streszczenie

Wprowadzenie: Ocena funkcji połykania jest zagadnieniem interdyscyplinarnym. W praktyce otolaryngologicznej i foniatrycznej dysfagia często współistnieje z innymi dysfunkcjami krtani. Stan ten jest często bagatelizowany ze względu na łagodne objawy i dominację innych dysfunkcji. Jednak ze względu na poziom dyskomfortu pacjentów należy stosować badania przesiewowe i dokładne narzędzia diagnostycznych w celu określenia ryzyka wystąpienia tych zaburzeń. Celem niniejszego badania było przedstawienie charakterystyki podstawowych wartości psychometrycznych nowego kwestionariusza *Skali zaburzeń połykania* (SDS).

Materiał i metody: Badaniem objęto 208 pacjentów z czynnościowymi zaburzeniami głosu współistniejącymi z dysfagią, którzy zgłosili się do specjalisty na konsultację audiologiczno-foniatryczną w latach 2021–2023. Postępowanie diagnostyczne obejmowało: wywiad, badanie otolaryngologiczno-foniatryczne, czynnościową ocenę endoskopową połykania oraz elektromiografię powierzchniową wybranych mięśni głowy i szyi. Dodatkowo pacjenci wypełniali pięć polskojęzycznych kwestionariuszy do oceny połykania: *Wizualną skalę analogową* (VAS), *Dysphagia Handicap Index* (DHI), *Eating Assessment Tool* (EAT-10), *Reflux Symptom Index* (RSI) oraz autorską *Skalę zaburzeń połykania* (ang. *Swallowing Disorder Scale*, SDS).

Wyniki: Przedstawiono wyniki dla następujących instrumentów: VAS, EAT-10, DHI, RSI i SDS. Charakterystyka podstawowych wartości psychometrycznych kwestionariusza SDS została przeprowadzona na próbie 87 pacjentów (56 kobiet i 31 mężczyzn). Wyniki kwestionariusza SDS korelowały istotnie z nasileniem dysfagii ocenianym za pomocą DSRS+ ($r = 0{,}61$; $p < 0{,}01$) oraz z SRS ($r = -0{,}74$; $p < 0{,}01$). Nie stwierdzono istotnego związku między pytaniami 1–3 SDS a nasileniem dysfagii. Istotne związki stwierdzono dla pytań 4–6 SDS ($r = 0{,}68$, $p < 0{,}01$) i 7–10 SDS ($r = 0{,}77$, $p < 0{,}01$). Słabe ujemne korelacje ze skalą SRS zaobserwowano również dla sumy wyników pytań 1–3 SDS ($r = -0{,}37$, $p < 0{,}05$).

Wnioski: W artykule dokonano przeglądu polskojęzycznych kwestionariuszy i oceniono ich wartość kliniczną w diagnostyce zaburzeń połykania. Dokonany przegląd wyraźnie wskazuje, że potrzebne są narzędzia pozwalające na różnicowanie i wstępną ocenę dysfagii funkcjonalnej. Kwestionariusz SDS może być zadowalającym narzędziem do badań przesiewowych i różnicowania pacjentów z dysfagią funkcjonalną. Kwestionariusz SDS umożliwia ocenę nasilenia zaburzeń połykania.

Słowa kluczowe: kwestionariusz • dysfagia • połykanie • czynnościowe zaburzenia połykania

Key for abbreviations	
ASHA	American Speech-Language-Hearing Association
DHI	Dysphagia Handicap Index
DSRS	Dysphagia Severity Rating Scale
EAT-10	Eating Assessment Tool
ENT (departments)	ear, nose, thoat (departments)
FEES	functional endoscopic evaluation of swallowing
GERD	gastroesophageal reflux disease
GUSS	Gugging swallowing screen
ICD-9	International Classification of Diseases, Ninth revision
IDI	Item Difficulty Index
IFPS	Institute of Physiology and Pathology of Hearing
LPR	laryngopharyngeal reflux
MAP method	minimum average partial method
MCID	minimal clinically important difference
MTDg	muscle tension dysphagia
RSI	Reflux Symptom Index
SDS	Swallowing Disorder Scale
SEMG	superficial electromyography
SRS	Swallowing Rating Scale
V-VST	Volume-Viscosity Swallow Test
VAS	Visual Analogue Scale
VFS	videofluoroscopy
WST	water swallow test

Introduction

The assessment of swallowing is a multidisciplinary issue that falls within the expertise of various specialists, including audiologists, phoniatricians, and otolaryngologists. Outpatients presenting with dysphagia to one of these specialists require extensive differential diagnosis and often multidisciplinary consultation. Neurological disorders are the most common cause of dysphagia, accounting for 60% of cases [1]. Next are complications caused by oncological diseases. As for oropharyngeal dysphagia, it mostly occurs in the course of neurological diseases, in patients with head and neck tumours, and in the elderly [2]. Data from the literature estimate the prevalence of oropharyngeal dysphagia in the population to be several per cent [3,4].

Accurate diagnosis of the type and severity of oropharyngeal dysphagia and its appropriate treatment are clinically important. If left untreated, dysphagia can lead to dehydration, malnutrition, and other complications such as aspiration, pneumonia, and even death [5,6]. Because of the adverse consequences of dysphagia, it is advisable to identify its symptoms as early as possible and make an appropriate diagnosis. Any tool used to assess dysphagia should also be effective in identifying healthy individuals who do not have the condition [7]. Bolus tests (such as the screening water swallow test (WST) or Volume-Viscosity Swallow Test, V-VST) allow the assessment of swallowing safety [8].

There are numerous questionnaires in the literature that are designed to assess the severity of dysphagia or of malnutrition, and can be used to gauge the effectiveness of various therapies [9]. Most questionnaires focus on assessing the quality of life related to swallowing rather than on swallowing as a specific function [10]. In otolaryngology and phoniatrics practice, dysphagia often coexists with other laryngeal dysfunctions and other symptoms affecting the throat and larynx. It is often trivialised due to its relatively mild symptoms and the dominance of other dysfunctions. Because the objective symptoms are mild, dysphagia patients usually seek initial consultation with specialists in other fields (gastroenterologists, neurologists, oncologists). At the same time, however, the subjective symptoms of dysphagia are distressing enough that patients are advised to make use of screening and diagnostic tools to determine the risk of adverse effects and the need for further diagnosis and, if appropriate, treatment [11].

It is therefore necessary to distinguish dysphagia from other similar clinical conditions. In particular, clinical practice often finds that swallowing difficulties are commonly associated with reflux disease or muscle tension dysphagia (MTDg). In laryngology, the largest group of patients

Table 1. Definition of terms related to swallowing dysfunction and disorder with reference to ICD-9 and ICD-10 classifications [12–16]

Term	Definition	ICD-9	ICD-10
Feeding difficulties	Feeding difficulties and inappropriate feeding, poor diet patterns, and poor eating habits.	783.3	R63.3
Globus pharyngeus	A functional disorder manifested by a sensation of a foreign body or tightness in the throat that is unrelated to eating or drinking. The psychological aspect is of great importance.	306.4	F45.8
Muscle tension dysphagia (MTDg)	Dysphagia resulting in delayed movement of the food bite. It is associated with impaired coordination of the muscles involved in the act of swallowing and sensory dysfunction of the mucosa of the oral cavity, pharynx, and larynx.	787.2	R13
Oropharyngeal dysphagia	The real (not necessarily subjective) difficulty in safe passage of food from the oral cavity to the pharynx and oesophagus.	787.2	R13
Swallowing dysfunction	The dysfunction includes an incorrect pattern of the oral phase of swallowing. There is non-normative swallowing resulting from improper movements of the tongue, lips, palate, malocclusion, non-physiological breathing pattern, or other parafunction of the masticatory system. The risk of aspiration of food content is not higher than in the healthy population. Abnormal resting position of the tongue resulting in difficulty in forming and moving the bolus.	783.3	R63.3

Table 2. Original DSR scale (right) and the expanded DSR scale (left) used in the study (here called DSRS+)

Expanded DSR scale (DSRS+) with new ratings for functional swallowing disorders		Degree of dysphagia according to the original DSR scale
0	Dysfunctional swallowing	not fulfilling dysphagia criteria
1	Muscle tension dysphagia	various degrees
2	Minimal dysphagia	1
3	Mild dysphagia	2
4	Mild/moderate	3
5	Moderate	4
6	Moderate/severe	5
7	Severe	6

with swallowing disorders are those following treatment of the head and neck area for cancer, or after surgical treatment for non-cancer causes. The SDS is a tool created with the idea of assigning symptoms to different levels of the swallowing tract, and differentiating potential causes of the disorder [11]. That study also highlighted other causes of swallowing dysfunction among phoniatric–laryngology patients, by describing a group of patients with swallowing dysfunction or MTDg.

The aim of this study is to show the characteristics of basic psychometric values of the new Swallowing Disorder Scale (SDS) questionnaire. This work involves comparisons of the following scales: Eating Assessment Tool (EAT-10), Dysphagia Handicap Index (DHI), Swallowing Disorder Scale (SDS), and Reflux Symptom Index (RSI). Classification of severity was done in terms of the Dysphagia Severity Rating Scale (DSRS), extended to include abnormal swallowing patterns and functional swallowing disorders (DSRS+), as well as the Swallowing Rating Scale (SRS).

Material and methods

The sample in the study consisted of 208 patients who presented to a specialist – an audiologist and phoniatrician – between 2021 and 2023 with functional voice disorders and associated swallowing problems. The patients were referred to the Audiology and Phoniatrics Clinic of the Institute of Physiology and Pathology of Hearing (IFPS) in Warsaw for diagnosis on the basis of their reported swallowing complaints and related concerns.

The diagnosis was based on a history, an otorhinolaryngological and phoniatric physical examination, functional endoscopic evaluation of swallowing (FEES), and superficial electromyography (SEMG) of selected head and neck muscles. The procedures have been described in our previous work [11]. In addition, patients completed Polish-validated swallowing assessment questionnaires (DHI, EAT-10, and RSI) as well as the authors' own SDS. Based on the diagnosis, swallowing dysfunction was differentiated from swallowing disorders (dysphagia). Definitions are given in **Table 1** based on [12–16]. The severity of the swallowing disorders were classified by physicians using the extended DSRS+ and the SRS – scales recommended by the American Speech-Language-Hearing Association (ASHA) [17,18]. **Table 2** lists the modified DSR scale according to which patients were classified. The addition of grade 0, corresponding to swallowing dysfunction, and grade 1, corresponding to MTDg, allowed functional disorders

imię i nazwisko **data**

Skala Zaburzeń Połykania (ang. *Swallowing Disorder Scale*)

Jem zbyt szybko	Tak	Czasami	Nie
Boję się, że podczas jedzenia zakrztuszę się	Tak	Czasami	Nie
Odczuwam przeszkodę w gardle niezależnie od spożywania pokarmów	Tak	Czasami	Nie
Mam problem z pogryzieniem pokarmu	Tak	Czasami	Nie
Zmieniłam/em sposób w jaki połykam, aby ułatwić sobie jedzenie	Tak	Czasami	Nie
Muszę kilkukrotnie przełknąć lub popić, aby udało mi się połknąć kęs	Tak	Czasami	Nie
Odczuwam dyskomfort podczas jedzenia	Tak	Czasami	Nie
Po jedzeniu muszę odchrząknąć	Tak	Czasami	Nie
Po piciu muszę odchrząknąć	Tak	Czasami	Nie
Ze względu na problemy z połykaniem schudłam/em ponad 5 kg	Tak	Trudno powiedzieć	Nie
			Suma

Krasnodębska P, Jarzyńska-Bućko A, Szkiełkowska A, Miaśkiewicz B, Skarzynski H. Diagnostic in Muscle Tension Dysphagia, Otolaryngol Pol, 2021; 75(1): 16–22. DOI 10.S604/0l.3001.0014.1997

Figure 1. Print version of the Swallowing Disorders Scale questionnaire (in Polish) used in the Audiology and Phoniatrics Department of IFPS, Warsaw/Kajetany, Poland

to be included in the classification. People with functional disorders who have severe swallowing disorders find it difficult to describe their swallowing problem, and the severity of the problem often differs from how they themselves perceive it.

This study was carried out in order to verify the psychometric properties of the SDS questionnaire. These properties include validity, intra-rater reliability, responsiveness, ceiling effects, floor effects, and minimal clinically important difference. For statistical analysis, the Pearson correlation coefficient was used. The level of statistical significance was set at $p < 0.05$. The degree of correlation was classified according to: $0.0 \leq |r| \leq 0.2$ (no correlation); $0.2 < |r| \leq 0.4$ (weak); $0.4 < |r| \leq 0.7$ (average); $0.7 < |r| \leq 0.9$ (strong); and $0.9 < |r| \leq 1.0$ (very strong) [11]. The Item Difficulty Index (IDI) was used to assess the item difficulty, including the presence of floor and ceiling effects. Velicer's MAP method was used to determine the optimal number of scales to be extracted. Cronbach's alpha reliability coefficient was calculated to assess data reliability. A mixed-design two-factor analysis of variance (ANOVA) was used to determine whether in the questionnaire scales there was a group effect on the scores. The following questionnaires were used.

EAT-10

A primary questionnaire used to screen for dysphagia is the Eating Assessment Tool [19]. EAT-10 aims to assess the functional health status in relation to both oropharyngeal and oesophageal dysphagia [20]. The questionnaire consists of 10 questions about the presence of symptoms related to swallowing and the degree of abnormality. Patients rate on a scale of 0 to 4 the extent to which they have experienced weight loss; ability to eat outside the home; ease of drinking, eating solid foods, or taking medication; enjoyment of eating; and coughing while eating. A score above 3 is considered abnormal. A score above 15 indicates a high likelihood of the presence of aspiration.

DHI

The Dysphagia Handicap Index consists of 25 questions divided into three parts relating to the impact of dysphagia on three aspects of disability: physical, emotional, and functional [9]. Developed in 2012 by Silbergleit et al. [21] and subsequently translated and adapted into Polish in 2022 [19], this questionnaire provides a clinically effective tool for assessing the impact of dysphagia on quality of life based on the patient's subjective responses. The physical, functional, and emotional subscales of DHI are scored as follows: never (0 points); sometimes (2 points); and always (4 points). The higher the total score (0 to 100), the greater is the impact of dysphagia on quality of life [22]. The normative value for the DHI score is 4 [7].

RSI

Another useful questionnaire for assessing patients with swallowing disorders is the Reflux Symptom Index. This questionnaire aims to rule out another cause of symptoms, namely reflux. The person completing the

Table 3. Basic descriptive statistics of the SDS questionnaire items together with the corresponding item difficulty index (IDI) values

No.	Mean	Mode	IDI
Item 1	0	0	0.519
Item 2	2	2	0.676
Item 3	2	0	0.630
Item 4	0	0	0.505
Item 5	0	0	0.551
Item 6	1	0	0.593
Item 7	2	0	0.565
Item 8	0	0	0.546
Item 9	0	0	0.523
Item 10	0	0	0.417

questionnaire rates on a scale of 1–5 the extent to which symptoms suggestive of laryngopharyngeal reflux have occurred in the past month [16,23]. A score on the questionnaire indicating reflux forms the basis for further diagnostic and therapeutic management.

SDS

The Swallowing Disorder Scale was developed as a screening tool in otolaryngological and phoniatric practice to identify and assess dysphagia, including symptoms suggestive of functional causes [11]. **Figure 1** shows the questionnaire (in Polish) used in the Audiology and Phoniatrics Department of IFPS. The scale consists of 10 questions relating to the oropharyngeal phase of swallowing, grouped as follows. Questions 1–3 relate to subjective sensations suggesting other (including functional) pathologies in the pharynx. Questions 4–6 focus on dysfunction of the oropharyngeal phase. Questions 7–10 suggest the presence of serious symptoms, such as aspiration [11]. The patient answers a series of short questions: "no" scores 0 points; "sometimes, or hard to say", 2 points; and "yes", 4 points. SDS serves as a screening for the location and type of possible dysphagia. According to several studies, the questionnaire correlates well with dysphagia severity as assessed by endoscopy [11,24].

Results

The basic psychometric values of the SDS questionnaire are set out below. **Table 3** summarises the descriptive statistics of the SDS questionnaire items. In addition, the obtained IDIs did not indicate the presence of data granularity problems, nor did they indicate the presence of floor or ceiling effects.

Item difficulty ratings

Using Velicer's MAP method, the optimal number of separable components was found to be 3. The resulting index had high internal consistency. The overall Cronbach's alpha reliability index for the new questionnaire was 0.795, confirming its high consistency. In addition, analysis of the discriminatory power of individual items showed that all test items were positively correlated with the scale. In accordance with the assumptions made, the first scale of the questionnaire (consisting of items 1–3) had the lowest reliability index (< 0.6), while the other scales had reliability index values of 0.658 for scales 4–6 and 0.734 for scales 7–10. Due to slight fluctuations in Cronbach's alpha values for items where the correlation with the scale was lower than 0.3, it was decided to include all test items in the factor. The results are given in **Table 4**.

Table 4. Discriminant power scores for SDS questionnaire items 1 to 10

No.	Item-total correlation	Cronbach's alpha after removal of items
Item 1	0.119	0.816
Item 2	0.537	0.768
Item 3	0.127	0.819
Item 4	0.537	0.768
Item 5	0.566	0.764
Item 6	0.599	0.759
Item 7	0.681	0.751
Item 8	0.555	0.767
Item 9	0.515	0.771
Item 10	0.553	0.772

Validity and responsiveness

The validity of the SDS questionnaire was verified by comparing its results with the DSRS+ and the SRS. Those tools describe the severity of the swallowing disorder based on physical evaluation of swallowing conducted and classified by a qualified physician. The comparison of the SDS with the two scales above quantifies the questionnaire suitability to detect changes in the health status of the respondent.

The population recruited for the SDS questionnaire validation included 87 patients (56 women and 31 men). Inclusion criteria were based on a wide-ranging diagnostic procedure described in the Material and methods section. The mean age of the patients was 56 years ($SD = 16$ years) in females and 56 years ($SD = 15$ years) in males. In addition to the standard report of dysphagia, the following diagnoses were present in the patients' medical history: unilateral laryngeal paralysis, functional dysphonia, laryngopharyngeal reflux, gastroenteropharyngeal reflux, globus pharyngeus, sensorineural laryngeal neuropathy, neurological diseases with associated peripheral speech organ muscle dysfunction, iatrogenic scarring from pharyngeal surgery, and oesophageal defects. Patients in the study group were assigned a dysfunction type according to diagnosis and etiology. **Table 5** gives the dysfunction name, etiology, and number of patients diagnosed with it.

Table 5. Distribution of patients according to the diagnosis of their sensorimotor dysfunction and reflux

Dysfunction	Etiology	Number of patients
Sensory dysfunction of mucosa of throat and larynx	post-inflammatory (due to reflux); neurogenic (associated with laryngeal paralysis); functional (associated with functional voice disorders)	63
Laryngeal muscle dysfunction	neurogenic changes – paralysis, iatrogenic	30
Oral muscle dysfunction	neurological diseases, congenital defects of the oral cavity and pharynx	24
Diagnosed laryngopharyngeal reflux (LPR)	LPR	17
Diagnosed gastroesophageal reflux disease (GERD)	GERD	6

Relationship between scale scores and study groups

No significant correlation was found between the type of dysphagia and the sum and profile of responses in SDS ($p > 0.05$). The type and degree of dysphagia diagnosed on the basis of the complete diagnostic protocol are shown in **Figure 2**. **Table 6** gives the median scores of each questionnaire according to the severity of dysphagia. **Figure 3** shows the summed scores of the SDS questionnaire of all patients, plotted against the severity of their condition as assessed by DSRS+.

The results of the SDS questionnaire were significantly correlated with the severity of dysphagia ($r = 0.61$; $p < 0.01$). The measurements were based on a group of 84 patients who completed the SDS questionnaires. **Figure 4** shows the correlations between the individual parts of the SDS (questions 1–3, 4–6, and 7–10) according to the DSRS+ classification. Using a two-factor ANOVA in a mixed 3 (questionnaire scales) × 6 (study groups) scheme (groups taken from the classification in **Table 6**), it was verified that the patients' scores of the individual questionnaire scales depended significantly on the study group. The results obtained are discussed below.

No questionnaire main effect was found ($F(2,156) = 1.01$; $p = 0.366$; with Mauchly's assumption of sphericity in the data $p > 0.05$). Thus, there is no basis to conclude that patients obtained significantly different scores for the three scales of the SDS questionnaire. The study group factor was found to be statistically significant ($F(5,78) = 10.84$; $p < 0.001$; $\eta^2 = 0.410$), indicating that there were clear intergroup differences. It was determined that patients with no dysfunction had significantly lower scores in the questionnaire than the mild, mild/medium, and moderate groups. The remaining differences were found to be statistically nonsignificant ($p > 0.05$). The existence of an interaction effect of group and questionnaire measurement scales was confirmed ($F(10,156) = 5.12$; $p < 0.001$; $\eta^2 = 0.247$). No significant correlation was found between questions 1–3 and the severity of dysphagia. Careful analysis of simple effects with Šidák correction indicated, for questions 1–3, no intergroup differences. Differences were only evident for the other two diagnostic scales and consisted of a linear trend showing that the scores obtained in these questionnaire scales increased with the severity of dysphagia ($p < 0.001$). Significant correlations were found for questions 4–6 ($r = 0.63$, $p < 0.01$) and 7–10 ($r = 0.64$, $p < 0.01$).

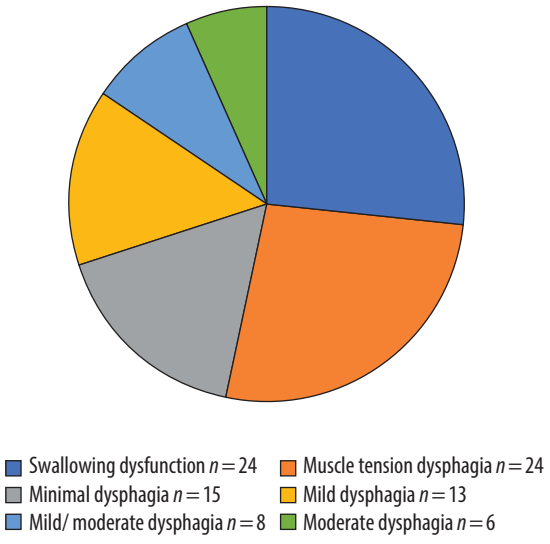

Figure 2. Distribution of patients according to type of dysphagia after endoscopic diagnosis

The results of scales 4–6 and scales 7–10 did not differ significantly between the groups. The results obtained are displayed in **Figure 5**. Dysphagia of varying severity and cause was diagnosed in subjects who scored 8 or more on part 3 of the questionnaire (questions 7–10). All subjects who answered "yes" to all questions in this section were diagnosed with dysphagia of mild/moderate severity or higher. The total SDS scores (the sum of questions 1–3, 4–6, and 7–10) for each DSRS+ rating are displayed in **Figure 6**.

Mixed-design ANOVA

Differences in scores for each set of questions (1–3, 4–6, and 7–10) according to the dysphagia severity groups (DSRS+) were examined using a mixed-design ANOVA. The intergroup factor (independent variable) was taken as dysphagia severity according to the DSRS+ . The within-group factor (repeated measure) was taken as the total score of each set of questions (1–3, 4–6, and 7–10). There was a significant main effect of dysphagia severity ($F(5,78) = 10.84$; $p < 0.001$; $\eta^2 = 0.410$). The estimated edge averages are shown in **Figure 7**. Moreover, no effect of the questionnaire was obtained ($F(2,77) = 0.99$; $p = 0.378$).

Table 6. Median, minimum, and maximum scores of questionnaires in patient groups, classified by the severity of their swallowing disorder according to the DSRS+

DSRS+	SDS	DHI	EAT-10	RSI
0	6 min 0; max 24	6 min 2; max 14	1 min 0; max 23	16 min 2; max 33
1	12 min 0; max 28	26 min 2; max 68	8 min 0; max 29	23 min 7; max 38
2	12 min 4; max 30	36 min 26; max 48	11 min 2; max 27	21 min 0; max 38
3	18 min 6; max 24	40 min 34; max 42	11 min 6; max 40	24 min 8; max 37
4	31 min 18; max 36	54 min 42; max 92	20 min 14; max 30	24 min 7; max 42
5	28 min 20; max 36	62 min 42; max 82	21 min 9; max 33	12.5 min 3; max 22
Correlation of SDS with the questionnaire	–	$r = 0.81$, $p < 0.05$	$r = 0.26$, $p > 0.05$	$r = 0.06$, $p > 0.05$

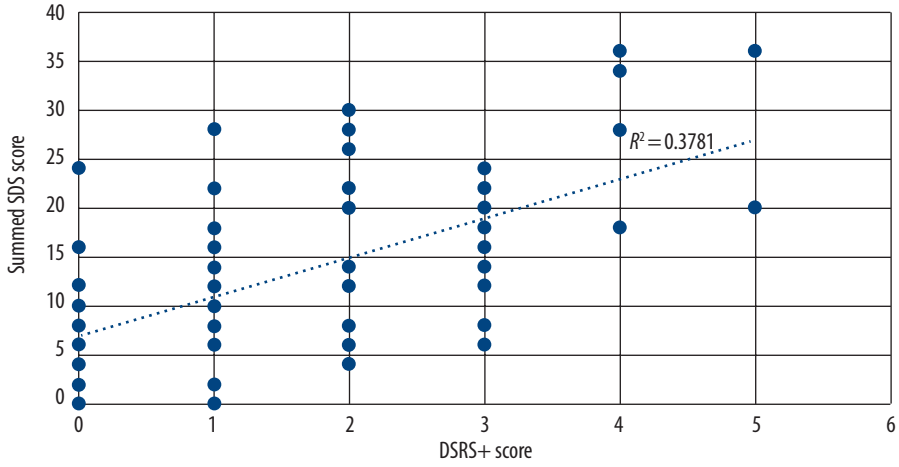

Figure 3. Total scores of all patients on the SDS questionnaire plotted against scores on the DSRS+ questionnaire

There was a significant interaction effect between the dysphagia severity and DSRS+ scores ($F(10,156) = 4.01$; $p < 0.001$; $\eta^2 = 0.205$) in the study group.

In patients with swallowing dysfunction or functional dysphagia, complaints in questions 1–3 were more common. The weight of questions 1–3 with respect to the total questionnaire scores were: group 1 (56%); group 2 (47%); group 3 (35%); group 4 (30%); group 5 (25%); and group 6 (21%) (the group number is +1 of the DSRS+ severity of **Table 6**). With increasing severity of dysphagia, an increase was seen in response scores for questions 4–10 (in groups 3–6 by DSRS+).

Additional measurements on a group of 38 patients provided their complete SDS, DSRS+, and SRS data. **Figure 8** shows a strong correlation between the SRS scores and the DSRS+ ratings ($R^2 = 0.79$). The underlying correlation is between the severity of dysphagia and swallowing patterns. Subjects diagnosed with abnormal swallowing or functional dysphagia were assessed by physicians as having normal swallowing in all life situations, or occasional abnormalities that prolonged eating time (grades 7 or 6 in the SRS classification).

Figure 9 shows a negative correlation between the total SDS score and the SRS grade ($r = -0.74$, $p < 0.01$). Similar to the DSRS+, the results of the SRS are presented with the SDS questionnaire divided into 3 parts (**Figure 10**). Statistically significant negative correlations with the SRS were obtained for the sum of scores of questions 4–6 of the SDS (**Figure 9**; $r = -0.68$, $p < 0.01$) and for the sum of scores of questions 7–10 of the SDS (**Figure 9**; $r = -0.77$, $p < 0.01$). Weak negative correlations with the SRS were observed also for the sum of scores of questions 1–3 of the SDS ($r = -0.37$, $p < 0.05$). Patients who got 4 or more "yes" answers on questions 7–10 required swallowing assistance due to the severity of their dysphagia.

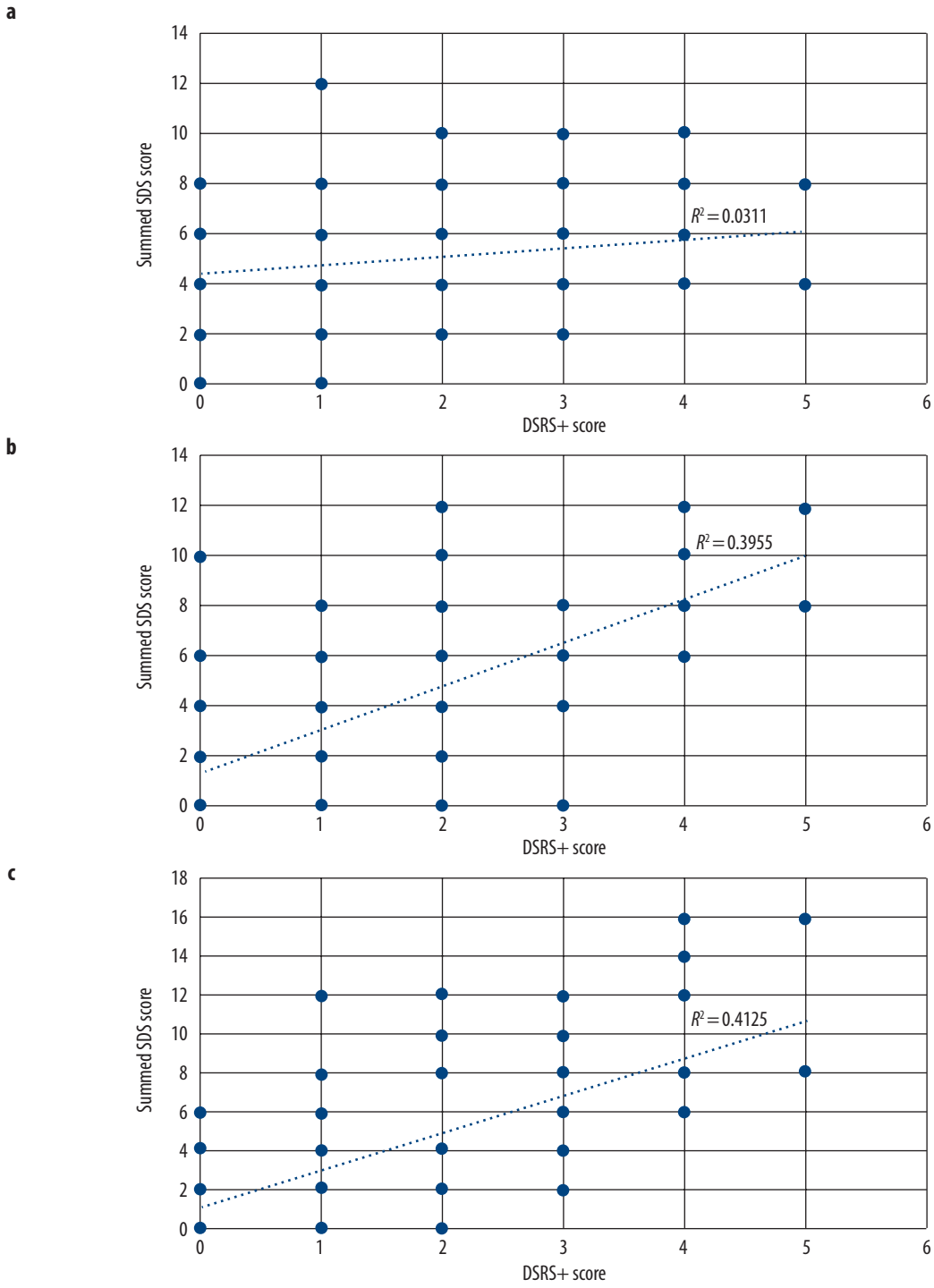

Figure 4. Dependence of the different parts of the SDS questionnaire on the DSRS+ ratings. **a**) SDS 1: sum of scores obtained in questions 1–3 (raising suspicion of a functional swallowing disorder). **b**) SDS 2: sum of questions 4–6 (raising suspicion of oropharyngeal dysphagia). **c**) SDS 3: sum of questions 7–10 (raising suspicion of gastroesophageal dysphagia or severe swallowing disorder)

Intra-rater reliability

Intra-rater reliability was only tested in people who were not diagnosed with dysphagia in physical examination; patients who were diagnosed with dysphagia were recommended treatment immediately after diagnosis. While the study was largely based on the group enrolled in the swallowing study, in the opinion of the investigators it would not have been ethical to delay treatment for the sole purpose of retesting the questionnaire.

Based on the clinical usefulness of the questionnaire shown in this study, another study was designed to evaluate intra-rater reliability by having patients complete the first

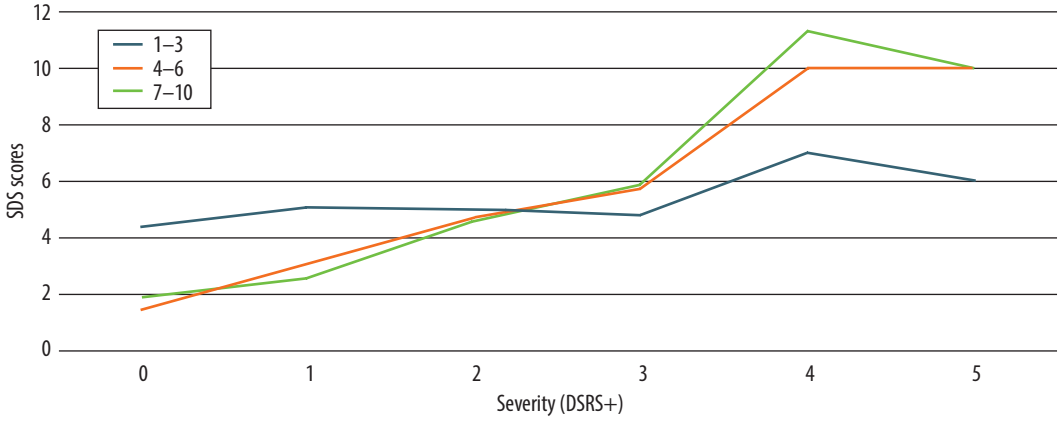

Figure 5. Average SDS scores in questions 1–3, 4–6, and 7–10, plotted against DSRS+ severity

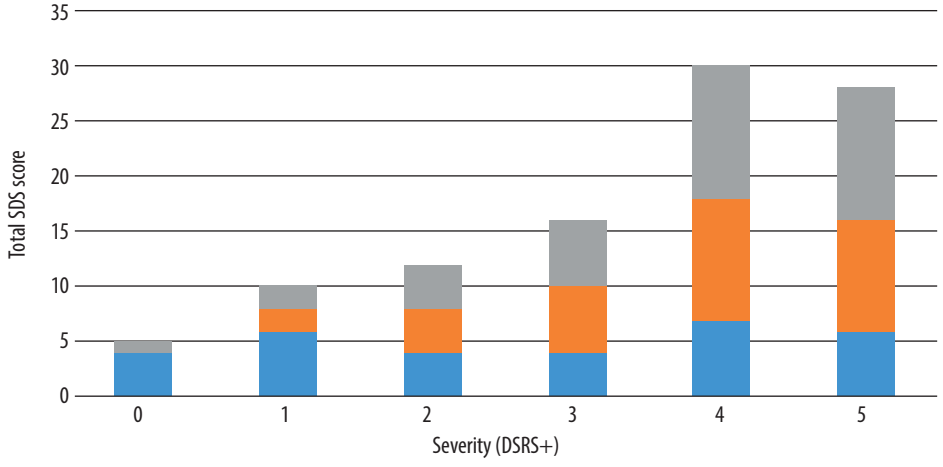

Figure 6. Median scores on questions 1–3, 4–6, and 7–10 of the SDS questionnaire in each DSRS+ group

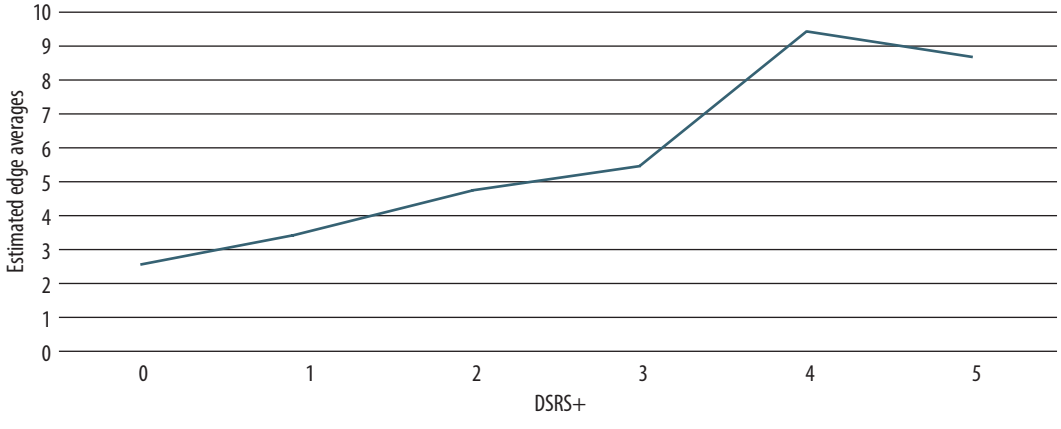

Figure 7. Estimated edge averages of the SDS questionnaire

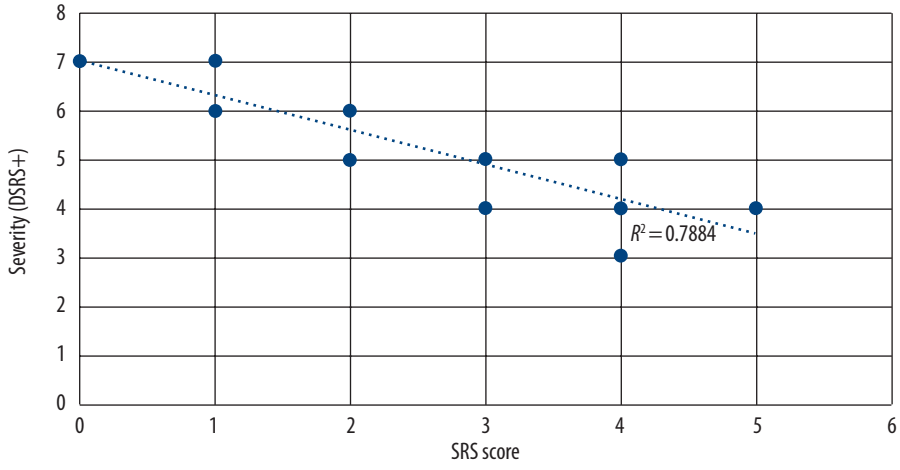

Figure 8. Distribution of SRS scores according to the DSRS+ ratings

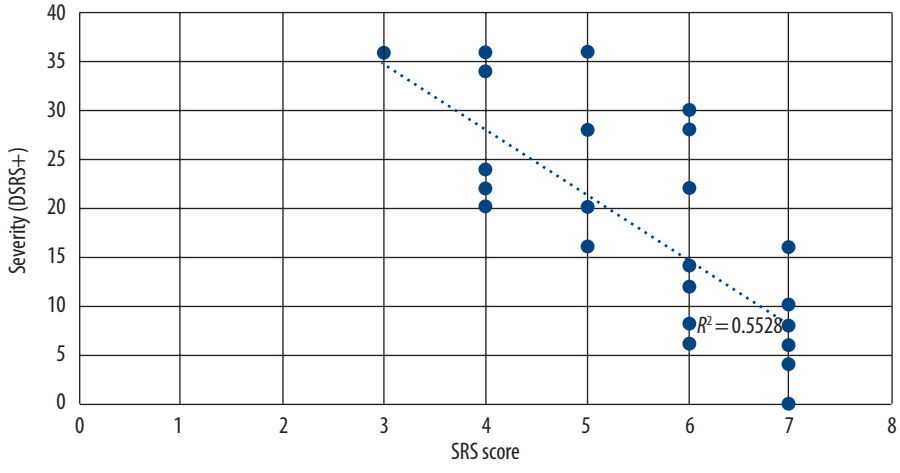

Figure 9. Distribution of SDS scores according to the SRS ratings

questionnaire both during the study recruitment visit or at the time of referral. A test–retest was performed on a group of 21 healthy patients who were not diagnosed with dysphagia in the physical examination. The questionnaire was administered to the subjects during their diagnostic stay and then, on the day of the start of the therapeutic rehabilitation process, for laryngeal dysfunctions other than dysphagia (average time between examinations 1.7 months). This was done in accordance with the diagnostic standard adopted at the Audiology and Phoniatric Clinic for screening complaints related to different laryngeal functions. The analysis showed a very high, statistically significant correlation ($r = 0.96$ $p < 0.01$).

Minimal clinically important differences

The main aim in creating the SDS tool was to assign symptoms to different levels of the swallowing tract and different potential causes of the disorder. The main intention was to create a questionnaire to help select a diagnostic pathway for a patient reporting symptoms of dysphagia. The minimal clinically important difference (MCID) relates to the minimum change that is relevant from the patient's perspective. Since the SDS includes questions about subjective symptoms, the questionnaire could be used to evaluate the effectiveness of treatment methods. For this purpose, a larger sample of patients needs to be recruited with varying degrees of dysphagia severity and different causes (including the most severe, such as neurological disorder or oncological disease). From the data collected, the MCID was estimated based on the distribution of outcomes observed in the population (a distribution-based approach). In this case, it was based on half the standard deviation of the population, which was 4.4 points [25]. The reliability of the assessment tool as a whole was 0.80, which means that it can be used for individual diagnosis.

Discussion

This article has presented four Polish-language tools for assessing swallowing and the risk of common comorbidities such as laryngopharyngeal reflux and functional dysphagia. According to the literature, the EAT-10, DHI, and SDS scales are well-correlated with the severity of

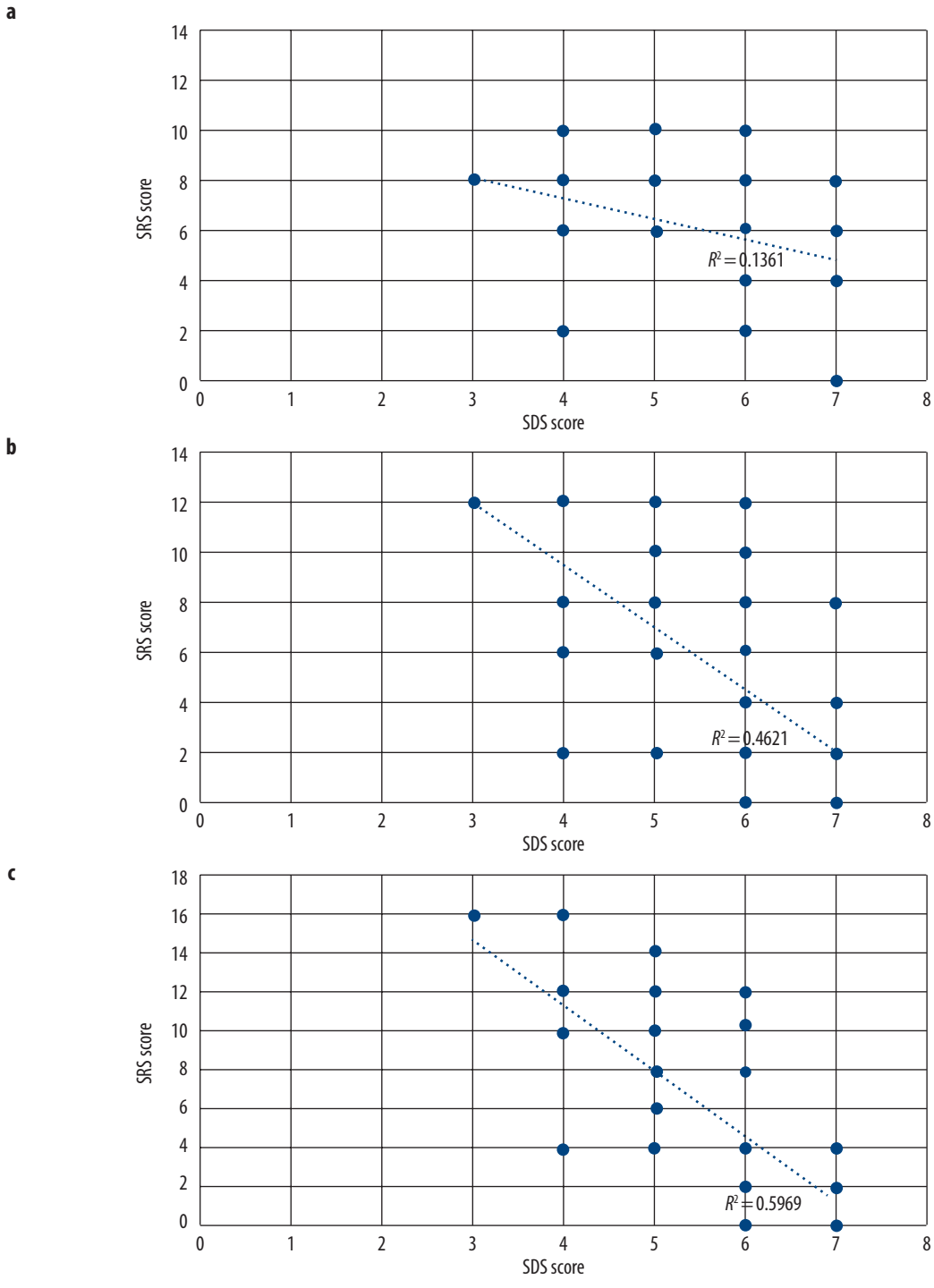

Figure 10. Dependence of individual parts of the SDS questionnaire on SRS ratings. **a**) SDS 1: sum of scores obtained in questions 1–3 (raising suspicion of functional swallowing disorder); **b**) SDS 2: sum of questions 4–6 (raising suspicion of oropharyngeal dysphagia); **c**) SDS 3: sum of questions 7–10 (raising suspicion of gastroesophageal dysphagia or severe swallowing disorder)

dysphagia [13]. The authors believe that these scales can be used by ENT doctors, audiologists, and phoniatrists to assess outpatients presenting with swallowing problems. The study material shows that more than half the patients referred to our audiology-phoniatrics clinic for swallowing difficulties were diagnosed with functional dysphagia or non-normative swallowing. Such patients respond well to treatment aimed at improving the function of the pharynx and larynx. Typically, phoniatric and neurological treatment, together with physiotherapy, are pursued. In the study group, only a small percentage of patients had severe dysphagia. These patients had to be referred to other centres for videofluoroscopy (VFS) and other specialised care.

Table 7. Main observations regarding the SDS questionnaire scores

SDS score	Corresponding diagnosis
Percentage of total scores for questions 1–3 > 45%	atypical swallowing or functional dysphagia
≥ 8 points in questions 7–10	dysphagia
Total > 28	dysphagia other than MTDg
3 × YES in questions 4–6	dysphagia ≥ 1 DSRS level
4 × YES in questions 7–10	dysphagia ≥ 3 DSRS level and need for appropriate assistive techniques during swallowing

Questionnaires are useful to screen patients with dysphagia and can be used as a tool to help differentiate the causes of dysphagia [14,15]. If dysphagia is suspected, the next diagnostic step after administering the questionnaires involves swallowing screening tests, i.e., water swallowing screen; the Gugging swallowing screen (GUSS); the Daniels test, or V-VST [26]. Descriptions of the test procedure in Polish have been published by Jamróz and Milewska [8,26]. If the above methods indicate deviations from normality, it may be necessary to resort to instrumental testing such as FEES and VFS [26].

We found that the SDS scores were correlated with the severity of dysphagia. All patients with a score greater than 28 were diagnosed with dysphagia other than MTDg. A low correlation is sometimes found due to the high severity of reported complaints in groups of patients with non-normative swallowing or functional dysphagia. It should be emphasised that the study material consisted of patients from the Audiology and Phoniatrics Outpatient Clinic. Due to the specific nature of the patients referred to specialists in this field, the reported swallowing difficulties were not a dominant symptom, but an accompanying symptom of functional voice disorders, caused by coordination disorders of the laryngeal muscles and the muscles surrounding the larynx.

The limitations of the study in the broader context of dysphagia are due to the characteristics of phoniatric patients in outpatient clinics and audiological-phoniatric departments. In order to validate the SDS questionnaire, patients with severer degrees of dysphagia should be included in the study group. As mentioned, the largest group of patients with swallowing disorders in ENT departments are those who have undergone treatment for cancer of the head and neck or surgery for non-cancerous causes. Because of the wide range of causes of dysphagia encountered in ENT practice and the variable severity of subjective and objective symptoms of swallowing disorders, screening tests and questionnaires should always be used in patients suspected of having dysphagia. The SDS was created with the idea of assigning symptoms to different levels of the swallowing tract, and differentiating potential causes of the disorder. The scale is intended to be used for selecting patients with advanced dysphagia for further diagnosis and specialist care. In addition, the scale can facilitate the identification of patients with functional swallowing disorders, who require only otolaryngological-phoniatric care.

It was found here that functional dysphagia is characterised by a different profile of responses to the SDS questions. Basic psychometric values of the SDS questionnaire indicate the usefulness of the diagnostic tool. Patients with MTDg mainly report complaints related to questions 1–3. These patients will require ENT-phoniatric care due to their muscle hyperfunction, chronic pharyngeal mucositis, laryngeal dysfunction associated with sensory abnormalities during swallowing, or globus pharyngeus. We observed that with an increase in severity of dysphagia, there was an increase in responses to questions 4–10, whereas complaints reported in questions 1–3 remained at a similar level. Patients who responded positively to the majority of questions 4–10 required a thorough multidisciplinary diagnosis of dysphagia and consultation with other specialists [16]. **Table 7** summarises our relevant observations from the study material.

Conclusions

This article has examined four Polish-language questionnaires and examined their clinical value in assessing swallowing disorders in an otolaryngology–phoniatric practice. The review of these questionnaires clearly demonstrates the need for tools to differentiate and give an initial assessment of functional dysphagia. We conclude that the SDS questionnaire should be further validated, because it may be an appropriate tool for screening and differentiating patients with functional dysphagia. The SDS questionnaire may provide good differentiation of the severity of swallowing disorders.

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Oral Presentations

I Studies

(ID-6958) A case of a child with misophonia and hyperacusis: assessment and management of auditory hypersensitivity

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Introduction: Misophonia and hyperacusis are auditory disorders that can significantly affect a child's daily life. This case study presents a 12-year-old girl with normal hearing thresholds but increased sensitivity to sound, resulting in emotional distress and avoidance behaviors.

Case presentation: The patient experienced extreme discomfort with repetitive environmental sounds, particularly chewing and pencil clicking. Audiological assessment revealed that pure tone hearing was within normal limits, but loudness discomfort levels (LDL) were low, consistent with hyperacusis. The Dunn Sensory Profile assessment revealed high auditory sensitivity and a tendency to avoid sounds. *Treatment and intervention:* A multidisciplinary approach including cognitive behavioral therapy (CBT), desensitisation with graduated sound therapy and psychoeducation was recommended for the patient and family. Environmental modifications such as controlled sound exposure and the use of noise reduction strategies were also included in the treatment plan.

Keywords: misophonia • hyperacusis • Dunn Sensory Profile • child

(ID-6845) An overview of tinnitus in children: prevalence, etiology, and management strategies

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Tinnitus is defined as the perception of sound without an external auditory stimulus. Although it has been extensively studied in adults, it is also commonly observed in children. Detecting tinnitus in children can be challenging, as younger individuals often have difficulty articulating the sounds they hear. Consequently, the true prevalence of tinnitus in children remains uncertain. However, studies suggest that tinnitus is more widespread among the pediatric population than previously estimated. The prevalence ranges from 6% to 29% in children with normal hearing, while it increases from 34% to 66% in children with hearing loss. Exposure to loud noise and the presence of hyperacusis further elevate the risk of tinnitus in children. The primary etiological factors contributing to tinnitus in children include hearing loss, noise exposure, ototoxic medication use, neurological and psychological conditions, and genetic predisposition. Middle ear infections and conditions such as ADHD Attention Deficit Hyperactivity Disorder (ADHD) are also significant risk factors. Tinnitus can negatively affect children's academic performance, social interactions, and emotional development. It is often associated with sleep disturbances, attention deficits, anxiety, and depression, highlighting the importance of early diagnosis. Diagnostic approaches for pediatric tinnitus involve audiological tests (pure-tone audiometry, otoacoustic emissions, auditory brainstem responses), psychosocial evaluations, and child-friendly, play-based assessment tools. Management strategies include education and counseling, sound therapy, psychological support, and non-pharmacological interventions. Cognitive behavioral therapy (CBT) and white noise devices are among the most effective treatments. To better understand tinnitus in children, long-term follow-up studies are needed, and diagnostic and treatment methods tailored specifically for pediatric populations should be developed. This review aims to evaluate the prevalence, causes, diagnostic methods, and management strategies for tinnitus in children while providing insights for future research in this field.

Keywords: tinnitus • children • prevalence • etiology • hearing loss • noise exposure • pediatric audiology

(ID-6932) Auditory and language skills in cochlear implanted children of deaf parents

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Introduction: Cochlear implants (CIs) provide critical auditory sensory input required for the acquisition of speech and language in children with congenital severe to profound hearing loss. Numerous studies have demonstrated that the

quantity and quality of parental interaction significantly impact CI outcomes. Therefore, lack of speech input might harm auditory, speech, and language development after CI in implanted children whose parents are deaf.

Aim: The aim of this study was to compare the auditory and language skills of children with cochlear implants with deaf parents (CIDP) to those with cochlear implants with normal-hearing parents (CINH).

Material and methods: Eight CIDP (3 female, 5 male) and 8 CINH (3 female, 5 male) were included in this study. They received unilateral CIs. The CIDP had additional caregiver(s) (such as grandmother, grandfather) with normal hearing, who communicated orally and provided auditory input. The caregivers of the CINH group were their parents who had normal hearing. Their receptive and expressive language development was evaluated using the Test of Early Language Development (TELD-3). Their auditory skills development evaluated using the Meaningful Auditory Integration Scale (MAIS).

Results: There was no significant difference between the groups in terms of chronological age ($p = 0.17$, $p > 0.05$), hearing aided age ($p = 0.19$, $p > 0.05$), age at implantation ($p = 0.81$, $p > 0.05$) and duration of CI use ($p = 0.11$, $p > 0.05$). Furthermore, no significant difference was found between the groups' receptive language ($p = 0.34$, $p > 0.05$), expressive language ($p = 0.31$, $p > 0.05$), and MAIS ($p = 0.23$, $p > 0.05$) scores.

Conclusions: The findings of this study indicate that CIDP may improve their auditory and language skills after cochlear implantation, similar to CINH. A longitudinal study with a larger sample size is recommended to investigate the auditory and language development of CIDP.

Keywords: auditory skills • language skills • deaf parent • cochlear implant

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(ID-7077) Auditory brainstem response findings in incomplete partition malformations: preliminary results

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Introduction: Inner ear malformations (IEM) account for about 20% of congenital hearing loss cases. Incomplete Partition (IP) malformations, which have normal external dimensions but abnormal internal cochlear structure, are the most common subgroup of IEM. Auditory brainstem response (ABR) is a crucial diagnostic tool for assessing IP anomalies (IP-I, IP-II, IP-III).

Aim: The aim of this study was to evaluate ABR findings according to subgroups of IP anomalies.

Material and methods: The study included individuals who were followed up in Hacettepe University Faculty of Medicine, Department of Otorhinolaryngology, diagnosed with IP malformation on radiologic imaging and underwent ABR evaluation. Participants were evaluated on an ear basis, with 8 ears having IP-I, 30 ears with IP-II, and 3 ears with IP-III included in the study. ABR findings were analyzed statistically.

Results: Participants' ages ranged from 2.5 months to 8 years. In IP-I ears, wave V wasn't observed at 99 dB nHL, and cochlear microphonics (CM) were seen in one ear at 2.5 ms. In IP-II, wave V was recorded in 56.67% of ears, with thresholds ranging from 40 to 99 dB nHL (mean: 69.65 ± 14.78 dB nHL). CM were not detected in IP-III, ABR was obtained in all of IP-III cases, with wave V threshold at 73.33 ± 6.24 dB nHL and latency of 7.43 ± 0.54 ms.

Conclusions: Preliminary results revealed varying ABR outcomes across IP malformation subgroups. The absence of ABR in IP-I ears suggests poorer auditory outcomes, while the IP-II group showed highly variable results. These findings will enhance the literature and aid in clinical understanding of ABR outcomes in these anomalies.

Keywords: incomplete partition • auditory brainstem response • hearing loss

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(ID-6964) Auditory intervention in pediatric patients with single-sided deafness and cochlear nerve deficiency

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Aim: This study aimed to evaluate auditory intervention options in pediatric patients with single-sided deafness (SSD) and cochlear nerve (CN) aplasia, with a particular focus on the feasibility of bone-anchored hearing aids (BAHA) as an alternative rehabilitation strategy.

Material and methods: Seven pediatric patients (3 males, 4 females, mean age: 5.14 ± 3.32 years) diagnosed with SSD were analyzed. All patients exhibited CN aplasia in the affected ear. Additionally, cochlear anomalies were identified in five patients: Michel deformity ($n = 1$), cochlear hypoplasia type II ($n = 1$), and cochlear aperture anomaly ($n = 3$). Auditory rehabilitation strategies were determined based on patient age and anatomical considerations.

Results: Cochlear implantation was considered contraindicated due to the presence of CN aplasia. Instead, based on current clinical guidelines and available literature, soft band BAHA was recommended for patients younger than five years, while percutaneous/transcutaneous or adhesive BAHA was suggested for those older than five years. Given the limited evidence regarding auditory rehabilitation in SSD patients with CN aplasia, these recommendations were made with the aim of providing optimal auditory stimulation through bone conduction.

Conclusions: While SSD cases typically present with a normally developed cochlea and CN in normal hearing ear, significant inner ear malformations and CN deficiency may be observed in the affected ear. CI is a well-established intervention in SSD patients with an intact CN, however, in cases of

CN aplasia, necessitating alternative rehabilitative approaches. Current literature on auditory intervention in SSD patients with CN aplasia remains sparse. In our clinical practice, BAHA was proposed as the primary auditory intervention for these patients. Further longitudinal studies are required to assess the auditory outcomes and overall benefit of BAHA in this patient population. Evaluating speech perception, localization abilities, and quality-of-life outcomes in these children will be crucial in refining management strategies.

Keywords: cochlear aplasia • single sided deafness • SSD • bone anchored hearing aid

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(ID-6943) Behavioral and self-reported listening effort in cochlear implant users: insights from the dual-task paradigm and T-EEAS

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Introduction: Cochlear implant (CI) users may require increased effort to process auditory information and may rely more on visual cues during speech perception in comparison to those with normal hearing (NH). Audiovisual integration can improve speech perception and reduce listening effort in noisy environments, especially in individuals with hearing loss. However, the precise impact of audiovisual integration on listening effort remains to be fully elucidated, and this remains an area of ongoing research.

Aim: This study aimed to evaluate listening effort and audiovisual integration in young adults with CIs and NH, identify group differences, and examine the relationship between these measures.

Material and methods: The study included 30 unilateral CIs with bilateral profound hearing loss (15 prelingual, 15 postlingual) and 30 NH individuals aged 18–30 years. All participants were assessed for audiovisual integration, as well as behavioral and subjective listening effort. The dual-task paradigm was used to assess behavioral listening effort. The Turkish Expanded Version of the Effort Evaluation Scale (T-EEAS) was used for the subjective listening effort. Audiovisual integration was evaluated in four conditions: auditory-only, visual-only, congruent audiovisual, and incongruent audiovisual. Audiovisual integration and listening effort measures were compared between groups, and correlations between the test measures were analyzed.

Results: Behavioral listening effort was found to be significantly higher in the CI group compared to the NH group ($p < .05$). The CI group had significantly higher T-EEAS quiet, noise subscale, and total scores than the NH group ($p < .05$). Statistically significant differences were observed between NH and CI groups in all audiovisual integration conditions ($p < .05$). A moderate negative correlation was found between behavioral listening effort and auditory-only, congruent audiovisual, and fusion responses ($p < .05$). A strong negative correlation was observed between T-EEAS total scores and auditory-only, congruent audiovisual, and fusion responses ($p < .05$).

Conclusions: CI users exhibited poorer audiovisual integration performance and higher listening effort than NH individuals. These findings suggest that targeted audiovisual training strategies may enhance speech perception and reduce listening effort in CI users, which has implications for rehabilitation programs.

Keywords: listening effort • audiovisual integration • cochlear implant

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(ID-6887) Benefits of contralateral hearing aid for unilateral cochlear implanted children, linked bimodal fitting

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Introduction: Bimodal hearing is a non-invasive alternative for people with residual hearing in other ear (Ching et al, 2009). Nearly 75% of adult CI recipients have aidable acoustic hearing in the non-implanted ear that could be used in a bimodal hearing configuration.

Aim: To evaluate the influence of bimodal fitting of Phonak Naida Link UP hearing aid (PNL) on speech perception abilities for unilateral Advanced Bionic cochlear implanted children with Naida Q90 sound processor.

Material and methods: Multi-center research from four centers (Hearing & Speech Institute, Zagazig University, Minia University and Bahtim Health Insurance Hospital). The study included two unilateral cochlear implant user groups: 1st group included 92 prelingual children and 2nd group 17 postlingual children. Assessment was first done 3 months after CI processor fitting. PNL then was fitted. Testing was repeated at three and 6 months after PNL fitting for all subjects. Assessment was done using: aided hearing thresholds at 500, 1000, 2000 and 4000 Hz, Arabic version of Auditory Perception of Alphabet Letters (APAL) test in quiet and noise, Speech Intelligibility Rating (SIR), Categories of Auditory Performance (CAP) and Hearing disability ratings using Meaningful Auditory Integrated Scale questionnaire (MAIS).

Results: A significant improvement was found in all assessment aspects for the two groups especially after 6 months of bimodal hearing using contralateral PNL with unilateral CI.

Conclusions: The auditory asymmetry between both ears is not a barrier for bimodal stimulation, the electric and acoustic signals coming from each ear are well tolerated by both pre- and postlingual children, who significantly benefit more from bimodal stimulation overtime.

Keywords: bimodal hearing • cochlear implant • Naida link • prelingual and post lingual hearing loss • APAL • SIR • CAP

(ID-6955) Bilateral cochlear nerve hypoplasia in CAPOS syndrome: a case report

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Introduction: CAPOS syndrome (**c**erebellar ataxia, **a**reflexia, **p**es cavus, **o**ptic atrophy, and **s**ensorineural hearing loss) is a rare autosomal dominant disorder caused by mutations in the *ATP1A3* gene. It is characterized by early-onset neurological symptoms and progressive hearing loss, often manifesting as auditory neuropathy spectrum disorder (ANSD).

Aim: Hearing impairment in CAPOS syndrome can significantly affect speech and language development, making early diagnosis and intervention essential. Here, we present an 11-year-old girl with CAPOS syndrome and hearing loss due to bilateral cochlear nerve hypoplasia, for whom cochlear implantation was recommended.

Case report: An 11-year-old female with a genetically confirmed *ATP1A3* mutation was referred for hearing evaluation due to communication difficulties. Her newborn hearing screening was normal, but hearing loss was diagnosed at age six. Pure-tone audiometry revealed bilateral moderate hearing loss (pure-tone average: 50 dB right, 45 dB left). ABR testing indicated bilateral cochlear microphonic responses with absent neural waveforms, consistent with ANSD. MRI showed bilateral cochlear nerve hypoplasia. The patient wears hearing aids at school but often removes them at home, relying heavily on lip-reading. Speech perception testing showed poor auditory-only recognition (three-syllable: 13/24, one-syllable: 2/24). In an auditory-visual condition, her sentence recognition was 60%, but she struggled with longer sentences. Her language skills were delayed, estimated at a 4-year-old level, and her speech intelligibility was poor. She also has dystonia and receives neurological, ophthalmologic, physiotherapy, and special education support.

Results: Due to her poor auditory speech perception, limited hearing aid benefit, and reliance on visual cues, bilateral cochlear implantation was recommended. Although cochlear nerve hypoplasia may affect implant outcomes, some ANSD patients show auditory improvements with implants. Additionally, progressive optic atrophy in CAPOS syndrome may further impair lip-reading ability over time, making auditory skill enhancement crucial for future communication. A cochlear implant trial is planned to assess auditory and language gains.

Conclusions: Hearing loss in CAPOS syndrome progresses over time, underscoring the need for continuous audiological monitoring. Cochlear implantation may provide auditory benefits even with cochlear nerve hypoplasia. A multidisciplinary approach is essential to optimize communication and support.

Keywords: CAPOS syndrome • cochlear implant • cochlear nerve hypoplasia

(ID-6977) Bridging language and social cognition: theory of mind development in children with cochlear implants

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Introduction: Theory of mind (ToM), a critical aspect of social cognition, refers to the ability to attribute mental states – such as beliefs, desires, and emotions – to oneself and others. ToM typically develops between ages 3 and 5 and is closely linked to language acquisition. While cochlear implants (CIs) enable auditory access and support language development in children with hearing impairment, ToM and broader aspects of social cognition in CI users may follow an alternative trajectory.

Material and methods: Participants included a CI group ($N = 6$, ages 48–70 months) and an age-matched normal-hearing (NH) control group ($N = 6$). ToM was assessed using the Theory of Mind Scale. Language proficiency was measured with the Test of Early Language Development (TELD-3). Social behavior was evaluated using the Social Competence and Behavior Evaluation (SCBE-30), and emotional expressiveness was assessed via the Child Emotion Expressiveness Questionnaire.

Results: Preliminary ToM assessments revealed consistent success across all tasks among NH children (6/6 in Diverse Desire, Diverse Belief, and Knowledge Access; 5/6 in Contents False Belief and Explicit False Belief). In contrast, children with CIs demonstrated lower performance (2/6 in Diverse Desire, 3/6 in Diverse Belief, 4/6 in Knowledge Access, 2/6 in Contents False Belief, and 1/6 in Explicit False Belief). TELD-3 results indicated weaker receptive (73.3 ± 20.3, range: 55–112) and expressive (71.8 ± 23.4, range: 47–108) language proficiency in the CI group compared to NH children (receptive: 107 ± 6.3, range: 100–115; expressive: 107 ± 10.8, range: 98–121). NH children also scored higher in social competence (51 ± 9.4, range: 40–58) than CI users (46.5 ± 6.4, range: 35–56). Anger–aggression scores were comparable (CI: 16.5 ± 5.5, range: 12–26; NH: 17.2 ± 2.2, range: 14–19), as were anxiety – withdrawal scores (CI: 17.6 ± 3.8, range: 13–24; NH: 17.7 ± 7.4, range: 11–31). Emotional expressiveness was slightly lower in the CI group for both positive emotion expression (12.5 ± 1.2, range: 11–14 vs. 13 ± 2.4, range: 10–15) and negative emotion expression (36.2 ± 7.8, range: 27–47 vs. 40.8 ± 8.7, range: 27–48).

Conclusions: These early findings suggest that social cognition in children with CIs is shaped not only by language development but also by broader socio-emotional factors,

highlighting the need for integrated interventions targeting ToM, language, and emotional understanding

Keywords: theory of mind • cochlear implants • language development • social cognition • emotional expressiveness

(ID-6937) Central auditory processing differences in dizygotic twins: case study

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Introduction: Auditory processing skills play a crucial role in speech comprehension,particularly in challenging listening environments. These skills vary among individuals due to genetic and environmental factors. While monozygotic twins tend to exhibit more similar auditory processing abilities due to their identical genetic makeup, dizygotic twins, who share only 50% of their genetic material, may present differences in auditory processing skills.

Case report: In this study, the central auditory processing abilities of 13-year-old male dizygotic twin brothers,both in the 8th grade,were evaluated. Both children had normal hearing thresholds and no middle ear pathology. In the auditory processing skills checklist completed by their parents, Child 2 received a higher score compared to Child 1 (9 vs. 5), indicating greater listening difficulties. Additionally, Child 2's academic performance was reported to be lower than that of his twin brother. The Turkish Anatolian Central Auditory Processing Disorder Test Battery was administered to both children, and significant differences were observed in specific test.

Results: Dichotic Sentence (DC) Test: Child 1 scored 10 points in both the right and left ears, whereas Child 2 scored 9 points in the right ear and 4 points in the left ear. Dichotic Word (DW) Test: Child 1 scored 42 points in the right ear and 32 points in the left ear, while Child 2 scored 16 and 15 points, respectively. Filtered Word (FW) Test: Child 1 scored 19 points in the right ear and 13 in the left, totaling 32 points, whereas Child 2 scored 9 points in both ears, totaling 18 points. Dichotic Monosyllabic Competing Word (DMCW) Test: Child 1 scored 32.75 points in the right ear and 30.5 points in the left, totaling 63.25 points. In contrast, Child 2 scored 11.25 points in both ears, totaling 22.5 points.

Conclusions: The findings indicate that while Child 1 exhibited ear asymmetry in the DW and FW tests, Child 2 demonstrated ear asymmetry in the DC test. Moreover, Child 2's total scores in the DC, DW, FW, and DMCW tests were lower compared to Child 1. These results suggest a possible delay in interhemispheric information transfer and may contribute to Child 2's difficulties in listening and academic performance. Furthermore, the findings highlight that auditory processing skills can differ between dizygotic twins.

Keywords: central auditory processing • dichotic listening • academic performance • dizygotic twins

(ID-6833) Children's Tinnitus Questionnaire: a novel tool for assessing the impact of tinnitus on a child's everyday life

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Introduction: Self-report instruments are commonly used in tinnitus clinics, but they are presently available only for adults. There is a lack of a validated multi-item instrument to capture tinnitus-related problems in children and their impact on everyday life. This study has developed and validated a specifically child-centered questionnaire to assess the impact of tinnitus.

Material and methods: Development of the tool consisted of several stages. Following a pilot study on 12 children with tinnitus, a validation study was done on a further 192 children with tinnitus aged between 11 and 14 years. The children had an audiological examination, completed a Visual Analogue Scale (VAS) and the newly framed questionnaire.

Results: The development and validation process resulted in the new 11-item Children's Tinnitus Questionnaire (CTQ). It includes items concerning the impact of tinnitus on functional, cognitive, emotional and social domains. The validity of the new tool has been established by finding significant correlations between it and VAS loudness ($r = 0.42$), VAS annoyance ($r = 0.67$), and VAS coping ($r = -0.41$). Validity has also been confirmed by measuring differences in CTQ scores and 4 groups of children having graded incidences of tinnitus. The internal consistency assessed with Cronbach's alpha was high ($\alpha = 0.82$).

Conclusions: The Children's Tinnitus Questionnaire (CTQ) is the first fully validated multi-item instrument designed specifically for children. The tool has the potential to become a valuable new instrument for use in clinical practice and research, it might be useful for assessing the impact of tinnitus on those children who find that the condition creates problems in their everyday life.

Keywords: children tinnitus questionnaire • CTQ • children with tinnitus

(ID-6888) Clinical findings in cochlear implant users with auditory neuropathy spectrum disorder: a retrospective analysis

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Introduction: Auditory neuropathy spectrum disorder (ANSD) is a type of hearing impairment in which neural responses are absent or abnormal, while preneural responses are present. ANSD has been identified as a common cause of hearing impairment, accounting for 10 to 15% of permanent childhood hearing loss cases.

Aim: The primary objective of this study is to examine the clinical findings of cochlear implant (CI) users with ANSD who were followed at the Audiology Clinic of Marmara University Faculty of Medicine. The secondary objective is to ascertain whether diagnostic possibilities and patient management strategies in the ANSD population would improve as organisational experience and knowledge increased.

Material and methods: A retrospective file review was performed on patients diagnosed with ANSD and who underwent CI surgery at Marmara University Medical Faculty Hospital between 2002 and 2024. A comprehensive review of the patients' demographic and clinical information was conducted, encompassing risk factors, newborn hearing screening programme results, additional health problems, age at onset of hearing loss and age at diagnosis, hearing status, duration of hearing aid use, and speech performance before and after CI surgery.

Results: The present study comprised 45 patients (17 female, 28 male). As the time between the age at first diagnosis and the age at diagnosis of ANSD increased, pure-tone average ($p = 0.013$) and speech test results ($p = 0.04$) with CIs worsened. As the age of onset of hearing aid use prior to CI was delayed, performance on speech tests with CIs also decreased ($p = 0.042$). Conversely, an increase in auditory training time was associated with improved speech test results with CI ($p = 0.005$). Furthermore, a decrease in both the age at diagnosis of ANSD ($p = 0.002$) and the age at surgery ($p < .0.001$) was observed as the present day was approached.

Conclusions: Early diagnosis, timely intervention, and auditory training have been shown to have a significant impact on the outcomes of CI in patients with ANSD. However, advancements in clinical awareness have resulted in earlier interventions being made over time.

Keywords: auditory neuropathy • cochlear implant • hearing loss

(ID-6935) Development of a computer-based Speech Recognition Test in Noise for Preschool Children

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Introduction: School-aged children engage in communication, socialization, and learning in environments characterized by background noise and reverberation. The ability to perceive language in noisy and often loud environments, such as classrooms and playgrounds, presents a significant challenge for all children in mainstream schools. This challenge arises from the fact that their perceptual, cognitive, and linguistic skills have not yet fully matured. Therefore, it is essential to assess speech recognition in noise in younger age groups and provide necessary support at an early stage.

Aim: This study aims to develop a Speech Recognition Test in Noise for preschool-aged children and to establish age-specific speech recognition thresholds.

Material and methods: In this study, children's books for children aged 3–6 years were reviewed, and high-recognition words were selected. These words were illustrated in a way that is appropriate for the children's age and cognitive level. A list of 24 words was created for each group and transferred to the developed computer-based test software. The test was administered twice to 138 participants aged 3–6 years, with a 15-day interval, using a test-retest design. The speech recognition threshold in noise for each age group was determined using the signal-to-noise ratio (SNR).

Results: As a result of the study, the signal-to-noise ratio (SNR) values for the Speech Recognition Test in Noise for Preschool Children were found to be –8.1 dB, –8.9 dB, and –10.7 dB for Group 1, Group 2, and Group 3, respectively. The retest SNR values were –8.0 dB, –9.3 dB, and –11.1 dB, respectively. These findings were found to be consistent with previous developmental and speech perception in noise studies conducted for preschool children aged 3–6. No significant difference was detected between the test and retest SNR values ($p = 0.102$).

Conclusions: It was concluded that the Speech Recognition Test in Noise for Preschool Children is a reliable assessment tool for evaluating speech recognition ability in noise in young children.

Keywords: speech understanding • speech recognition • speech recognition in noise • signal-to-noise ratio

(ID-6949) Development of a new test battery to assess selective auditory attention for the Turkish pediatric population

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Introduction: Selective auditory attention is the ability of an individual to consciously distinguish and focus on a specific sound or speech from a variety of sounds in their environment. This is an important cognitive process, especially in noisy environments or when there are multiple sound sources. This ability allows an individual to determine which sound information to prioritize and is one of the basic components of the auditory processing process. Selective auditory attention plays a critical role, especially in speech comprehension, language development, and academic success.

Aim: For school-aged children, it is critical to select important information and ignore the distractors, and it is the main precondition for learning. Therefore, tests that evaluate selective auditory attention are an important tool for supporting language development and shaping educational programs, especially in children. The aim of this study was to develop a test battery that behaviorally assesses selective auditory attention in children.

Material and methods: The behavioral oddball paradigm was adopted for selective auditory attention and male and female voices were used. 200 monosyllabic words were selected for both female and male voices and some words were determined as deviant stimuli (at a rate of 10%). A total of 40 words, 20 for female and male voices, were determined as a deviant stimulation. The semitone thresholds of deviant words were increased to +3. Deviant words were presented at different times for both female and male voices. The participant was asked to respond only when there was a change in the frequency of the male voice. The results were determined as a percentage depending on the number of correctly guessed words. Editing of the recorded material was done using Audacity.

Results: Selective auditory attention scores were obtained as 82 ± 5.70% in the spatially separated condition.

Conclusions: This selective auditory attention test is an effective and reliable test battery that can be performed in a short time, especially on children aged 6–12.

Keywords: auditory attention • spatial hearing • pediatric audiology

(ID-6963) Development of a sentence verification test to evaluate listening effort

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Introduction: Listening effort refers to the cognitive resources allocated to auditory tasks, particularly in challenging acoustic environments, increased task demands, and when listeners strive to maintain optimal performance. Various methods including self-report questionnaires, physiological measurements, and behavioral assessments can be used to evaluate listening effort.

Aim: To our knowledge, no standardized and accessible test battery incorporating a sentence verification task for assessing listening effort exists in audiology clinics in Türkiye. This study aims to develop the Turkish Sentence Verification Test as a behavioral measure to assess listening effort.

Material and methods: Fifteen normal-hearing adults and fifteen adult cochlear implant users participated in the study. The Turkish Sentence Verification Test is a computer-based assessment consisting of sentences structured according to Turkish grammar. Participants were instructed to evaluate the semantic validity of presented sentences (determine whether sentences were true or false), and their response times were recorded. Pupil dilation was measured during the test, and listening effort was additionally assessed through self-report measures.

Results: In the developed Turkish Sentence Verification Test, four lists were created, each containing 30 sentences (15 meaningful-true, 15 meaningless-false) to be administered under four different listening conditions (quiet, +8 dB SNR, +4 dB SNR, 0 dB SNR). The accuracy rate, error rate, non-response rate, mean reaction time for meaningful sentences, and mean reaction time for meaningless sentences differed significantly between the normal-hearing group and cochlear implant users across all test conditions ($p < .001$).

Conclusions: Due to its accessibility, ease of administration, and interpretability, the Turkish Sentence Verification Test is expected to be a valuable tool for assessing speech comprehension and listening effort in clinical settings. Furthermore, it may contribute to a more comprehensive evaluation of individuals' real-world communication abilities.

Keywords: listening effort • sentence verification • cochlear implant

(ID-6906) Development of an auditory cognitive test battery for adults with hearing loss: a novel assessment tool

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Introduction: The reduction or regression of input to auditory cortex with hearing loss makes listening more effortful and requires more top-down sensory, attentional and cognitive compensation. This can then reduce the resources available to contribute to other tasks and potentially negatively impact cognitive function. Aims: This study aims to develop and validate a novel auditory-cognitive test battery to assess the impact of hearing loss on cognitive performance in adults.

Material and methods: The test battery was designed to evaluate auditory-based short-term memory, working memory, attention, executive function, and long-term memory. It was first administered to three age groups of adults with normal hearing ($n = 70$) and then to individuals using hearing aids ($n = 20$) and cochlear implants ($n = 21$). A validity and reliability analyses was performed for the normal hearing group, followed by a comparison of cognitive skill scores across the groups.

Results: Statistical analysis confirmed that the developed test battery is a valid and reliable assessment tool. Results from hearing aid and cochlear implant users revealed a significant decline in working memory, attention, phonemic fluency, and semantic fluency subtests compared to individuals with normal hearing.

Conclusions: The auditory-cognitive test battery is a reliable tool for assessing cognitive function in adults with hearing loss. It effectively highlights the cognitive challenges faced by hearing aid and cochlear implant users, offering valuable insights for both clinical and research applications.

Keywords: cognitive skills • hearing loss • hearing aid • cochlear implant

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(ID-6876) Effect of tinnitus on speech perception and cognitive functions

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Introduction: Tinnitus acts as a distracting sound, making conversation in noisy environments more difficult and leading to decreased cognitive resources. Studies in this field in the literature have different methodologies and show inconsistent results.

Aim: The aim of our study is to examine the effect of chronic tinnitus on cognitive functions and speech understanding in noise.

Material and methods: 25 individuals with chronic tinnitus and normal hearing, 25 individuals with normal hearing and without tinnitus (controls) were included in the study. All participants were evaluated to standard and high frequency pure tone audiometry. All participants were applied the Montreal Cognitive Assessment Test to demonstrate that they had normal cognitive functions. Afterwards, Speech, Spatial Perception and Hearing Quality Scale, TURMatrix Test and Listening Effort (LE), P300 test, Visual Aural Digit Span Test (VADS), Stroop TBAG test were applied to all participants. LE was measured using a dual task paradigm using a –5 dB signal-to-noise ratio (SNR). The P300 test was performed in silence and in the presence of background noise at a –5 dB SNR.

Results: Comparisons between groups were analyzed using Student's *t*-test for normally distributed data and Mann–Whitney *U* test for non-normally distributed data. No significant difference was found between the tinnitus group and the control group in the LE task. In the TURMatrix Test, significant differences were found between the two groups in the adaptive and nonadaptive procedures. No significant difference was found between the groups in the P300 latencies performed in the silence and in the presence of –5 SNR background noise. In the P300 test, a significant difference was found between the noise-induced latency change (P300 latency performed at –5 SNR minus P300 latency performed in silence) in both groups. Statistically significant differences were found between the groups in Speech Perception and Hearing Quality scores, Stroop effect and VADS scores.

Conclusions: This study shows that chronic tinnitus can negatively affect cognitive functions and the ability to understand speech in noise. It also demonstrates the importance of using electrophysiological tests, personal questionnaires to detect this effect in tinnitus patients.

Keywords: tinnitus • speech understanding in noise • cognitive functions

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(ID-6899) Effectiveness of transcutaneous vagal stimulation on treatment of chronic tinnitus

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Introduction: Transcutaneous vagus nerve stimulation (tVNS) is a non-invasive neuromodulation method that has been investigated for the treatment of tinnitus. The vagus nerve is connected to the brainstem and limbic system, playing an important role in sensory and autonomic functions. The effect of tVNS on tinnitus treatment is based on

its potential to modulate neuroplasticity in the auditory cortex and limbic system, thereby reducing tinnitus perception.

Aim: This study aims to evaluate the effectiveness of tVNS in individuals with subjective chronic tinnitus.

Material and methods: Thirteen individuals (6 female, 7 male), aged 18–50 years (mean age 41.46 ± 8.04), with at least one year of subjective tinnitus complaints, were included in the study. İnitial tests, including evaluations of hearing thresholds, tinnitus frequency, tinnitus loudness, and residual inhibition using Madsen Astera 2 audiometer (Otometrics, Denmark), as well as diffusion tensor imaging (DTI), Visual Analog Scale (VAS), Tinnitus Handicap Inventory (THI), Beck Depression Inventory (BDI), and Beck Anxiety Inventory (BAI), were conducted. DTI was performed with a Siemens Avanto 1.5 Tesla MRI scanner (Erlangen, Germany) to evaluate apparent diffusion coefficient (ADC) and fractional anisotropy (FA) values in the corpus geniculatum laterale, Heschl's gyrus, inferior colliculus, and lateral lemniscus regions. Subsequently, participants underwent 30-minute sessions of tVNS using the Vagustim TENS device for 10 sessions over two weeks. The initial assessments were repeated after treatment.

Results: This study demonstrates that a two-week tVNS treatment in individuals with subjective chronic tinnitus leads to significant improvements in depression (BDI) and tinnitus handicap (THI) scores (respectively, $p = 0.047$, $p = 0.007$). Additionally, a significant decrease was observed in inferior colliculus FA values assessed with DTI ($p = 0.001$). Although a reduction in VAS scores was noted, it was not statistically significant ($p > 0.05$). Furthermore, no significant changes were found in BAI scores, tinnitus frequency, intensity, or residual inhibition ($p > 0.05$).

Conclusions: These findings suggest that tVNS may be an effective treatment option for alleviating tinnitus-related handicaps and depression. The decrease in inferior colliculus FA values following tVNS indicates that the effects of tinnitus on central auditory pathways may be modulated through neuroplastic changes. Further large-scale studies are needed to evaluate the long-term effects.

Keywords: tinnitus • neuromodulation • vagus nerve

(ID-6972) Electrically evoked auditory brainstem response (eABR) variability in inner ear malformations: a preliminary study

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Introduction: Cochlear malformations and cochlear nerve deficiencies can significantly impact auditory performance in cochlear implant (CI) users. Electrically evoked auditory brainstem responses (eABR) are an objective tool used to evaluate neural activation following cochlear implantation. Understanding the variability in eABR responses across different malformation types may contribute to optimizing CI programming and post-implantation rehabilitation strategies.

Aim: This study aims to investigate eABR thresholds and latencies in CI users with cochlear malformations (CH I, CH II, CH III) compared to those with normal inner ear anatomy and to determine whether malformation type affects eABR responses.

Material and methods: This preliminary study included cochlear implant users with CH I, CH II, and CH III malformations, all of whom also had cochlear nerve deficiency, as well as individuals with normal inner ear anatomy. eABR recordings were obtained from three cochlear regions: apical, medial, and basal electrodes. The threshold levels and latencies were assessed across groups.

Results: The findings suggest that cochlear hypoplasia and cochlear nerve deficiency may affect eABR responses. Individuals with inner ear malformations generally exhibited higher eABR thresholds and prolonged latencies compared to those with normal inner ear anatomy. In contrast, CI users with normal inner ear structures showed lower thresholds and stronger neural responses. Additionally, threshold levels and latencies differed across apical, medial, and basal electrodes, suggesting that cochlear region variations may influence neural activation.

Conclusions: This preliminary study indicates that cochlear hypoplasia and cochlear nerve deficiency may affect eABR responses, which could have implications for CI programming and auditory rehabilitation. Further research with a larger sample size is needed to better understand the relationship between anatomical differences and auditory outcomes.

Keywords: inner ear malformations • cochlear hypoplasia • cochlear nerve deficiency • eABR • cochlear implant

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(ID-6931) Evaluation of executive functions of cochlear implant users with saccadometry and cognitive tests

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Introduction: Saccadometry is an advanced ocular motor test that allows the functional evaluation of the various brain regions and circuits involved in the generation of fast, appropriate, purposeful, and accurate saccadic eye movements. Saccadometry evaluates the analysis of phase data, which provides further insight into lesion localisation, and antisaccade analysis, which provides windows into cognition, emotional regulation, response inhibition and executive function. Saccadometry consists of prosaccade (PS) and antisaccade (AS) tests that progressively increase cognitive demand.

Aim: The objectives of this study were to determine whether the saccadometry test reliably assessed in cochlear implant recipients and to explore the relationship between saccadometry test results and executive functions of cochlear implant users.

Material and methods: 25 CI users and 25 normal hearing (NH) participants (age range 10–18) took part in the study. Saccadometry Test, Auditory P300 responses, Behavior Rating Inventory of Executive Function (BRIEF), and Auditory-Visual Digit Span Test (AVDST) were obtained.

Results: There was no statistically significant difference between the mean ages of the two groups (p: 0.36 > 0.05). Antisaccade latencies were delayed significantly in CI group when compared with the NH group (p: 0.04 < .0.05). P300 amplitudes were decreased significantly in CI group when compared with NH group (p: 0.03 < .0.05). When we compered the modality scores, visual modality scores were greater than auditory modality scores at CI group (p: 0.04 < .0.05). The NH group had higher scores than the CI group when we compared the intersensory fusion scores (p: 0.027 < .0.05).

Conclusions: The results suggest that saccadometry can be performed reliably in CI users. Saccadometry, P300, and AVDST results may help to explain some of the differences in executive function observed in CI users.

Keywords: executive functions • saccadometry • cochlear implant

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(ID-6878) Evaluation of narrative skills of children with hearing loss

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Introduction: Narrative is defined as "speech text units beyond the sentence level". Narrative skills support children's verbal language and listening abilities.

Aim: Comparing the narrative skills of children with hearing loss (HL) and normal hearing children (NH) was the purpose of the study.

Material and methods: In this study, including 27 children with HL and 27 children with NH between the ages of 4–8. The Turkish Early Language Development Test (TEDIL) was used to assess children's early verbal language development. The Edmonton Narrative Norms Instrument (ENNI) narrative tool has been used to assess children's language skills through narrative. The Average Utterance Length (MLU), the Number of Different Words (NDW), the Total Number of Words (TNW) and story structure scores were calculated for A1 and A3 stories from children's language samples.

Results: According to the TEDIL test, the composite scores for receptive language, expressive language, and verbal language of children with HL are statistically significantly lower than those of children with NH. When comparing children's narrative skills, a statistically significant difference was found between the groups in the Mean Length Utterance (MLU) scores at A1 story, A1 and A3 story structure scores in favor of NH children. There was a positive significant correlation between the ages of the children in the HL group in the scores of MLU at A1 and A3 story, as well as A1 and A3 story structure scores. Additionally, there was a positive statistically significant correlation between the ages of children with NH and their MLU scores at A1 story, A1 and A3 story structure scores, as well as between the mother's educational level and their A3 MLU in word scores.

Conclusions: The study concluded that children with hearing loss performed lower in language and narrative skills, including cause-and-effect reasoning and story inference, compared to those with normal hearing.These findings suggest that the language skills of children with hearing loss should be followed up, as well as narrative skills.

Keywords: cochlear implant • hearing aid • narrative • hearing loss

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(ID-6936) Evaluation of quality of life and hearing aid satisfaction in adults using hearing aid regularly and irregularly

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Introduction: Communication, social connections, and general well-being can all be greatly impacted by hearing loss. In order to improve hearing and quality of life, hearing aids are necessary instruments. Maximizing the advantages of hearing aids requires an understanding of the connection between consistent use, user happiness, and life quality.

Aim: The purpose of the study was to examine the difference in quality of life and hearing aid satisfaction between individuals aged 50 to 85 who have been using hearing aids regularly for one year and those who have been using them irregularly, using scales with Turkish validity and reliability.

Material and methods: Thirty bilateral hearing-aided individuals (mean age: 67 ± 6, 15 male, 14 female) were included in the study. Two scales were used in our study. One will be used to measure the quality of life, the WHOQOL-BREF questionnaire, which is the short form of the World Health Organization Quality of Life Scale consisting of 26 questions. The other will be used to evaluate the duration of use and satisfaction with the hearing aid, the International Hearing Aid Evaluation Form (IOI-HA TR), consisting of 7 questions.

Results: The hearing aid satisfaction score of those who used hearing aids regularly was statistically significantly higher than that of those who used hearing aids irregularly ($p = 0.047$). When the WHOQOL-BREF subcategories were examined, there was no statistically significant difference between the groups in general health, physical health, mental health, social health, and environmental health subscores (p: 0.13, 0.16, 0.06, 0.5, 0.19, respectively). When the correlation between hearing aid usage duration and IOI-HA-TR score and WHOQOL-BREF subscores was examined, a positive correlation was observed between mental health and hearing aid usage duration ($p = 0.029$). Additionally, a positive correlation was observed between hearing aid usage duration and IOI-HA-TR score ($p = 0.016$).

Conclusions: Irregular use of hearing aids reduces adaptation, user satisfaction, and effectiveness. Inconsistent use can cause communication difficulties, leading to social isolation, stress, anxiety, and depression. Regular use is essential for optimizing benefits, enhancing auditory experiences, and improving overall well-being and mental health.

Keywords: hearing aid • quality of life • satisfaction

(ID-6826) Evaluation of the effect of tinnitus suffering time period on tinnitus discomfort

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Aim: The purpose of this study is to investigate whether the duration of tinnitus suffering in tinnitus patients has an effect on tinnitus discomfort.

Material and methods: 260 tinnitus patients were included in the study. The Tinnitus Handicap İnventory (THI) and the time periods of tinnitus suffering of these patients were investigated retrospectively. The relationship between these two data was evaluated with the Pearson correlation coefficient. In addition, the tinnitus handicap inventory scores were divided into two as above and below level 3 (corresponds to 38 points in THI) and the time periods of tinnitus suffering of these two groups were compared with the independent sample *t*-test.

Results: A statistically significant weak positive correlation was observed between the tinnitus handicap inventory and the time periods of tinnitus suffering ($p = 0.002$). Also, when the levels of the tinnitus handicap inventory were considered, the tinnitus duration of the group with the higher THI level (level 3 and higher) was found to be statistically significantly higher ($p = 0.026$).

Conclusions: As a result of our study, it was determined that individuals became more disturbed by tinnitus as the tinnitus suffering time period increased. This result emphasized the importance of clinicians including patients who apply for tinnitus treatment/therapy in the rehabilitation process as soon as possible.

Keywords: tinnitus • tinnitus duration • tinnitus discomfort

(ID-6910) Exploring sound sensitivity in children: the Turkish validation of the Pediatric Hyperacusis Questionnaire

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Introduction: Hyperacusis assessment in children is a critical step for early detection of auditory sensitivity problems.

Aim: This study aimed to adapt the Pediatric Hyperacusis Questionnaire Parent Form (P-HQ) into Turkish and to conduct validity and reliability studies.

Material and methods: The P-HQ Parent Form was adapted into Turkish and administered to 110 parents who volunteered to participate in the study. The reliability of the scale was assessed with Cronbach's alpha coefficient, and its validity was examined with explatory (EFA) and confirmatory factor analysis (CFA). Data analysis was conducted using IBM SPSS 21 and AMOS 23.

Results: Cronbach's alpha internal consistency coefficient indicated that the scale was highly reliable. CFA fit statistics revealed that the instrument provided an excellent fit with the data obtained from Turkish participants. Factor analysis revealed that the instrument had a two-factor structure, which explained 50.06% of the total variance.

Conclusions: Statistical analyses revealed that the Turkish P-HQ Parent Form is a valid and reliable scale. This scale will provide guidance for understanding children's auditory sensitivities and taking appropriate measures. Furthermore, the validity and reliability of the Turkish version makes an important contribution as one of the few tools used in the assessment of hyperacusis.

Keywords: children • hyperacusis • hyperacusis questionnaire • validity • reliability

(ID-6980) Immittance measurements in children aged 7–12 with different otologic findings

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Introduction: Wideband tympanometry (WBT) offers numerous advantages. It may also more distinctive information in detecting pathologies compared to traditional 226 Hz tympanometry. However, due to limited normative data, it is still not routinely used in many clinical settings.

Aim: To evaluate the outer and middle ear functions of children with different otologic findings with 226 Hz tympanometry and WBT, as well as to examine the distinguishing characteristics of these two methods.

Material and methods: A total of 32 participants ($n = 64$ ears), aged between 7–12 were included in the study. 226 Hz tympanometry and acoustic reflex tests were performed, followed by wideband tympanometry measurements. Volume, compliance, absorbance, and resonance frequency values were analyzed. The findings of both groups were compared.

Results: Twenty two children ($n = 44$ ears) exhibited a Type A tympanogram in traditional tympanometry, while 10 children ($n = 20$ ears) showed findings other than Type A (Type As, Ad, B, C). For the group with Type A findings

($n = 44$ ears), the mean tympanometric peak pressure was –9.2 daPa (min: –89, max: 72), the mean equivalent ear canal volume was 0.92 mL (min: 0.575, max: 1.545), and the mean resonance frequency was 833 Hz (min: 397, max: 1376). For the group with findings other than Type A ($n = 20$ ears), the mean tympanometric peak pressure was –177 daPa (min: –389, max: 185), the mean equivalent ear canal volume was 0.779 mL (min: 0.530, max: 1.490), and the mean resonance frequency was 808 Hz (min: 298, max: 1131). Absorbance values were found to differ across various frequencies between the two evaluated groups.

Conclusions: In this study, the outer and middle ear functions of children aged 7–12 with different otologic findings were evaluated using traditional 226 Hz tympanometry and WBT, and the distinguishing characteristics of these two methods were identified and discussed. Future studies with larger sample sizes and more detailed subgroup analyses are expected to contribute to a better understanding of the subject.

Keywords: immittance measurements • children • wideband • middle ear • resonance frequency

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(ID-7079) Investigating the perspective of parents with children with hearing loss on information and support process

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Introduction: The process of diagnosing hearing loss in children is a difficult time for their parents. Parents of children with hearing loss need detailed information about the nature of the hearing loss, the difficulties it may cause and the type of intervention that should be used. In addition to the need for adequate and accurate information, parents should be provided with appropriate emotional support during this process. It has been reported in the literature that audiologists, due to busy schedules, do not spend enough time with parents and often leave parents' questions unanswered.

Aim: The aim of this study was to evaluate the experiences and satisfaction of parents of children with hearing loss regarding the information and support processes.

Material and methods: Parents of 54 children with hearing loss aged 0–6 years were included in the study. Participants were asked to complete 2 forms. While the first form was the data collection form about the child with hearing loss, the second form was a semi-structured form, the perspective of parents with a child with hearing loss on the information and support process. Participants were asked to rate some questions on a scale of 1–5 and to choose one of the answers "yes", "no", "undecided" for others. SPSS statistical package program was used to evaluate the data.

Results: When asked whether adequate information was provided about newborn hearing screening (NHS), 37% of parents reported that adequate information was provided. When asked if they had received adequate support and information prior to the hearing test, 53.7% of parents reported that they had received adequate information. When asked about emotional support, 96.3% of parents were satisfied. Statistical analysis revealed a statistically significant difference between satisfaction with the NHS and satisfaction with the service received from the hearing aid/ cochlear implant centre ($p = 0.004$).

Conclusions: This study of 54 parents showed that there are gaps in information and support in the management of paediatric hearing loss. Although it is not new for parents to need more information and emotional support, it is important that these needs are properly met. The process of information and support should begin.

Keywords: parental perspective • hearing loss • information and support

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(ID-6946) Is physical activity intensity an important factor for balance skills in sedentary individuals? A pilot study

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Introduction: Sports and exercise improve balance skills and postural control. However, many individuals today adopt a sedentary lifestyle.

Aim: This study investigated whether the intensity of daily routine activity affects functional balance skills in sedentary individuals.

Material and methods: This prospective, cross-sectional study included 34 healthy individuals (28 females, 6 males, mean age: 22.00 ± 6.75) aged between 19–50 years, who did not do regular sports. The Physical Activity Scale-2 (PAS-2) was applied to determine the daily average physical activity level of the participants. Participants' height and weight information was obtained, and body mass index (BMI) was calculated. Functional Reach Test (FRT), Romberg Test (firm and foam surface), eyes open and closed One Leg Standing Test (OLST) and Timed Up and Go Test (TUG) were applied to all individuals. Data were analyzed using the Statistical Package for the Social Sciences 21. Normality distribution was evaluated with the Shappiro–Wilk test. The relationship between variables was examined using the Spearman or Pearson correlation test, according to the normal distribution of the data. The significance level was accepted as $p = 0.05$. Permission was obtained from the Karabük University SHC Ethics Committee for this study (Date: 19.06.2023, Decision: 2023/05).

Result: The mean PAS-2 score of the participants was 2238.48 mel/min/day. All participants had Romberg and eyes-open OLST scores of 30 seconds. Mean height was 164.38 ± 8.26 cm, mean weight was 58.76 ± 10.23 kg, mean BMI was 21.74 ± 3.65, mean FRT score was 36.85 ± 9.64 cm, mean TUG score was 7.15±0.78 seconds, and mean eyes-closed

OLST score was 21.68 ± 10.67 seconds. There was no correlation between the PAS-2 score and height, weight, BMI, FRT, TUG, Romberg, and OLST scores ($p > 0.05$).

Conclusions: This study shows that there is no relationship between physical activity levels and balance skills in individuals who are sedentary. Our findings show the importance of regular exercise in improving functional balance skills.

Keywords: physical activity • sedentary life • balance • daily activity

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(ID-6986) Is it possible for atypical forms of BPPV to cause vestibular deficits?

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Introduction: In this study, researchers focused on two rare BPPV forms mimicking central vestibular disorders. They are characterized by peripheral down-beating positional nystagmus and positional vertigo triggered by sudden head movements during acute attacks: (1) apogeotropic posterior canal (APC) BPPV and (2) anterior canal (AC) BPPV canalithiasis.

Aim: To investigate the vestibular deficit in the affected canal and utricle of patients with rare vertical canal BPPV forms.

Material and methods: In this study, the study group consists of 23 patients (mean age: 56.86 ± 12.21 years, min–max: 29–73, female/male ratio = 0.91) with rare BPPV forms (AC or APC BPPV). In 23 patients, a complete vestibular evaluation was performed. To diagnose BPPV, Dix–Hallpike or Semont, McClure-Pagnini, and central head-hanging diagnostic maneuvers were used. In the case of APC or AC BPPV, video head impulse tests (vHIT) and ocular vestibular myogenic potentials (oVEMPs) were performed before the treatment.

Results: The APC rate was 78.3% (18/23) and the AC rate was 21.7% (5/23). The APC was more common than AC (APC/AC ratio: 3.6/1) in this study sample. The mean VOR gain of the affected canal was 0.74 ± 0.088. In the rare BPPV group, during the acute BPPV attacks, 7 patients (30.43%) had canal deficit (VOR gain < .0.80) on the affected canal, and 10 patients (43.48%) had utricular deficit (7 of them absent P1-N1, 3 of them decreased P1-N1 amplitude) on the affected side.

Conclusions: In this study, it was revealed that vestibular deficits in the affected utricle and canal may be seen in acute BPPV stages. Therefore, objective vestibular evaluation is recommended in patients with atypical forms of BPPV.

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Keywords: apogeotropic posterior canal BPPV • anterior canal BPPV • vestibular deficit • vestibular loss

(ID-6925) Knowledge of interjections in children with cochlear implants: an investigation

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Introduction: Research on children with cochlear implants and their emotional processing primarily focuses on perception abilities, particularly in emotion labeling tasks. While most voice-emotion research relies on prosodic features, the role of interjections – key elements in conveying emotional cues – remains underexplored.

Aim: This study investigates interjection knowledge in children with cochlear implants as a foundational step before assessing their emotion perception and expression skills.

Material and methods: The study included 15 children with cochlear implants (26.66% female, 73.34% male), aged 7–14 years (mean = 11.06 ± 2.07), who had been receiving rehabilitation support for at least five years. Fourteen commonly used Turkish interjections were identified, and their knowledge levels were assessed in three stages: word recognition, definition, and contextual use. Participants who provided meaningful responses to at least two stages were classified as accurate, indicating their knowledge of the interjections.

Results: Knowledge levels varied among participants, with recognition rates ranging from 66.66% to 100%. The mean knowledge level was 88.57% (*SD* = 10.53%). The 95% confidence interval for knowledge levels (82.83%, 94.30%) suggests consistently high recognition among children with cochlear implants. A chi-square test was conducted to examine differences in accurate and inaccurate responses to interjections based on gender and age groups. Participants were categorized into two age groups: 7–10 years and 11–14 years. Given the small sample size, Fisher's exact test *p*-values were used for statistical interpretation. The analysis revealed no significant differences in interjection responses based on gender ($p > 0.05$) or age groups ($p > 0.05$). The internal consistency of the interjection responses was evaluated using Cronbach's alpha, which was calculated as 0.9218, indicating excellent reliability.

Conclusions: The findings suggest that children with cochlear implants have high interjection knowledge in Turkish. Gender and age did not significantly influence interjection knowledge. Further studies should incorporate interjection stimulus sets with sound-emotion components to address research gaps. Additionally, examining interjections across different languages and cultural contexts could enhance understanding of linguistic emotional competence.

Keywords: cochlear implant • children • interjections • emotions • knowledge

(ID-6898) Misophonia and speech-in-noise perception: the role of visual triggers

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Introduction: Misophonia is a disorder characterized by reduced sound tolerance, manifesting as behavioral, emotional, and physiological reactions to specific trigger stimuli, influenced by memory, attention, and neurocognitive processes. Previous research suggests that multisensory integration and the mirror neuron system may play a role in the mechanisms underlying misophonia.

Aim: The primary aim of this study was to assess speech-in-noise perception in individuals with misophonia, specifically under conditions involving visual triggers. The secondary objective was to evaluate frequency-specific auditory attention in individuals with misophonia.

Material and methods: The study included 62 participants aged 18–30 years (31 with misophonia, 31 controls). Participants were administered the Misophonia Assessment Questionnaire, pure-tone audiometry, the Frequency-Specific Auditory Attention Test for Adults, and the Turkish Matrix Test. The Turkish Matrix Test was conducted in three stages at a fixed intensity of 65 dB SPL with a 0 dB signal-to-noise ratio, using a non-adaptive paradigm. In the first stage, no visual stimulus was presented. In the second stage, a neutral visual stimulus was presented, and in the third stage, visual trigger stimuli were used.

Results: In the Turkish Matrix Test, no statistically significant difference was observed between individuals with misophonia and the control group in the absence of visual stimuli or in the presence of a neutral visual stimulus ($p > 0.05$). When exposed to misophonia-triggering visual stimuli, individuals with misophonia exhibited significantly lower speech-in-noise perception scores in both the right and left ears, compared to the control group ($p < .0.05$). In the Frequency-Specific Auditory Attention Test for Adults, no significant group differences were observed in scores from the general lists, mid-frequency lists, or high-frequency lists ($p > 0.05$). However, in the low-frequency lists, individuals with misophonia achieved significantly higher scores compared to the control group ($p < .0.05$).

Conclusions: These findings support previous research and strengthen the hypothesis that misophonia involves multisensory processing. Moreover, these results suggest a potential effect of misophonia on frequency-specific auditory attention mechanisms.

Keywords: misophonia • speech-in-noise perception • visual triggers • multisensory integration

(ID-6948) Outcomes of fitting with loudness discomfort level and real ear measurement: listening comfort, discrimination, and patient satisfaction

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Introduction: Conducting real ear measurement (REM) ensures the hearing aid users have sufficient auditory stimulation, while loudness discomfort level (LDL) measurement provides this stimulation to be at a level that will not disturb individuals. In this regard, using REM and LDL measurement together in hearing aid fitting may help both increase auditory performance and ensure individual comfort.

Aim: To investigate short-term outcomes of fitting, based on loudness discomfort level (LDL) and real ear measurement (REM) in bilateral hearing aid users. Speech reception thresholds (SRT), speech discrimination scores (SDS) and hearing aid satisfaction levels were examined.

Material and methods: A total of 13 bilateral hearing aid users older than 45 years old were participated. SRT, SDS and satisfaction levels were examined with International Outcome Inventory for Hearing Aids (IOI-HA-TR), Satisfaction with Amplification in Daily Life (SADL) questionnaire, Khalfa Hyperacusis Scale, and SDS before the application. Subsequently all participants had their hearing aids fitted based on LDL and REM. Outcome measurements were repeated after 10 days, and results were compared.

Results: The application was found to have a significant effect on SRT and SDS scores (SRT: $Z = 2.810$, $p = 0.005$, SDS: $t = 8.607$, $p < .0.001$). After application, the SRT decreased by 5 dB, and the SDS score increased by 13.85%. However, no significant difference was observed in SADL, IOI-HA, and Khalfa Hyperacusis Scale results ($p > 0.05$).

Conclusions: The study demonstrated that REM and LDL-based adaptations improve speech intelligibility in hearing aid users but do not create a significant change in patient satisfaction in the short term. Future researches will enhance comprehensive understanding of the subject.

Keywords: REM • bilateral hearing aid • LDL • speech discrimination score • hearing aid satisfaction questionnaires

(ID-6922) Parental views of children with hearing loss on audiology services in Türkiye

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Introduction: Although auditory implants and hearing aids (HA) support language, speech, cognitive, and social

development areas, audiologists are essential in the assessment and (re)habilitation for the management of hearing loss (HL). Most existing studies prioritize auditory outcomes, while parental satisfaction and perspectives on the audiology services their children receive remain insufficiently addressed.

Aim: This study aims to evaluate the parental perspectives, expectations, and satisfaction of children using auditory implants or HA regarding audiologists or audiology services in Türkiye.

Material and methods: Parents of children using HA or auditory implants from different cities and age groups across Türkiye were included. Data were collected using a demographic form and a questionnaire developed by the researchers. The demographic form included 20 questions, while the Parental Perceptions of Audiologists Questionnaire comprised seven sections with a total of 36 questions. Responses were measured using five-point and three-point Likert scales.

Results: A total of 150 parents participated in the study, with the mean age of children being 7.1 ± 3.7 years. Among the children, 50% were cochlear implants, 40.02% were HA, 3.99% were bone-anchored HA, and 5.99% were bimodal users. A total of 87.3% of parents stated that audiologists played a significant role in their understanding of their child's HL, while 80% reported that they could communicate easily with their audiologists. However, 68% of the participants considered the role of the audiologist in managing HL to be highly important, and 53.3% believed that audiologists made a significant contribution to their quality of life. Finally, trust in the audiologist for selecting the most suitable hearing device for the child's HL was rated as very high by 58% of the participants. Additionally, 62.7% perceived the audiologist's professionalism in device adjustments and technical evaluations as excellent. The responses to open-ended questions revealed that parents highlighted the inadequate employment of audiologists and difficulties in accessing audiological services – particularly in the Eastern and Southeastern Anatolia regions.

Conclusions: Parents, particularly those in rural areas, face difficulties in accessing audiology services. To improve the healthcare process, reduce appointment waiting times, and increase audiologist employment, there is an urgent need for solutions all over the country.

Keywords: audiology services • audiologists • parental satisfaction • hearing loss

(ID-6832) Prevalence of tinnitus in a sample of 43,064 children in Warsaw, Poland

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Introduction: Tinnitus affects both adults and children. Children rarely complain spontaneously of tinnitus, and their parents are not aware of the condition. The prevalence of tinnitus in children differs considerably between studies, and large studies are needed to reliably estimate how many children experience tinnitus symptoms.

Aim: The goal of the study was to estimate the prevalence of tinnitus in a large sample of schoolchildren.

Material and methods: Results from 43,064 children aged 11 to 13 years old, as well as their parents, were collected. This study was population-based, epidemiological research, conducted in the general, paediatric population of school-age children in Warsaw, Poland. Pure-tone audiometric testing was done, and hearing thresholds were determined from 0.5 to 8 kHz. Both the children and parents answered questions about the presence of tinnitus in the child.

Results: The study showed that tinnitus affected 3.1% of the children, but it was significantly more frequent (9%) in children with hearing loss. We found that 1.4% of the parents were aware of the presence of tinnitus in their children.

Conclusions: Children should be routinely asked whether they experience tinnitus and if so, they should be included in the thorough assessment and management of the condition.

Keywords: tinnitus • hearing screening

(ID-6950) Profile and reasons for admission of childhood hearing loss in the audiology clinic

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Introduction: Childhood hearing loss is a significant public health issue affecting approximately 38.7 million children worldwide. According to the World Health Organization, 60% of childhood hearing losses can be treated or prevented if diagnosed early. Therefore, regular hearing tests and early diagnosis play a critical role in hearing healthcare services.

Aim: This study aims to retrospectively analyze reasons for admission of children who applied to the audiology clinic and the hearing test results and to determine the profile of childhood hearing loss.

Material and methods: This retrospective study includes data from 211 children who applied to the audiology clinic between July and December 2024. The demographic data, reasons for admission, hearing test results, and comorbid conditions of the children were analyzed.

Results: The children included in the study, 42.2% were female ($n = 89$) and 57.8% were male ($n = 122$), with an average age of 59.39 months ($SD = 34.72$) and 64.16 months (SD = 32.25), respectively. The most common reason for admission was hearing evaluation (27%), followed by suspected hearing loss (17.5%), open-mouth breathing and snoring (15.6%), middle ear infection (14.3%), speech delay (12.3%), and speech-language disorders (13.3%). Out of 211 children, hearing test result of 83 children were obtain from database, 55.42% of them had normal hearing, while 6.02% had very mild, 14.46% mild, 8.43% moderate, 4.82% moderate-severe, 6.02% severe, and 4.82% profound hearing loss. A significant proportion of children admitted for hearing loss evaluation had risk factors such as premature birth (4.74%), a history of intensive care unit (ICU) stays (8.06%), consanguineous marriage (1.42%), and a family history of hearing loss (1.90%). While 67.3% of participants ($n = 142$) had no additional medical conditions, 32.7% ($n = 69$) had various syndromic and non-syndromic disorders.

Conclusions: Childhood hearing loss requires early diagnosis and intervention. This study highlights the need to improve hearing screenings, identify risk factors, and adopt a multidisciplinary approach. Prematurity, ICU stays, and family history are significant risk factors. Children with comorbid conditions should be closely monitored. Screening programs should prioritize high-risk infants and children.

Keywords: hearing screening • pediatric audiology

(ID-6902) Serous otitis media and dynamic visual acuity in children: insights from functional head impulse testing

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Introduction: Serous otitis media (SOM) is characterized by fluid formation in the middle ear cavity. Although SOM mostly manifests itself with hearing loss, it also causes complaints related to the vestibular system in addition to hearing loss. The functional head impulse test (fHIT) was developed as a new test method to evaluate the functionality of vestibulo-ocular reflex (VOR) gain and dynamic visual acuity. In our study, it was aimed to examine the diagnostic contribution of the fHIT test to evaluate vestibular function in children with SOM.

Aim: The aim of this study was to evaluate the VOR functionality of children with SOM at different head accelerations in the lateral semicircular canal using the fHIT and to compare the Percentage of correct Answers (PCA) results obtained in fHIT with healthy children.

Material and methods: A total of 76 children, including 17 participants with unilateral SOM with a mean age of 6.82 ± 1.66 years, 25 participants with bilateral SOM with a mean age of 5.80 ± 1.58 years, and 34 participants with no health problems (control group) with a mean age of 6.85 ± 1.84 years, were included in this study. All participants underwent fHIT test only in the lateral semicircular canals. fHIT results were evaluated by total PCA and PCA values at head accelerations of 4000, 5000, 6000°/s^2.

Results: In our study, a statistically significant difference was obtained between the right lateral canal total PCAs (mean percentage of correct responses in the range of 4000–6000°/s^2) between the groups in lateral SSC ($P < .05$). In addition, a significant difference was obtained between the groups at 4000 and 6000°/s^2 in the right lateral canal ($P < .05$), but no significant difference was obtained at 5000°/s^2 in the right lateral canal and at all head accelerations in the left lateral canal ($P > .05$).

Conclusions: We suggest that SOM partially affects the VOR functionality and fHIT can be used to evaluate VOR functionality in children with SOM. Future studies should include more patients and examine the complementarity of fHIT with other vestibular tests evaluating the VOR.

Keywords: functional head impuls test • fHIT • serous otitis media • SOM • vestibulo-ocular reflex • VOR

(ID-6947) Significant effect of different types of speech processor on musical perception in adolescent cochlear implant users

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Introduction: Speech processors can be broadly classified into two categories: off-the-ear (OTE) and behind-the-ear (BTE). While the functions of these processors are exactly the same, the location of the external component on the head causes a noticeable variation in the placements of the microphones.

Aim: The aim of this study is to investigate the effects of BTE and OTE speech processors on the pitch and melody perception abilities of adolescent cochlear implant users.

Material and methods: A total of 17 adolescents, 9 BTE and 8 OTE users, between the ages of 12–18, who underwent cochlear implantation (CI) at Hacettepe University and were followed up at the audiology department were included in the study. Pitch Direction Discrimination (PDD) and Melodic Contour Identification (MCI) tests were applied to

the participants. A quick subjective test measuring the frequency of music listening, the enjoyment of music listening, and understanding of the lyrics was also administered to each participant.

Results: There was no statistically significant difference between the two groups in terms of duration of CI use ($p = 0.06$), but a significant difference was obtained in duration of CI daily use ($p = 0.005$). There was no statistical difference between the groups in the frequency of listening to music ($p = 0.30$), enjoyment ($p = 0.17$) and understanding lyrics ($p = 0.73$). No significant difference was observed in PDD thresholds between groups ($p = 0.16$), but a significant difference was obtained in MCI scores ($p = 0.01$).

Conclusions: Our study shows that processor type may be more important in more difficult tasks. This study particularly emphasizes the importance of speech processor type in terms of melody perception and daily CI use in adolescent CI users.

Keywords: music perception • pitch perception • speech processor

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(ID-6942) Speech Sound disorders and auditory processing

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Introduction: Children diagnosed with speech sound disorders (SSDs) encounter difficulties in speech perception, especially listening in background noise.

Aim: This study compared the auditory processing profiles of children with SSD and typically developing (TD) children as described by parent questionnaires, behavioral language and auditory tests, and auditory evoked responses.

Material and methods: Parents of 40 Greek Cypriot children 7–10 years old completed questionnaires related to listening characteristics of their children. The children were evaluated by a battery comprising language, phonology, auditory processing tests, and auditory evoked responses. Twenty four (24) children with a history of SSD and 16 typically developing (TD) children formed the experimental and control groups respectively.

Results: Significant differences between the groups included CHAPS questionnaire indices of performance in noise and quiet, phonological processing indices, auditory brainstem response interwave I–V latencies. There were significant correlations between ABR I–V latencies and behavioral indices of phonological processing like rhyme identification, first syllable localization, first phoneme identification, word finding, and word repetition.

Conclusions: These findings indicated auditory processing deficits in children with a history of SSD, even after completion of their treatment. There were moderate to strong correlations in performance in noise and quiet, phonological processing, and auditory pathway conduction times as indicated by ABR interwave latencies. Poor discrimination of speech in noise imposes discrepancies between incoming auditory information and retained phonological representations which disrupts the implicit processing mechanisms that align auditory input with phonological representations stored in memory. Clinicans may consider assessment of auditory processing in children with SSD to formulate more effective therapeutic intervention strategies.

Keywords: speech sound disorders • auditory processing • phonology

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(ID-6831) Symptoms of auditory processing disorders (APD) in children with tinnitus

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Introduction: Children rarely self-report having tinnitus and so there is limited understanding of the problems they face and how tinnitus affects their daily lives. In situations where peripheral hearing is normal and the patient reports difficulty understanding speech, one may consider the co-occurrence of other causes, such as central auditory processing disorders (CAPD).

Aim: The aim of the study was to assess the presence of CAPD symptoms in children with tinnitus.

Material and methods: The study group consisted of 10,582 children 13 years old. The study material included questions about tinnitus experience, screening pure tone audiometry, and the results of the Scale of Auditory Behaviors (SAB), in its Polish adaptation, which was used to assess whether they may have CAPD. Results In children with tinnitus, symptoms that may indicate CAPD were observed. In 2849 children, an SAB total score of less than 46 was obtained, an indication for an extended diagnosis. Among these same children 33.7% experienced tinnitus. The more frequently a child experienced tinnitus, the lower the mean overall SAB score.

Conclusions: Children reporting tinnitus should receive additional diagnostic tests for CAPD. The diagnosis should be multispecialty and, in addition to hearing tests, include an in-depth interview, psychological and pedagogical evaluation, and psychoacoustic tests.

Keywords: CAPD • tinnitus

(ID-6896) Technology use in young cochlear implant recipients and its differences from typically hearing peers

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Introduction: Technology is essential for communication and connection in adolescence. Young people with cochlear implants (CIs) face unique challenges and opportunities in engaging with the digital world. Understanding their technology use can help ensure they fully benefit from its potential.

Aim: the aim of our study was to obtain knowledge regarding the technological features of the devices that adolescences with CIs know and use, to investigate the ways in which they interact with technology, including social media, computer use and music listening, and to look into any differences between them and individuals with normal hearing (NH).

Material and methods: The study included 36 cochlear implant (CI) users (15 female, 21 male, mean age 18.2 ± 3.98, range 8–25) and 38 normal hearing (NH) participants (16 female, 22 male, mean age 20.2 ± 2.23, range 13–25). For CI users, being a stable unilateral, bimodal, or bilateral CI user for at least one year. The researchers designed a questionnaire to gather descriptive data on hearing loss (for CI users), technology use habits, communication habits, gaming habits, and demographic information about CI users and NH individuals.

Results: When technology usage habits were compared between the two groups, NH participants scored significantly higher for 'using technological tools to acquire new skills' ($U = 489.0$, z = –2.38, p = 0.025), 'web-based content production' ($U = 437.0$, $z = -2.94$, $p = 0.003$), 'messaging in daily life' ($U = 439.0$, $z = -2.74$, $p = 0.006$), 'using internet-based communication tools'($U = 476.0$, $z = -2.36$, $p = 0.018$), 'using bluetooth feature of electronic devices' ($U = 487.0$, $z = -2.18$, $p = 0.029$), and 'using internet-based applications in school and classroom work'($U = 496.0$, $z = -2.08$, $p = 0.037$), while CI users scored significantly higher for 'frequency of gaming' ($U = 450.0$, $z = -2.59$, $p = 0.010$),'having difficulty communicating while gaming'($U = 433.0$, $z = -2.90$, $p = 0.004$), and 'the need to use subtitles while watching videos' ($U = 460.5$, $z = -2.64$, $p = 0.008$). Also, CI users reported using the internet and technology mostly for watching videos (77.8%), social media (75.6%) and messaging (62.2%), while NH participants reported using it mostly for social media (94.9%), watching videos (74.4%) and listening to music (71.8%).

Conclusions: The results of the study indicate notable differences in technology usage patterns between young CI users and NH individuals. CI users may encounter challenges in certain aspects of technology use, which can shape their preferences and behaviors.

Keywords: cochlear implant • adolescence • technology

(ID-6852) The cochlear implant challenge in children with multiple disabilities over the past ten years

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The present contribution examines the last 10 years of medical literature on the benefits of cochlear implantation in children who are deaf or hard of hearing (DHH) with additional disabilities. The most recent literature concerning cochlear implants (CIs) in DHH children with additional disabilities was systematically explored through PubMed, Embase, Scopus, PsycINFO, and Web of Science from January 2012 to July 2023. We performed a two-stage search strategy and we selected a total of 61 articles concerning CI implantation in children with several forms of additional disabilities: autism spectrum disorder, cerebral palsy, visual impairment, motor disorders, developmental delay, genetic syndromes, and intellectual disability. Our results showed that, overall, many children with additional disabilities benefit from CIs by acquiring greater environmental sound awareness. This, in turn, improves non-verbal communication and adaptive skills, with greater possibilities to relate to others and to be connected with the environment. Instead, despite some improvement, expressive language tends to develop more slowly and to a lesser extent compared to children affected by hearing loss only. Further studies are needed to better appreciate the specificities of each single disability and to personalize interventions, not restricting the analysis to auditory and language skills, but rather applying or developing cross-culturally validated instruments able to reliably assess the developmental trajectory and the quality of life of DHH children with additional disabilities before and after CI.

Keywords: Usher syndrome • Waardenburg syndrome • autism • cerebral palsy • cochlear implant • intellectual disability

(ID-6975) The effect of vascular loop syndromes on tinnitus

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Introduction: Tinnitus is the auditory perception of a meaningless sound without any external or internal acoustic stimulus. The prevalence of any form of tinnitus in adults ranges between 4.1% and 37.2%, with an average of 14.1%. The most common cause of tinnitus is said to be otologic disorders, primarily sensorineural hearing loss. The presence of a vascular loop formed by the anterior inferior cerebellar artery (AICA) in the internal acoustic canal has been described as potentially causing tinnitus by compressing the cochleovestibular nerve, although debates continue about the relationship between this condition and tinnitus.

Aim: In this study, we aimed to determine the frequency and types of vascular loop syndromes in patients presenting with tinnitus.

Material and methods: Patients who presented to the ENT clinic of Istanbul Aydin University Medical Park Florya Hospital with tinnitus between November 2021 and February 2025 were included in the study. Data from 115 patients who had temporal bone MRIs, consisting of 63 men (55%) and 52 women (45%), were analyzed. The age of the patients ranged from 6 to 78 years, with an average age of 45.3 years.

Results: Pathologies were detected in the MRIs of 53 patients (46%). In one patient, a tumor was found in the internal acoustic canal, 9 patients had mastoiditis, 2 had unilateral vertebral artery hypoplasia, 2 had both mastoiditis and unilateral vertebral artery hypoplasia, and 39 patients (34%) were diagnosed with vascular loop syndrome. of these 39 patients, 22 (56%) had type 1, 11 (28%) had type 2, and 6 (16%) had type 3 vascular loop syndrome. The cerebellopontine angle houses vital neurovascular structures such as cranial nerves V, VII, VIII, and the anterior inferior cerebellar artery (AICA), and its complex anatomy often leads to neurovascular compression syndromes.

Conclusions: Compression of the facial-vestibulocochlear nerve complex by AICA can lead to various clinical manifestations, including hemifacial spasm, tinnitus, and hemiataxia. Although vascular compression is a known cause of certain neuralgias, its relationship with otological symptoms such as tinnitus, hearing loss, and dizziness remains uncertain.

Keywords: tinnitus • anterior and inferior cerebellar artery vascular loop syndromes

(ID-6858) The professional development course for therapists in Kyrgyzstan working with children with hearing loss

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The Lehnhardt Foundation has launched a unique project in Kyrgyzstan aimed at developing an online training course for therapists working with children with hearing impairments. In Kyrgyzstan the course is organized by the International Association of Hearing Rehabilitation Specialists in partnership with the State Pedagogical University in Bishkek. The course focuses on the rehabilitation of children with cochlear implants. The report presents the key stages of the project, including the analysis of the target audience's needs, creating educational materials, and conducting practical sessions and exams. It highlights positive outcomes like improved support for children and families, participant feedback, and challenges faced by organizers. The project aims to not only enhance and develop educators' professional skills but also foster a sustainable educational environment that supports the successful rehabilitation of children with hearing impairments. The professional development course is aimed at supporting practical skills for educators necessary when working in resource-limited environments, as well as raising awareness about modern methods and approaches to the rehabilitation of children with hearing impairments. The report outlines the structure and topics of the course, access to materials, and the timeline and format for completing the training. Thirty educators in Kyrgyzstan completed the training course, enhancing their knowledge of rehabilitating children with hearing impairments. Participants received a state-recognized certificate from the Pedagogical University in Bishkek, equivalent to 144 academic hours. Participants gain access to methodological materials for further application in their practice. Educators who successfully passed the exam are added to the registry (an open resource) of early intervention specialists. The Lehnhardt Foundation project marks a significant step in the field of inclusive education for children with hearing impairments in Kyrgyzstan. The Pedagogical University in Bishkek plans to integrate this course into the curriculum for final-year students. The introduction of a registry for early childhood educators helps parents from the regions to obtain information about educators near them. The implementation of the professional development course contributes to strengthening professional communities and creating a sustainable foundation for further improving the inclusive education of children with hearing impairments in Kyrgyzstan.

This unique initiative for Kyrgyzstan is implemented by the Lehnhardt Foundation with the support of the KIND Hörstiftung grant program.

Keywords: online training course • rehabilitation • cochlear implant and hearing aid • therapists education

(ID-6897) The impact of ASMR and misophonia on emotion recognition

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Introduction: In everyday life, certain sounds can trigger involuntary physiological and emotional responses, leading to sensitivities categorized as misophonia and autonomous sensory meridian response (ASMR). These sensory experiences elicit subjective emotional reactions and can lead to functional and structural changes in brain regions associated with emotional perception.

Aim: This study aims to evaluate the auditory and auditory-visual emotional perception of individuals with ASMR and misophonia, which can also be defined as a difference in sensitivity to sound.

Material and methods: The ASMR-15 scale and the Misophonia Questionnaire (MQ) were initially administered to identify participants. Forty-eight individuals (mean age: 31,54 ± *SD* = 7,25) aged 18–45 years, with bilateral type A tympanograms and pure tone averages better than 20 dB, were included in the study. We then administered the Maudsley Obsessional Compulsive Inventory (MOCI), the Emotional Communication in Hearing Questionnaire (EMO-CHeQ), and auditory and video-based auditory/facial emotion recognition tests to the misophonia, ASMR, and control groups.

Results: No significant differences were found between the misophonia, ASMR, and control groups in the auditory and video-based auditory/facial emotion recognition tests ($p > 0.05$). Significant differences were observed between the misophonia and ASMR groups on the EMO-CHeQ, and between the misophonia and control groups on the MOCI ($p < .0.05$). Females' MQ scores were significantly higher than males', and males outperformed females in identifying the emotion of anger in the video-based auditory/facial emotion recognition test ($p < .0.05$). A negative correlation was found between increasing age and the recognition of surprised and neutral emotions in the auditory emotion recognition test ($p < .0.05$).

Conclusions: Age and gender may influence voice sensitivity and emotional perception. Consistent with the literature, a positive correlation was observed between the severity of misophonia and the likelihood of a diagnosis of obsessive-compulsive disorder. While there may be differences in the recognition of emotion in speech between individuals with ASMR and misophonia, further research is needed.

Keywords: autonomous sensory meridian response • ASMR • misophonia • emotion recognition

(ID-6909) The onset of facial nerve stimulation as a side effect ten years after cochlear implantation

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Introduction: Cochlear implantation (CI) restores auditory perception by directly stimulating the auditory nerve through electrical impulses, bypassing the damaged or nonfunctional cochlea. While CI is generally regarded as a safe procedure, postoperative complications have been documented in various studies. Among these, abnormal stimulation of the facial nerve has been identified as a significant complication.

Aim: This study aims to evaluate the potential causes and solutions of facial nerve stimulation occurring after long-term cochlear implant use.

Material and methods: A 2.5-year-old child received an Advanced Bionics HiRes 90K Advantage CI with a HiFocus 1J lateral wall electrode. At the time of implantation, electrode selection was not based on specific anatomical or clinical considerations. No signs of facial nerve stimulation were reported preoperatively or in the immediate postoperative period. A decade after implantation, the patient began experiencing facial nerve stimulation. When the cochlear implant processor was active, facial nerve stimulation was observed; however, no facial nerve stimulation occurred when the processor was turned off. Electrode integrity assessments, including electrophysiological tests (integrity tests), yielded results within normal limits. Radiological imaging confirmed bilaterally normal 7th and 8th cranial nerves, as well as normal middle and inner ear structures.

Results: Due to suspected soft device failure contributing to facial nerve stimulation and the patient's inability to use the implant, the initial cochlear implant was explanted and replaced with a Cochlear™ Nucleus® CI522 lateral wall electrode. However, facial nerve stimulation persisted following activation of the cochlear implant processor one month postoperatively.

Conclusions: In the literature, no reports have documented facial nerve stimulation caused by an active cochlear implant processor after ten years of implantation. However, in our case, the patient exhibited facial nerve stimulation. This finding underscores the need for individualized electrode selection in cochlear implantation, considering factors such as anatomical variations, prior implantation history, and long-term auditory outcomes. A multidisciplinary approach is essential for the optimal management of such cases. Lateral wall electrodes may increase the risk of facial nerve stimulation, especially in patients with anatomical predispositions. In such cases, perimodiolar electrodes could serve as a safer alternative by minimizing the likelihood of off-target electrical stimulation.

Keywords: facial nerve stimulation • cochlear implantation • lateral wall electrodes • perimodiolar electrodes

(ID-6860) Use of machine learning in ABR test findings in children: preliminary results

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Introduction: Auditory Brainstem Response (ABR) test is an important electrophysiological assessment used together with behavioral tests to diagnose hearing loss.

Aim: The aim of this study is to estimate the intensity threshold and latency of the V wave in ABR tests performed in children using machine learning methods. In this way, it is aimed to save time during the ABR test, contribute to early diagnosis in cases where the test cannot be performed due to sleep problems in children with special needs, and obtain more objective and reliable results by preventing late diagnosis problems.

Material and methods: In this study, a dataset consisting of 88 ABR waveforms consisting of 32 hearing-impaired and normal-hearing individuals from the pediatric group between the ages of 0–8 was analyzed using machine learning techniques. The V wave latency values of the ABR test were estimated using the deep learning model Artificial Neural Networks (ANN). The model was trained using the Levenberg-Marquardt technique for optimization using the MATLAB program.

Results: R^2 values were used to evaluate the performance of the model. The corresponding R^2 values of the training, validation and test sets were determined as 0.99, 0.97 and 0.92, respectively. The Levenberg–Marquardt algorithm was used to optimize the training and test parameters for data evaluation, aiming to estimate wave V features with maximum

precision. A classification accuracy of 92.9% was achieved for ABR waveforms matched with the trained machine learning model.

Conclusions: The preliminary results obtained demonstrate the potential of machine learning models to objectify and increase the accuracy of ABR interpretation. The results of this study are expected to significantly increase the diagnostic efficiency in pediatric audiology. The potential to reduce the time and level of expertise required for ABR assessments is expected to support a faster and more comfortable assessment process for patients and audiologists. The use of machine learning models has the potential to reduce the workload of audiologists in a clinical setting by enabling faster and more accurate ABR tests.

Keywords: pediatric hearing loss • machine learning • auditory brainstem response test

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(ID-6912) Visual perception in children with cochlear implants: preliminary results

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Introduction: Visual perception is the interpretation of visual information in the environment. It includes many components such as color-shape perception, spatial perception, motion perception, and figure-ground discrimination. Hearing loss affects sensory perception processes. This effect can also manifest on visual perception.

Aim: This study aims to evaluate the visual perception skills of children with cochlear implants as well as to examine the possible effects of hearing loss on visual perception.

Material and methods: Verbal and Nonverbal Cancellation Test was developed by Weintraub and Mesulam in 1985. The test is used to evaluate the spatial distribution of attention. The test evaluates cognitive skills such as visual-spatial perception, visual scan, sustained attention, reaction speed, and reaction inhibition. The test was standardized for Turkish society as part of the Neuropsychological Test Battery for Cognitive Potentials. Fifteen children aged 6 to 11, who were cochlear implant users and undergoing routine check-ups at the Hacettepe University Audiology Department were included in the study. Personal information was collected from the participants through a demographic information form. Then, the testing phase was carried out in a quiet room free from distracting stimuli.

Results: The results showed that children using cochlear implants exhibited differences in several types of subscores compared to the normative values of typically developing children. Similar or contradictory findings have been reported in the literature.

Conclusions: There is a limited number of studies in the literature on the visual perception skills of children with cochlear implants. This study aims to address this gap and presents our preliminary findings on visual perception in these children. Children should receive support in areas where differences are observed. Visual perceptual exercises should be integrated into rehabilitation programs.

Keywords: cochlear implant • cancellation test • visual perception • visual-spatial perception • visual scan

II Graduate and Undergraduate Projects

Graduate Project Presentations

(ID-6918) Auditory performance analysis of patients with bilateral simultaneous, bilateral intermittent and unilateral cochlear implants

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Aim: There are two applications of bilateral implantation, either simultaneously or intermittently. It is thought that bilateral simultaneous, bilateral intermittent and unilateral cochlear implantation are thought to have varying effects on hearing. The aim of this study is to evaluate the effects of these implantation types on auditory performance.

Material and methods: 105 children using cochlear implants in Gaziantep Hearing Center between October 2021 and January 2022 were included in the study. LIP, MTP and MAIS from the EARS test battery were administered to the participants.

Results: While 53 of the participants included in the study were men, 52 were women. The mean age of the participants was 44.05 ± 9.02 months. In our study, the scores obtained from the LIP, MTP test and MAIS questionnaire were found to be significantly higher as the participants' age increased. No statistical difference was observed when the scores of the test and MAIS questionnaire were compared. It was observed that the age of cochlear implant surgery was significantly higher in those who could not complete MTP12. In addition, a positive, weak and significant correlation was found between the age of cochlear implant surgery and MAIS scores. A positive correlation was found between the time between the two implants and the MAIS scores.

Conclusions: As a result, in our study, it was observed that auditory performance increased with age. There are studies compatible with this in the literature. There was no statistical difference between bilateral simultaneous, bilaterally intermittent and unilateral implantation. Studies have shown that bilateral implantation is more advantageous than unilateral, and bilateral simultaneous implantation is more advantageous than bilateral intermittent implantation. The reason why we obtained results that are inconsistent with the literature may be that the skills in the tests were acquired in the first 6 months of hearing.

Keywords: bilateral simultaneous • bilaterally intermittent • unilateral

(ID-6921) Development and usability evaluation of virtual reality-based auditory rehabilitation in children with cochlear implants: a pilot study

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Introduction: Cochlear implant users face challenges in central auditory processing skills, such as sound localization, auditory discrimination, temporal resolution and speech perception in noise. Interactive rehabilitation methods are considered to be effective in supporting central auditory processing skills in addition to traditional auditory training. Therefore, virtual reality applications that simulate realistic conditions are increasingly being used in rehabilitation processes.

Aim: This study aims to develop and evaluate the usability of a virtual reality restaurant simulation game designed to support central auditory processing skills in children with cochlear implants.

Material and methods: A restaurant game prototype consisting of six levels, ranging from easy to difficult, was developed, involving tasks such as understanding and accurately delivering customer orders. In the pilot study, the Game Observation Checklist, the Children's Game Evaluation Form, the System Usability Scale and One-on-One Interview Forms were used to assess the gaming experience of eight children with bilateral cochlear implants, eight normally hearing children and their parents. Usability was evaluated using these forms. Additionally, participants played the six level prototype and their game scores were compared across groups.

Results: The average System Usability Scale score was 84.69 for parents of normally hearing children and 85.94 for parents of children with cochlear implants. According to the Children's Game Evaluation Form, the parameters of ease of use, attitude, intention to continue, fun and satisfaction were found to be at a high usability level, exceeding 90% for both normally hearing children and children with cochlear implants. When comparing the game scores of the two groups, the normally hearing group obtained significantly higher scores at all levels compared to the cochlear implant group ($p < .0.01$).

Conclusions: The developed game demonstrated high usability and was well received by both children and their families. We consider this game to be a potentially innovative and supportive alternative to traditional auditory rehabilitation methods. It is planned to evaluate the effectiveness of the final version of the game. This research, derived from a doctoral dissertation, was supported by the Istanbul Aydin University Scientific Research Projects Commission with decision number 2024/11.

Keywords: cochlear implant • central auditory processing • virtual reality • auditory rehabilitation • usability

(ID-6924) Development of a mobile application for rehabilitation of decreased sound tolerance disorders in children and adolescents

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Introduction: Decreased sound tolerance disorders (DSTD) are a common condition in children and adolescents, characterized by hypersensitivity to sounds and the resulting in negative reactions to these sounds. DSTD is subdivided into subtypes such as hyperacusis and misophonia and can negatively affect individuals' daily lives. Current treatment methods are limited and generally require specialist follow-up rehabilitation. The aim of this study is to develop a mobile application for children and adolescents with DSTD that provides counseling and sound enrichment therapy content aimed at reducing discomfort with sounds.

Material and methods: The study will consist of the development and piloting phases of the mobile application. The counseling section will provide informational videos about hyperacusis and misophonia for children and their parents, while the sound enrichment therapy section will create custom stimulations from nature sounds, instrumental musics and complex noise sounds. After 14 users with autism spectrum disorder (ASD), a group in which DSTD is common, have used the app for at least one month, pre- and post-tests will be conducted and the results will be analyzed.

Results: The content of the counseling and sound enrichment therapy sections will be shaped in line with expert opinions during the development phase of the application. The content of the application will be optimized according to the experts' feedback. Then, the effectiveness of the application will be evaluated with a pilot study conducted on individuals diagnosed with ASD. At this stage, the effect of the therapy on symptom severity and discomfort level in individuals with DSTD will be investigated. It is expected to develop a successful application and analyze the feedback received from users. The project is supported by TUBITAK 2214 International Doctoral Research Fund.

Conclusions: This study will contribute to the limited studies on DSTD rehabilitation for children and adolescents and present an effective mobile application to improve sound tolerance. The app can be extended as an alternative for clinical therapies and can serve as a guide.

Keywords: counseling • hyperacusis • misophonia • mobile application • sound enrichment

(ID-6916) Evaluation of device satisfaction and quality of life of adolescent group cochlear implant users wearing behind the ear and not behind the ear

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Aim: BTE or OTE speech processors have advantages and disadvantages over cochlear implant users. In our study, it was aimed to evaluate the device satisfaction and quality of life of adolescent cochlear implant users with OTE and BTE processors.

Material and methods: In the study, 98 children using cochlear implants in Gaziantep Hearing Center between October 2021 – January 2022 were included in the study. Quebec Assistive Technology User Satisfaction Assessment (Q-YTKMD) questionnaire and Mf07-01 Study Quality of Life (Pf36) Form were administered to the participants.

Results: 58 participants were male, 40 were female, and the mean age was 14.66 ± 2.83. The service satisfaction level of BTE users was higher than the level of satisfaction they felt from the device, while OTE users were close to each other. A negative correlation was found between the age of starting to use cochlear implants and the level of device satisfaction in BTE and OTE users. OTE users' device and total satisfaction levels were found to be significantly higher than BTE users. In BTE and OTE users, a negative correlation was found between age and Energy/Vivacity/Vitality, which is the subtitle of quality of life. A positive and significant relationship was found between device satisfaction and quality of life in BTE and OTE users.

Conclusions: As a result, it has been observed that OTE users have higher device satisfaction than BTE users. However, in the literature review, there are results that are compatible with our study, but there are also inconsistent results. It has been determined that the increase in device satisfaction increases the quality of life. In addition, it has been observed that the age of starting to use cochlear implants affects device satisfaction and quality of life.

Keywords: speech processor • device satisfaction • quality of life

(ID-6824) Investigation of the effect of family education on language development of hearing impaired children

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This researchs goal is investigating the effects of family's education level on the language development. With this, other goals are, gender, early diagnosis, applying hearing aids, socio-economic level and family's education levels effect on deaf childrens language development. The Turkish Early Language Development Test (TEDIL) was used in the study.

Individuals diagnosed with hearing loss between the ages of 2 and 8 and using hearing aids or cochlear implants were included in the study. Individuals with additional disabilities other than hearing impairment were not included in the study. The study was carried out in "Özel Yekta Özel Eğitim ve Rehabilitasyon Merkezi" in Şanliurfa/Haliliye, April–June 2021. A total of 54 people participated in the study. 48.1% (26 people) of the individuals participating in the study were girls and 51.9% (28 people) were boys. The average age of the individuals participating in the study was 4 years and 9 months. In research, we looked at the difference between before family education and 2 months of family educations effects on language development. With the results, We seen major differences between family with high education, and poor education in those two tests ($p < .0.05$) gender, socio-economic level and family's education levels tiny effects on receptive, expressive, general language also seen ($p > 0.05$) with the family's education level, we seen that applying hearing aids and early diagnosis have major effects on receptive and expressive development and general language development ($p < .0.05$). As a result of the study, family education is related to receptive, expressive and general language development and early diagnosis and instrumentation is related to receptive, expressive and general language development, gender, socioeconomic level of the family and educational status of the family were not found to be related to language development.

Keywords: family education • deaf child • hearing • language • language development

Undergraduate Project Presentations

(ID-6978) Evaluation of central auditory abilities in experienced action video game players adolescents

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Introduction: Action video game playing is associated with enhanced visual perception. However, it has been observed that there are not enough studies examining auditory skills.

Aim: The aim of this study was to examine temporal processing and auditory memory skills in action video game players and individuals with little to no video game experience.

Material and methods: 39 action video game players and 35 individuals with little to no video game experience were included in the study. Frequency pattern test, duration pattern test, random gap detection tests were applied to the participants to evaluate temporal auditory processing skills. Digit span and backward digit span tests were applied to evaluate auditory memory capacity.

Results: There were no significant differences between the action video game playing and non-playing groups in frequency pattern (respectively, 69.74 ± 15.55, 68.85 ± 17.70, $p > 0.05$), duration pattern (respectively, 84.35 ± 14.69, 86.71 ± 13.71, $p > 0.05$), random gap detection (respectively, 7.16 ± 4.90, 8.91 ± 7.21, $p > 0.05$), digit span (respectively, 5.56 ± 0.71, 5.51 ± 0.98, $p > 0.05$) and backward digit span (respectively, 3.94 ± 0.81, 3.60 ± 0.82, $p = 0.05$) tests.

Conclusions: In conclusion, this study showed that auditory skills did not increase in action video game players. Further research is needed to evaluate the possibility of video games as an intervention tool, especially for individuals who may have auditory processing difficulties.

Keywords: video game players • temporal processing • auditory memory

Speech Presentations for Panelists/ Speakers

(ID-6952) Acoustic change complex: it's place in pediatric evaluation

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Acoustic change complex (ACC) refers to auditory cortical potentials elicited in response to a change in an ongoing, long-term auditory stimulus. Although ACC is recognized as a promising tool for assessing speech discrimination abilities, its clinical application remains limited. Previous studies have demonstrated the test-retest reliability of ACC in children and its feasibility for measurements in both infants and children has been established. Notably, ACC can be recorded in the absence of attention and, in some cases, may serve as a more sensitive measure of speech sound discrimination than behavioral assessments in infants. ACC has been utilized to investigate sound discrimination abilities in children with hearing loss, auditory processing disorder, and auditory neuropathy spectrum disorder. Furthermore, it can be recorded in young children and infants, both with and without hearing aids, and may have potential applications in fine-tuning hearing aid settings. Additionally, ACC may contribute to guiding rehabilitation strategies and identifying cochlear implant candidates. The technique can be applied in children with cochlear implants and auditory brainstem implants. Despite its advantages, ACC presents several challenges. Its reliability is influenced by age, and the choice of stimulus parameters – such as type, rate, duration, and interstimulus interval – can affect responses due to heightened neural refractoriness in children. Moreover, myogenic noise can complicate data analysis; in such cases, multichannel recordings may help improve the signal-to-noise ratio. Ensuring that the child remains quiet, alert, and still during testing is crucial; however,

achieving these conditions can prolong the ACC assessment process. Nevertheless, ACC remains a potential alternative to traditional methods. Future research should explore the relationship between objective ACC measurements and behavioral psychophysical tests in children, focusing on narrow age groups and diverse clinical populations with large sample sizes. Additionally, age-related effects should be carefully considered when applying, analyzing, and interpreting ACC data across pediatric populations.

Keywords: acoustic change complex • auditory discrimination • hearing loss

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(ID-6979) Advanced considerations in pediatric hearing aid fitting: evidence-based perspectives

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Pediatric hearing aid fitting is essential for early intervention, shaping language, cognition, and long-term communication. Timely diagnosis and amplification support neuroplasticity and optimize speech perception. This presentation explores evidence-based strategies, individualized fitting approaches, family engagement, and emerging technologies. Special emphasis is placed on complex cases such as auditory neuropathy spectrum disorder (ANSD), tinnitus management, and conductive hearing loss, including bone-anchored solutions.

Key principles of pediatric hearing aid fitting early identification and intervention: Early diagnosis and amplification are essential for auditory development, ensuring access to sound during critical language acquisition periods. Pediatric-specific hearing aids: Devices must be durable, tamper-resistant, and adaptable to anatomical growth. Role of the pediatric audiologist: Precise fitting, real-ear verification, and continuous monitoring ensure optimal auditory outcomes. Consistency and follow-up: Regular adjustments and parental education are crucial to sustaining hearing aid use and preventing developmental delays. Family engagement is fundamental in maximizing hearing aid benefit. Caregivers reinforce daily use, facilitate auditory learning, and advocate for educational accommodations. Interactive tools and children's literature on hearing loss promote self-confidence and social inclusion. Advanced considerations in pediatric hearing aid fitting speech perception in noise: Advanced signal processing, directional microphones, and remote microphone systems enhance speech clarity. Cognitive and neurodevelopmental factors: Individualized programming is required due to variations in working memory, auditory processing, and attention. Asymmetrical and unilateral hearing loss: Effective binaural hearing strategies help maintain auditory symmetry and enhance spatial awareness in children with asymmetric hearing loss. Smart hearing technologies: AI-driven and self-adjusting hearing aids provide personalized amplification, though pediatric validation remains necessary. Management of complex hearing loss cases: *ANSD*: Careful assessment of amplification benefit is required, with cochlear implantation considered when conventional aids prove insufficient. *Tinnitus*: Though uncommon, integrated sound therapy in hearing aids may mitigate symptoms. *Conductive Hearing Loss*: Bone-conduction and bone-anchored hearing aids including softband solutions, bypass the conductive pathway and provide direct cochlear stimulation.

A child-centered approach integrating clinical expertise, technology, and family support optimizes pediatric hearing aid outcomes. Evidence-based strategies refine pediatric amplification, ensuring accessibility, adherence, and long-term success.

Keywords: paediatric hearing aid fitting • early diagnosis

(ID-6973) Auditory and cognitive skills from assessment to therapy

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Auditory and cognitive skills are required for people to make sense of their surroundings, communicate successfully, and actively participate in learning processes. Assessing these skills in children and adults with hearing loss, as well as implementing appropriate treatment strategies, are critical components of auditory rehabilitation. Auditory and cognitive abilities must be considered simultaneously during the rehabilitation process since auditory perception is closely linked to cognitive functions and is not just dependent on hearing. The auditory information delivered by hearing aids or cochlear implants is only significant when combined with cognitive skills. Cognitive talents are essential for identifying and interpreting speech because they help people analyze, interpret, and respond to auditory stimuli. The cognitive processes involved in auditory perception can be stated as follows: *Selective attention*: Allows people to focus on the speaker's voice by separating it from the background noise. *Auditory memory*: Uses contextual signals to help you recall words inside a sentence. *Working memory*: Helps link words and sentences together during speech. *Semantic memory and auditory closure*: Auditory closure, in example, enables people to fill in missing or misheard words depending on the overall meaning of a statement. *Executive functions* (e.g., problem solving and information organization): Assist in understanding essential ideas during conversations and developing suitable responses. Language acquisition also requires cognitive ability. The link between auditory and cognitive processes is bidirectional: precise and consistent auditory input promotes cognitive functions, while well-functioning cognitive abilities enhance auditory perception. As a result, approaches that combine auditory and cognitive talents not only improve overall communication but also assist people in better integrating into society, thereby enhancing their quality of life.

Keywords: auditory skills • cognitive skills • hearing loss • rehabilitation

(ID-6929) Auditory Brainstem Implant Course/ Hands on workshop

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Auditory Brainstem Implantation (ABI) is a crucial intervention for patients with profound hearing loss or total deafness due to the absence of the auditory nerve or cochlea. Preoperative audiological evaluation begins with obtaining a detailed case history, including the onset and progression of hearing loss, and extends to a series of diagnostic tests. These include frequency-specific pure-tone or behavioral audiometry in each ear, speech audiometry, and electrophysiological evaluations such as ABR. In addition to these, radiological imaging for evaluation anatomical structures is very crucial. All these ensures the identification of patients who will benefit most from ABI and helps to predict post-implantation outcomes, enhancing the quality of life and auditory rehabilitation process. The multidisciplinary approach involving otolaryngologists, audiologists, and speech therapists is critical in achieving the best possible results. During surgery, utilisation eABR for assisting proper electrode placement in lateral recess is very crucial. The electrode contact points are stimulated via intraoperative test module of the software, neural responses are collected via an ABR device, which are linked to each other. By testing different channel combinations, depending on obtaining eABR responses, the placement of the electrode can be changed. Very often, the stimulation parameters are modified to obtain clear eABR waves, and removing response from the artefacts. Post-op programming, that is; initial fitting of the device is usually done around 4 weeks after the surgery as long as there are no medical considerations. Monitorization of the vital functions with a medical doctor is important during the initial fitting as serious side effects can occur. After the inital fitting, the electrical comfort and threshold levels are increased gradually in each programming session based on the subjective responses of the user. During these sessions, aided free field thresholds are obtained, both with pure tones and speech sounds. These also guide the clinician in device programming. The frequency of follow up visits are usually high in the first year of implantation. Not only device programming follow up sessions, but also auditory rehabilitation sessions are very crucial for optimal outcomes.

Keywords: auditory brainstem implants • pre-operative tests • intra-operative tests • post-op device programming

(ID-6944) Auditory implants and cognitive development: beyond hearing restoration

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Cognitive development is a multidimensional process that is closely linked to the development of other skills; difficulty or delay in one skill can negatively impact overall cognitive development in children. One of the key areas strongly associated with cognitive deficits is hearing loss. The deterioration in auditory input experienced by children due to hearing loss can negatively affect the normal development of cognitive, psychomotor, and behavioral skills. It has been reported that auditory implants not only improve communication skills but also enhance cognitive functions. Children with good hearing performance through cochlear implants can compensate for their sensory deficits in phonological encoding of speech through working memory and other cognitive skills. Although the number of studies investigating attention, memory, and language skills together in children using auditory brainstem implants is very limited, existing research has similarly suggested that auditory brainstem implants enhance not only language but also memory and attention skills. On the other hand, early cochlear/ auditory brainstem implantation plays a crucial role in supporting cognitive development by leveraging neuroplasticity. During early childhood, the brain exhibits high plasticity, allowing it to reorganize and adapt to auditory input more effectively. By providing access to sound at critical period, auditory implants facilitate the development of auditory pathways, which in turn enhances language acquisition, memory, and overall cognitive functions. Beyond merely restoring hearing, auditory implants serve as a catalyst for cognitive growth, enhancing neural plasticity, language acquisition, and overall cognitive function, ultimately shaping a stronger foundation for lifelong learning and development.

Keywords: auditory implants • hearing • cognitive

(ID-6828) Auditory N1 and N2 to pure-tone and consonant-vowel stimuli in developmental dyslexia: revisiting the anchoring-deficit hypothesis

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Introduction: Developmental dyslexia (DD) is one of the most studied disorders in childhood. The anchoring-defict hypothesis is viewed as a specific type of impaired-attention as an explanation to dyslexia deficits. Here we used auditory event-related potentials (AERPs) to shed light on these issues since several authors reported the existence of language and learning impairments. AERPs reflect the activation of different neuronal populations and are suggested to contribute to the evaluation of auditory discrimination (N1), attention allocation and phonological categorization (N2).

Aim: This study aims to investigate and document AERP changes in a group of children with DD and discuss auditory N1 as an eletrophysiological biomarker to DD, supported by the anchoring-deficit hypothesis.

Material and methods: AERPs were recorded to pure-tones and consonant-vowel stimuli (CV) in an auditory oddball paradigm in 7 Portuguese children with DD and 11 gender- and age-matched controls.

Results: Results revealed perceptual deficits for pure-tone and CV stimuli (pre-attentional and auditory discrimination) in DD, related to N1 reduced amplitude ($p < .0.05$; *Fz*: 2.57 μV, *Cz*: 2.75 μV), compared to control group.

Conclusions: the findings in DD group support the anchor-deficit hypothesis for explanation of neurolinguistic deficits. Future studies are required to test if the anchoring-deficit is inherited and validate de auditory N1 as an eletrophysiological biomarker for DD. Aknowledgments: this work was funded by the Grant (FCT, 2022.05618.PTDC) supported by the Portuguese Foundation for Science and Technology (FCT).

Keywords: N1 • N2 • auditory processing • developmental dyslexia

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(ID-6879) Beyond hearing: challenges in speech discrimination and localization in children with CI and ABI

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Children with inner ear malformations typically receive cochlear implants (CIs); however, when CIs are insufficient, auditory brainstem implants (ABIs) may be provided, sometimes in the contralateral ear. Cochlear implant technology imitates the tonotopic organization of the cochlea to stimulate the auditory nerve directly. In contrast, ABI bypasses the cochlea entirely and delivers electrical stimulation directly to the cochlear nucleus in the brainstem. This fundamental difference in stimulation sites of these modalities leads to distinct speech discrimination and localization differences and challenges. This presentation discusses the mechanisms underlying speech discrimination and localization difficulties in children using CI and ABI. One of the primary challenges faced by CI and ABI users is the limited ability to process spectral and temporal cues necessary for speech perception. Cochlear implants have evolved significantly, enabling many users to achieve high levels of speech understanding, particularly in quiet environments. However, limitations in conveying fine temporal structure and pitch cues persist, impacting speech perception in complex auditory environments. Auditory brainstem implant users frequently encounter greater challenges because the cochlear nucleus lacks a well-defined tonotopic organization. As a result, open-set speech recognition remains a challenge for many ABI recipients, even after prolonged auditory rehabilitation. Sound localization is another critical skill where CI and ABI users experience difficulties. Localization relies on binaural cues, including interaural time differences and interaural level differences, both of which are processed by the brainstem. While CI users can utilize some binaural cues when receiving bilateral implantation, ABI recipients often struggle due to the diffuse nature of electrical stimulation within the cochlear nucleus. This results in reduced spatial hearing abilities. Despite the challenges mentioned, advancements in implant technology continue to progress toward improving auditory outcomes. However, to optimize speech discrimination and spatial perception abilities in the mentioned cases, personalized rehabilitation programs are essential. Further research is needed to improve ABI stimulation strategies and CI-ABI integration and develop new therapeutic interventions. By addressing these critical issues, this presentation aims to provide insights into the auditory challenges faced by pediatric CI and ABI users and discuss future directions for improving outcomes beyond basic hearing.

Keywords: cochlear implants • auditory brainstem implants • speech perception • auditory localization

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(ID-6885) Bridging the gap: a technological support for auditory training in children

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The auditory training process is essential for children with hearing loss to develop appropriate auditory skills, support language acquisition, and progress in parallel with their peers. Today, the use of technology and electronic devices is not limited to adults but has become widespread among children. This situation allows for the effective use of technological tools for educational purposes, which becomes a significant advantage. With the advancement of technology, various computer-based auditory training programs have been developed and made available for people with hearing loss. There is evidence in the international literature that computer/software-based educational tools support auditory perception and language skills in people with hearing loss. There was a lack in this area in our country. Therefore, we aimed to develop a web-based auditory training program for children as a Ph.D. thesis. This project was supported by TÜBİTAK (Scientific and Technological Research Council of Türkiye) with the project code number 123E427. The developed application was developed as a web-based application because it is easily accessible to all segments of society, practical, updatable, and independent of time and place. Our training program is designed for children aged 3–10 years and consists of 6 modules and 38 sub-sections/games. There are 3 different levels of difficulty in each section, and a pass criterion of 70% is set for the transition between the different levels. An option to work in the presence of background noise was added to some modules in the application. There are different stimuli in our application (animal sounds, environmental sounds, phonemes, monosyllabic words, multisyllabic words, sentences, and speech stimuli in the presence of background noise) and all vocalizations were produced by a female and a male voice artist. The web-based auditory training program developed within the framework of our study has the distinction of being the first comprehensive web-based auditory training program developed for children aged 3–10 years in our country, which allows remote monitoring.

Keywords: application • auditory training • auditory rehabilitation • hearing loss

(ID-6855) Bridging the gap: the critical role of spectral discrimination in pediatric CI and ABI fittings

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Auditory development progresses through four key stages: detection, discrimination, identification, and comprehension. While detection and identification/comprehension are routinely assessed in clinical practice using pure tone and speech audiometry, discrimination is often overlooked. However, neglecting this crucial step limits our ability to optimize hearing aid, cochlear implant (CI), and auditory brainstem implant (ABI) outcomes. This presentation emphasizes the critical role of spectral discrimination in bridging the gap between audiometry and speech audiometry. We will discuss the rationale for discrimination testing, its development, and its integration into clinical practice. Additionally, we will explore its applications in measuring the benefit of a hearing aid, in CI candidacy, and post-operative CI and ABI follow-ups. Using real case studies, we will illustrate how discrimination abilities impact speech understanding. Integrating spectral discrimination testing into our practice in HA, CI, and ABI applications allows us to optimize patient care, ensuring a more comprehensive auditory assessment and improved patient outcomes.

Keywords: spectral discrimination • cochlear implants • hearing aids • auditory brainstem implants

(ID-6938) Central auditory processing disorder: what we have learned and what comes next?

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Central Auditory Processing Disorder (CAPD) is characterized by difficulties in perceiving and interpreting auditory information. This disorder cannot be diagnosed using standard hearing tests, as it results from deficiencies in the auditory processing mechanisms of the central nervous system. Auditory discrimination, auditory pattern recognition, and temporal auditory processing are fundamental components of central auditory processing. The proper functioning of these components directly influences speech perception and language development. In several research studies in which I have participated, the temporal and suprathreshold auditory processing abilities of individuals from different pathological groups were evaluated, revealing significant differences in the diagnostic process. These findings emphasize the critical importance of assessing various auditory processing abilities across different pathological populations. However, for an accurate diagnosis of CAPD, test batteries must be adapted to the linguistic and cultural characteristics of the target population. In Türkiye, there is a need for reliable and scientifically validated tests for CAPD diagnosis. The limited availability of tests incorporating Turkish speech sounds, words, and sentences poses a significant challenge in the diagnostic process. As part of the Türkiye-Anatolia Central Auditory Processing Disorder Screening and Diagnostic Test Battery, developed by Prof. Fulya Yalçinkaya, a data collection process was initiated in February 2022, starting with young adults (18–25 years old), and is currently continuing with children (5–17 years old). I have been actively involved in this process, which is now approaching its final stages. Within the study, the screening tests applied include bilateral frequency tone pattern tests, auditory figure ground, dichotic sentence tests, dichotic word tests, and filtered word tests. For diagnostic purposes, dichotic frequency tone pattern tests, dichotic monosyllabic competing tests, and time-compressed sentence tests were administered. Upon completion of this research, the normative data obtained will contribute to the development of standardized tests for CAPD diagnosis in Türkiye. Consequently, early diagnosis of CAPD will be facilitated, and individualized therapy programs will be developed. The findings of this study will serve as a guideline for Turkish clinicians and researchers, providing a scientifically grounded approach to CAPD screening and diagnosis.

Keywords: central auditory processing disorder • auditory processing tests • Turkish diagnostic battery • normative data

(ID-6976) Clinical experiences in cases with additional disabilities

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Any physical, mental, emotional or behavioral impairment that makes the education of a child with hearing loss more complex is defined as an "additional disability". Hearing loss cases with additional disabilities face greater difficulties in audiological evaluation and auditory rehabilitation follow-up. This patient group should be followed with a multidisciplinary and interdisciplinary approach, in cooperation with relevant departments. Individuals with hearing loss and additional disabilities represent a diverse and complex group. They vary in terms of the type and degree of hearing loss, the type and degree of accompanying disabilities, and their general level of functioning. The Gallaudet Research Institute (GRI) has stated that approximately 41% of children with hearing loss have additional disabilities. The most common of these is intellectual disability, followed by learning disabilities and visual impairments. The percentage of additional disabilities seen in children with hearing loss is as follows: visual impairment 5.5%, intellectual disability 8.3%, autism 1.7%, physical disability 4.4%, specific learning disability 8%, attention deficit hyperactivity disorder 5.4%, emotional disability 1.8%, other 14.3%. It has been shown in many studies that patients with additional disabilities can obtain significant benefits from hearing technologies during their daily living activities and in educational environments. Audiologists need to provide counseling regarding the benefits of the use of amplification devices and the patient's expectation level. The goals of auditory rehabilitation may vary in individuals with additional disabilities of hearing loss. The degree to which functional residual hearing is maximized depends not only on the degree of hearing loss but also on the extent, degree, or impact of more than one disability that may be more predominant. As a result, auditory rehabilitation in these patients requires teamwork and more knowledge, experience, patience, effort and time. The support provided to these patients through

a holistic approach and appropriate rehabilitation programs is important in improving the quality of life of both the patient and their family.

Keywords: hearing loss • additional handicap • aural rehabilitation

(ID-6927) Clinical experiences: difficult cases and solutions

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Managing children with hearing loss presents unique challenges, particularly in complex cases where standard approaches may not yield the desired outcomes. These difficult cases often involve comorbid conditions, anatomical abnormalities, late diagnoses, or limited access to early intervention services. Drawing upon clinical experience and evidence-based practices is essential to developing tailored strategies for optimal outcomes. One common challenge is managing children with auditory neuropathy spectrum disorder (ANSD). Traditional amplification may not always be effective, and the variability in auditory nerve function complicates intervention planning. Cochlear implantation can be a viable solution, but careful patient selection, detailed electrophysiological assessments, and longitudinal monitoring are necessary to assess auditory development and speech perception. Another complex scenario involves children with additional disabilities, such as autism spectrum disorder or cerebral palsy, where hearing loss intersects with broader developmental needs. Multidisciplinary collaboration is critical, integrating audiologists, physiotherapists, occupational therapists, and educators to create holistic, individualized intervention plans. Children with cochlear malformations or ossified cochlea present surgical and rehabilitation challenges. In such cases, advanced imaging techniques guide surgical decision-making, while tailored programming and auditory-verbal therapy enhance outcomes. For those with partial electrode insertions or compromised cochlear anatomy, electro-acoustic stimulation or hybrid devices may provide a functional auditory range. Additionally, late identified children often exhibit significant language delays, necessitating intensive therapy and parental guidance to facilitate language acquisition. Ultimately, successful management of difficult pediatric hearing loss cases relies on clinical expertise, continuous adaptation, and close family involvement. By leveraging interdisciplinary collaboration and emerging technologies, audiologists can navigate complexities and empower children to achieve their full communicative potential, reinforcing the importance of early and individualized interventions in auditory rehabilitation.

Keywords: hearing loss • additional disabilities • auditory neuropathy • inner ear malformations

(ID-6953) Cognitive and communication outcomes in adult cochlear implant users: insights from prelingually and postlingually deafened populations

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Introduction: Assessing speech recognition outcomes in pediatric cochlear implant (CI) users has long been a focus of clinical and research efforts. However, the clinical population of CI users increasingly consists of both early-implanted, prelingually deafened children who reach adulthood and postlingually deafened adults implanted later in life. Current speech recognition assessments may fail to capture the complexities of real-world communication challenges in these adult groups. Particularly, high-variability speech (e.g., multiple talkers, accents, dialects) presents substantial challenges, requiring a broader approach to evaluating communication outcomes in these populations.

Aim: This tutorial session will discuss the need for more ecologically valid measures to assess long-term outcomes in both prelingually and postlingually deafened adult CI users. We will provide an overview of our studies on high-variability speech recognition, indexical processing (e.g., talker and accent identification), and the role of cognitive factors in shaping communication outcomes and variability in these populations.

Material and methods: First, we will highlight the limitations of traditional speech recognition assessments in capturing real-world communication challenges. Then, we will discuss findings from studies comparing early-implanted adult CI users, postlingually deafened adult CI users, and normal-hearing peers on high-variability speech recognition tasks. We will examine how cognitive factors – such as working memory, executive function, and phonological processing – contribute to performance.

Results: Adult CI users, both early-implanted and postlingually deafened, face distinct challenges dealing with high-variability speech compared to normal-hearing peers. However, our findings reveal key differences between prelingually and postlingually deafened CI groups, particularly in adapting to talker and linguistic variability. Standard clinical tests may overestimate real-world speech recognition abilities, since they do not account for talker adaptation, indexical processing, linguistic variability, or cognitive effort. Finally, individual differences in cognitive skills are associated with variability in speech perception outcomes, emphasizing the need for a comprehensive approach to better understand outcomes and address patient needs.

Conclusions: Speech recognition assessments must go beyond conventional clinical measures to optimize long-term outcomes both for pediatric CI users transitioning into adulthood, and postlingually deafened adults. Incorporating high-variability speech tests and cognitive-linguistic assessments will provide a more accurate representation of real-world communication abilities and inform targeted interventions for adult CI users.

Keywords: cochlear implants • children • adults • real world communication

(ID-6969) Enhancing language development: the role of cognitive skills in auditory implants

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The intersection of cognitive skills and auditory implants marks a dynamic field in enhancing language development for children with hearing impairments. Language acquisition involves more than receiving auditory input; it is closely linked to cognitive skills like memory, attention, and executive functions. These skills are essential for understanding and processing language, and their development is crucial for children using auditory implants, who often face challenges in language learning due to hearing loss. Auditory implants have emerged as key tools in overcoming the challenges of hearing impairments by providing access to sound, thus facilitating language development. Their effectiveness is significantly increased when accompanied by robust cognitive skills. Research indicates that children with auditory implants who develop these skills concurrently experience accelerated language acquisition and improved linguistic performance. Cognitive skills such as working memory and attention play critical roles in retaining phonological information and focusing on relevant auditory cues in noisy environments, contributing to more effective language learning. During critical developmental periods, the brain's plasticity is at its peak, allowing for more effective integration of auditory input with cognitive processes, thus promoting the development of strong language skills. Beyond restoring hearing, auditory implants also enhance cognitive functions foundational to language development, academic success, and social interactions. Innovative approaches combining auditory implant technology with targeted cognitive interventions hold promise for even greater strides in language development. In conclusion, while auditory implants provide necessary auditory input for language learning, the simultaneous development of cognitive skills is essential. This dual focus significantly enhances language development, providing children with a strong foundation for lifelong learning and effective communication.

Keywords: language development • auditory implants • cognitive skills

(ID-6919) Hearing in noise and current approaches

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Hearing in noisy environments remains one of the most significant challenges for individuals with hearing loss and is a primary complaint among hearing aid users. Traditional pure tone audiometry, while essential for diagnosing hearing loss, does not provide insight into a person's ability to understand speech in noise. Since background noise severely impacts speech perception, accurate speech-in-noise assessments are crucial for tailoring hearing aids and improving communication in real-world settings. Several speech-in-noise tests have been developed to address this issue. However, despite their clinical availability, these tests are not widely used across clinics worldwide due to factors such as test duration, language dependency, and the need for specialized equipment. Recent advancements emphasize the importance of ecological validity, meaning that test conditions should closely mimic real-life listening environments. The Ecologically Valid Hearing in Noise Test was introduced as an improved version of Hearing in Noise Test, incorporating alternative noise signals and a more effective speaker setup to enhance realism. In this test, multiple speakers are strategically positioned around the listener to better replicate everyday listening conditions. While Eco-HINT improves accuracy in assessing hearing difficulties in noise, its implementation requires specialized test environments and equipment, making widespread adoption a challenge. Another recent approach is the Audible Contrast Threshold test, which provides an alternative to traditional speech-in-noise evaluations. Audible Contrast Threshold utilizes spectrotemporally modulated noise signals to determine how much "contrast" a person requires to differentiate sounds in noisy environments. By presenting noise samples through headphones and analyzing patient responses, Audible Contrast Threshold objectively measures the level of hearing aid support needed in complex listening situations. Unlike conventional tests, Audible Contrast Threshold does not rely on speech materials, making it more adaptable across different languages and clinical settings. These current approaches offer promising improvements in hearing in noise. As audiology continues to evolve, these new methodologies will play a crucial role in providing personalized hearing solutions and improving the overall quality of life for individuals with hearing impairments.

Keywords: hearing in noise • audible contrast threshold • ecologically valid • current

(ID-6939) Hearing in Noise Test (HINT): from normalization to clinical practice

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Speech perception in noise is a complex process influenced by both auditory and cognitive factors. Younger children often experience greater difficulty in noisy environments due to their developing cognitive and auditory skills. To ensure accurate assessment, age-specific norms were established for both the adult version of the Turkish Hearing in Noise Test (HINT) and the Turkish Hearing in Noise Test for Children (HINT-C). These norms enable clinicians to reliably interpret test results and consider developmental factors in speech-in-noise evaluations. After normalization, HINT began to be used in clinical settings to assess speech perception abilities in children with hearing aids and cochlear implants. In our studies, we found that children using hearing aids typically require a higher signal-to-noise ratio (SNR) than their normal-hearing peers to achieve similar speech perception performance. Additionally, in children with cochlear implants, we observed that chronological age had a greater impact on speech recognition performance than age at implantation or inter-implant interval. Despite its clinical relevance, standard HINT testing

requires an audiometric test room, limiting accessibility in certain settings. In our ongoing study with normal-hearing adults, we aim to establish reliable norms without the need for a controlled testing environment. Future directions include expanding normative data for older adults and diverse hearing profiles, integrating HINT into routine assessments, and promoting clinician training for widespread implementation. These advancements will enhance the test's applicability and improve speech-in-noise evaluations across various settings.

Keywords: speech perception in noise • HINT • HINT-C

(ID-6881) Hearing rehabilitation in children at the Ferrara University Hospital

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Fitting hearing devices to infants requires special consideration at each stage of the process. Congenital hearing loss (HL) has implications for the hearing development of children, as well as their language, academic and social development. Hearing rehabilitation, with hearing aids (HAs) and Cochlear Implants (CIs), provide the basis for improving audibility and minimizing developmental delays in children with mild to profound hearing loss. In the assessment stage, electrophysiological hearing threshold estimates, especially in case of infants, must be set appropriately so that an accurate fitting can occur. In case of toddlers and preschoolers, behavioural testing can provide further threshold assessment. Indubitably, the verification that the electroacoustic performance of the hearing device meets the auditory features of the infant or toddler is a vital part of the process. Also, the evaluation of the effectiveness of the device completes the hearing device fitting process for infants with hearing loss. Aim of this presentation is to describe all the features of this process at the paediatric audiology of the University Hospital of Ferrara.

Keywords: hearing loss • rehabilitation • children

(ID-6984) Hearing screening

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Hearing screening is the systematic application of a test or assessment under certain protocols to identify individuals with hearing impairment/disability in order to direct them for further assessment. This can be applied to all groups from newborns to geriatrics and performed using subjective and objective methods for the purpose of early diagnosis of hearing loss under certain programs. The screening programs have many components to ensure a successful screening, subsequent evaluation and follow-up. The population to be screened, the tests to be used, the protocol to be followed and the planning for the subsequent procedures are the primary among them. One of the most important of these components is the presence and support of the families. For example, the success or failure of the child's treatment may depend upon the parents' approach. This means, satisfied parents will cooperate well with healthcare providers, correctly follow the treatment plans, and be more likely to take the children for follow-up visits. Regardless of the age group, presence and participation of families in hearing screening programs is essential. When evaluating the success of a service, it is very important to consider the opinions of the service users. Since parents and/or other relatives of the patients are also service users, they should be included in all screening, diagnosis, and intervention activities. This highlights the importance of assessing the satisfaction level of parents and/or other relatives of the patients for the success of the hearing screening programs. Satisfaction measurements encourage good cooperation with the families. Reporting satisfaction with hearing screening programs is important to fulfill service providers' responsibility for public accountability, beyond better understanding users' expectations of the services to improve quality of care. However, it is seen that in many programs the satisfaction is unmeasured and/or unreported in different processes of the program. On the other hand, the cut-off criteria (critical values) for satisfaction level also are undetermined. As a conclusion, the users of the services should be included in all screening, diagnosis, and intervention activities processed by the service providers. Protocols must cover activities to support families and users' satisfaction measurements.

Keywords: hearing screening • families • satisfaction

(ID-6908) Hearing screening developments worldwide: are we making progress?

Theresa Byrne

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Introduction ◆ Cost-effective detection of hearing disorders (new technology and devices) ◆ Newborn and later screens for hearing loss ◆ Audiology service user/ consumer views & quality audits ◆ Collaborative research opportunities – across borders and professions. The author will briefly summarise any progress highlights she has seen over her long career in audiology and participate in the panel discussion.

Keywords: hearing screening progress

(ID-7081) Medical research and pediatric audiology

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This presentation will include: 1) information about clinical trials of vaccine development for cCMV (cytomegalia virus), 2) screening for the cCMV after birth and challenges, and 3) treatments for hearing disability and additional disabilities after birth that are pharmaceutical, technological and therapeutic interventions. Prevalence of cCMV as a cause of hearing loss in children will be presented. Information about current gene therapy clinical trials for auditory neuropathy spectrum disorder as a result of the Otoferlin gene, prevalence of the otoferlin gene among children with hearing disorder and auditory neuropathy spectrum disorder will

be provided. Research on long QT, gene therapy clinical trials and FDA approved gene therapy for retinitis pigmentosa, gene therapy research and Alzheimer's disease and research with mice for presbycusis and its relationship to pediatric audiology will be presented. The ethical issues that have been raised about gene therapy are complex and will be discussed.

Learning objectives:
- participants will be able to describe the clinical trials that are now being conducted for a vaccine for cCMV;
- participants will be able to describe ethical issues of vaccine development and use;
- participants will be able to describe gene therapy clinical trials for Otoferlin, research on long QT, retinitis pigmentosa, Alzheimers and presbycusis and the relationship to pediatric audiology;
- participants will be able to describe the ethical issues that have arisen about gene therapy and hearing disorders.

(ID-6967) Multidisciplinary approaches for children with hearing loss and multiple disabilities: a comprehensive perspective

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Optimal auditory experiences are essential for normal neurodevelopmental processes in infants and children. The ability to develop age-appropriate cognitive and linguistic skills is highly dependent on adequate and consistent exposure to auditory stimuli. If infants are unable to discriminate phonetic contrasts during the first year of life – due to hearing loss, environmental noise, attention deficits, dyslexia, intellectual disabilities, or other neurological conditions –their language acquisition, developmental trajectories, and academic achievements are significantly compromised. Hearing is a complex process involving both audibility (the ability to detect sounds via the peripheral auditory system) and intelligibility (the capacity to discriminate phonemes and assign meaning to auditory input through central auditory processing). The brainstem and auditory cortex are composed of intricate neural networks that facilitate spoken and written language acquisition. Any degree of hearing loss exceeding 15 dB can disrupt speech perception and learning (Martin, 1990). Additionally, individuals with hearing loss may detect speech sounds but struggle with comprehension, particularly in challenging listening environments. Beyond auditory impairment, the presence of co-occurring disabilities – such as autism spectrum disorder (ASD), attention-deficit/ hyperactivity disorder (ADHD), intellectual disabilities, cerebral palsy, genetic syndromes, and dyslexia – further complicates speech and language development. External factors, including delayed diagnosis, lack of amplification, insufficient rehabilitation, and poor interdisciplinary collaboration, can exacerbate these developmental challenges. This review emphasizes the necessity of early diagnosis and structured, multidisciplinary intervention strategies to optimize developmental outcomes for children with multiple disabilities. While advancements in auditory technology (e.g., hearing aids, cochlear implants) provide access to sound, they do not automatically lead to improved speech perception or language acquisition. Children's auditory neural plasticity, cognitive prediction skills, and social experiences differ significantly from those of adults, necessitating individualized and comprehensive intervention plans. A successful rehabilitative framework must incorporate: 1. A multidisciplinary team, including audiologists, speech-language pathologists, special educators, occupational therapists, music therapists, physiotherapists, and aquatic therapy specialists. Interventions should integrate auditory, cognitive, and neurolinguistic strategies. 2. Family-centered approaches, ensuring active parental involvement and home-based reinforcement of therapeutic goals. Intensive and regular rehabilitation enhances peer integration, developmental progress, social adaptation, and overall well-being. This paper discusses the latest evidence-based approaches for the management of children with hearing loss and coexisting disabilities, highlighting the role of interdisciplinary collaboration in optimizing outcomes.

Keywords: hearing loss • multiple disabilities • auditory processing • multidisciplinary intervention • language development • speech perception • pediatric rehabilitation

(ID-6930) Perception of Indexical Cues in Children and Adults (PICKA) and hearing devices

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Voice is a significant component of speech communication. The human voice can convey talker-specific information through indexical cues, such as speaker identity (e.g., age, sex) and emotional state (is the talker happy or angry?). Voice can also directly contribute to speech understanding, for example through speech segregation in cocktail-party listening. These are situations where listeners with hearing loss have most difficulties. Yet, no clinical test exists for voice and emotion perception, and hearing devices are not yet fitted for these purposes. The PICKA project was set up to unravel the role of voice perception for speech comprehension and identify the difficulties that children and adults with hearing devices (hearing aids, cochlear implants) experience in voice and speech perception. In addition, this project aimed at developing diagnostic tools that can be widely used in clinical settings and in various languages and countries. The PICKA project uses a test battery consisting of four tests, presented through a child-friendly serious game-like interface, each targeting a different aspect of voice or speech perception. The Fishy test measures voice cue sensitivity using an adaptive procedure. The Voice Gender test assesses how voice cues are used and weighed in a voice gender categorization task. The Child-friendly Coordinate Response Measure (CCRM) assesses how voice cues are used to discriminate between competing talkers in a speech perception task with single-talker speech maskers. The EmoHI test measures vocal emotion recognition of three basic emotions (happiness, sadness, anger) in non-language specific pseudospeech. This tutorial session will provide an overview of the PICKA project in three parts. Part one will focus on the background of the PICKA project and will provide an overview of the test populations. Part two will focus on efforts for making the project internationally applicable,

using Turkish as an example, by presenting the selection and preparation of the Turkish stimulus material and the design of the Turkish PICKA version. Part three will focus on statistical methods that can be used to characterize childhood developmental trajectories with and without hearing loss, and to investigate interactions with hearing status at the individual level and at a group level.

Keywords: voice • emotion • children • development • hearing loss • hearing aid • cochlear implant

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(ID-6957) Psychosocial effects of neurodevelopmental processes and neuromaturation: supporting the child and family in rehabilitation

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Neuromaturation is the development of the nervous system, essential for cognitive, emotional, and social growth. This process is influenced by genetic factors, environmental stimuli, and early sensory experiences. For children with hearing impairments, auditory rehabilitation plays a vital role in shaping their linguistic, cognitive, and emotional development. A key psychological need during neuromaturation is secure attachment, which is formed through consistent and responsive caregiving. Children with hearing impairments may struggle with attachment due to communication barriers, making early intervention programs crucial for emotional well-being. Other psychological needs include emotional regulation, autonomy, social interaction, exploration, and the establishment of boundaries. A nurturing environment fosters neurological and psychological well-being, supporting healthy development. Auditory rehabilitation enhances brain plasticity, emotional regulation, and sensory integration while strengthening attachment and improving social skills. It includes interventions like hearing aids, cochlear implants, and auditory-verbal therapy. Parental involvement is critical in ensuring successful outcomes, as research highlights its impact on children's linguistic and cognitive abilities. Family dynamics significantly influence neuromaturation. Secure attachment, emotional support, effective communication, stress management, and environmental stimulation all contribute to development. Parents of children with hearing impairments may experience emotional stress and uncertainty, making psychological counseling and parental training essential for strengthening the parent-child bond. In conclusion, neuromaturation in children, especially those with hearing impairments, depends on secure attachment, auditory rehabilitation, and supportive family dynamics. Early intervention, parental engagement, and a nurturing environment are key to optimizing their cognitive, emotional, and linguistic growth. Future research should focus on enhancing auditory rehabilitation strategies to improve overall well-being in these children.

Keywords: neuromaturation • child and adolescent • psychiatry • parenting • rehabilitation

(ID-6985) Selected topics in pediatric audiology: section 3

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Assessment, diagnosis and management of hearing loss in infants and children are main interests for audiologists. The pediatric population, which is a large population from newborn to adolescent, can experience many different hearing-related problems. Audiologists access pediatric cases at many different locations and provide a wide range of services. Hearing screening, diagnosis, treatment and therapies are primary topics of pediatric audiology. Beyond these, there are many other topics related to pediatric audiology, with many subheadings. For example, in patients with unilateral hearing loss, diagnostic procedure and intervention options vary significantly. Moreover, different clinical approaches can also be observed across childhood. Another subject, audiological evaluation in children with multiple disabilities, ensuring that they receive the appropriate care and support. The last example, education varieties regarding audiology and speech language therapy which brings differences in professional practice of audiologists on a global scale. By exploring all these topics, this session provides insights into best practice in pediatric audiology. The approaches to pediatric populations in different countries are also discussed.

Keywords: pediatric audiology • auditory rehabilitation • multidisciplinary approaches

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(ID-6926) Speech perception in noise of pediatric cochlear implant users: performance and influencing factors

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Hearing loss negatively affects speech intelligibility and leads to impaired speech understanding. Studies have shown significant differences in speech understanding between individuals with mild hearing loss and those with profound hearing loss. Implementing universal newborn hearing screening has significantly improved the early diagnosis of hearing impaired children. Advances in newborn hearing screening and hearing technologies have enabled children to use hearing aids or cochlear implants (CI) at an early age. Despite early intervention, children with hearing loss still face significant challenges, particularly in noisy environments such as schools. High noise levels and reverberation can negatively affect speech perception, reading abilities, auditory attention and academic skills. Considering these challenges, educational environments present further barriers for children with hearing loss. Moreover, children with hearing loss require a higher signal to noise ratio (SNR) than their normal hearing (NH) peers to achieve comparable speech perception performance. Studies have shown that children with cochlear implants have significantly poorer performance compared to NH children.

Additionally, children with CI are unable to benefit from voice pitch differences between target and masker speech. This further complicates their ability to understand spoken language in noisy environments. Advances in hearing technology, assessing speech perception in noise remains challenging, especially for young children. However, standardized speech in noise tests specifically designed for young children are limited. We have developed a new computer-based speech recognition test specifically designed to assess the performance of preschool aged children in noise. Speech recognition score variability in cochlear implant users is influenced by multiple factors, including age, duration of deafness, etiology, and linguistic and cognitive abilities. Additionally, studies have reported that working memory, attention, and speech perception in noise are intricately linked. Speech in noise tests should be used to evaluate this variability and to determine the efficacy of the assistive technology utilized. These tests offer a more accurate representation of realworld listening conditions and provide a more comprehensive assessment of functional communication skills.

Keywords: cochlear implant • pediatric audiology • speech in noise

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(ID-6870) Technological developments in auditory training and rehabilitation

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Hearing loss is a significant health issue that directly impacts individuals' language, communication, and cognitive development. Contemporary advancements in auditory rehabilitation and training are essential for enhancing the quality of life for individuals with hearing loss. This presentation will examine auditory training programs designed for individuals with hearing loss and the impact of digital technologies on the auditory rehabilitation process. Auditory rehabilitation encompasses sensory management, knowledge and skill (instruction), counseling, and auditory training. Innovative methods, including tele-audiology, artificial intelligence-driven auditory analyses, and mobile applications, serve as alternatives to conventional rehabilitation techniques and yield substantial improvements in the rehabilitation of individuals with hearing loss. In particular, applications that facilitate the understanding of speech in noisy environments and support communication using technology for individuals with hearing loss are noteworthy. In recent years, digital technologies, mobile applications, and personalized training programs have offered significant solutions to enhance the quality of life for individuals with hearing loss by improving their speech perception and communication abilities. Computer- or application-based auditory training programs, digital filtering systems that enhance speech signals, and applications integrated with hearing aids facilitate more effective communication for individuals in daily life. In auditory training for individuals with hearing impairment, alongside conventional methods, computer-based and mobile application-based programs gain prominence. Systems such as the Duyu-Yorum Computer-Based Auditory Training Program contribute to the development of cognitive and auditory perception by improving the auditory processing skills of individuals with hearing loss. This presentation will examine various auditory training methods for hearing loss in children and adults, along with current research in speech recognition, environmental sound awareness, music-based auditory training, and phonological awareness studies. The presentation will address the sustainability and efficacy of contemporary auditory rehabilitation and training programs, as well as potential innovative approaches for individuals with hearing loss. The potential of technological advancements in enhancing auditory skills will be assessed, and necessary studies in this area will be highlighted.

Keywords: auditory rehabilitation • assistive technology • auditory training, tele-audiology

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(ID-6974) Tele-audiological assessment: perspectives in the literature

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Telemedicine is defined as "the delivery of healthcare services and information via high-tech telecommunications technologies". The American Academy of Audiology (AAA) and American Speech-Language-Hearing Association (ASHA) have propagated and supported the use of telehealth services through position statement. These services are especially applicable for those patients with limited access to healthcare resources, cost-efficient and can be applied directly to patient care as well as indirectly for training health professionals. Telemedicine has been adapted to the field of audiology, known as tele-audiology, to provide remote hearing screenings, diagnostic testing, intervention, and/or rehabilitation services (e.g., hearing aid adjustment, cochlear implant programming). We can explain the tele-audiology evaluations under the following items: 1. *Home-based otoscopy*: Recently, artificial intelligence algorithms have been developed to improve the sensitivity and specificity of home based otoscopy using the smartphone-based machine learning algorithm; 2. *Hearing screening*: The researchers have examined the reliability of tablet-based, computer-based, and smartphone-based audiometry, but results have been mixed. These researchers found that, with proper planning, equipment, and financial resources, synchronous applications could be used to effectively evaluate infant hearing over long distaces; 3. *Diagnostic audiometry*: Online testing and machine learning will improve the both efficiency of tele-audiometry and its diagnostic power. However, thresholds are best-obtained when real-time noise monitoring is incorporated, especially in ambient noise; 4. *Diagnostic ABR*: In the literature it was found that there were no significant difference between in-person and remote tests results. In addition, it was stated that remote testing option can significantly reduce loss to follow-up rates in infants who fail their newborn hearing screenings. Future advancements in artificial intelligence, will continue to increase tele-audiology acceptance and application.

Keywords: tele-audiology • tele-medicine, assessment

(ID-6934) The Effect of music therapy on auditory and cognitive skills

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Temporal ordering is closely related with the importance of music. Considering the role of music in auditory skills, it is known that music also has a role in therapy. Despite the technical limitations of the cochlear implant with auditory therapy, an increase in the performance of individuals with cochlear implants in listening and music activities under challenging conditions was observed. One of the auditory therapy methods is musical therapy. In the literature, musical therapy is referred to the methods of stimulation of auditory processing in case of pathology. In general, various software and homework assignments are used for music therapy in the literature. Studies shows improvement in the musical skills of postlingual cochlear implant (CI) users after music therapy. Therapy programmes include exercises of discrimination and ordering of pitch and duration of tones, perception of rhythm and meter, recognition of melodic contour and timbre, training of temporal resolution, understanding of music lyrics with and without visual support, and use of a musical keyboard to play familiar children's songs. With the increase in the ageing population, the rate of cognitive deterioration is increasing and strategies to protect against this deterioration are becoming increasingly important. It is known that music, which we frequently encounter in every field, has cognitive benefits in addition to its auditory skills. Music playing influences brain and cognitive function, activating multiple brain areas and using cognitive and motor functions as well as multiple sensory systems, simultaneously. According to the cognitive reserve hypothesis, lifelong engagement with music may be a method of neurocognitive protection. Studies have shown that people who are engaged in music have better clinical outcomes than non-musicians and are able to maintain their cognitive functions even in the face of neurodegenerative burden. With this protection, the effects of neural degeneration on cognition during the aging process are slowed down and quality of life is improved. These findings prove that musical therapy is a good strategy to improve cognitive functioning. Also background music improves working memory and speeds up performance in skill tasks, however the role of personality type in influencing background music on cognitive and skill performance needs further investigation.

Keywords: music therapy • cognitive skills

(ID-6847) The use of Simplified Italian Matrix Sentence Test (SIIMax)

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Introduction: The Matrix Sentence Test is an adaptive speech audiometry test available in multiple languages. Its widespread use can be attributed to its valuable role in audiological evaluations, particularly for assessing hearing aids and cochlear implants.

Aim: The aim of this study is to report the experience of using the Simplified Italian Matrix Sentence Test (SIIMax) in the clinical routine of a tertiary pediatric audiological university hospital.

Material and methods: A total of 60 normal-hearing (NH) children (32 females, 28 males) and 78 hearing-impaired (HI) subjects (42 females, 36 males), aged 5–10 years, were consecutively evaluated using pure-tone audiometry and speech audiometry with SIIMax. Hearing aid (HA) benefits were assessed using free-field pure-tone and speech audiometry, as well as SIIMax with an SRT 50% measured at 65 dB HL (speech) and an initial signal-to-noise ratio (SNR) of +10 dB HL, both with and without HA.

Results: Participants with bilateral symmetric sensorineural hearing loss (HL) of varying degrees showed significantly improved SIIMAx scores when using HA. The improvement was related to the HA benefit measured by pure-tone audiometry (PTA) and changed by age. An average SRT 50 improvement of 2 dB HL was checked and analyzed across different age group. As expected, SIIMax accurately differentiated between NH and HI groups.

Conclusions: SIIMax proved to be a practical and time-efficient tool for use in pediatric populations. In particular, an adaptive SRT 50 was found to be a sensitive parameter for evaluating the effectiveness of HA in children.

Keywords: adaptive speech tests • children

(ID-6959) Tinnitus in children

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Tinnitus is defined as a sound perceived in children in the absence of an external sound source and is usually described as a ringing, humming or rustling sound. Although the exact

prevalence of pediatric tinnitus is unknown, studies show that it is present in children at a significant rate. Causes of tinnitus include hearing loss, exposure to loud noise, use of ototoxic medications, head or neck trauma, middle ear disease and psychosocial stressors. In some of the cases, no obvious cause can be found. The assessment of pediatric tinnitus is more complex than in adults because children have difficulty expressing their subjective experience. The diagnostic process should include taking a detailed history and asking about associated symptoms (dizziness, hearing loss, etc.). While ear structures are assessed by physical examination, tests such as pure tone audiometry, tympanometry and otoacoustic emissions should be used to determine the hearing function. Special tests, such as tinnitograms, can help determine the frequency and intensity of the sounds which the child is hearing. The treatment of tinnitus in children is largely based on conservative approaches. Counselling and information is one of the most important elements of treatment, and one study reported that 83.3% of pediatric patients subjectively benefitted from counselling. Hearing aids may be recommended in cases where there is associated hearing loss, but some studies show that the effect of these devices on tinnitus is limited. Methods such as tinnitus retraining therapy (TRT) and noise generators have been reported to be beneficial in some children. Cognitive behavioral therapy (CBT) may be particularly effective in reducing anxiety and stress associated with tinnitus. In conclusion, conservative approaches such as education and counselling should be preferred in the management of pediatric tinnitus.

Keywords: pediatric tinnitus symptoms • assessment • diagnosis • treatment

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(ID-6827) Validation of fitting in hearing devices: cochlear implant in inner ear malformation

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Introduction: Pediatric sensorineural hearing loss caused by IEM (inner ear malformation) accounts for approximately 20–40% of all cases of deafness. Cochlear implantation is the treatment of choice for most IEM. However, the resulting outcomes can vary significantly and are influenced by factors such as the type of cochleovestibular malformation, residual neural function, surgical approach, fitting management and the presence of syndromic or associated pathology.

Aim: to evaluate cochlear implant mapping parameters in cases of IEM and to assess audiological outcomes.

Material and methods: The study included a sample of 26 subjects with bilateral IEM. 85% of the sample underwent cochlear implantation. The age of implantation ranged from 12 months to 8 years. 27% of the subjects had neural hypolasia according to the Birman classification. 15% of the subjects were not candidates for CI due to cochlear aplasia or labyrinthine aplasia, and one case of IP-III who achieved a linguistic gain with the hearing aid. Management of these patients, during the fitting, included the finding of higher and variable impedance values, of ECAP often not detectable and of fold-over tips. Difficulties also were noted in case of incomplete insertion, facial nerve stimulation, the need for lower threshold levels (T-levels) and higher comfort levels (C-levels). Auditory perceptual skills were evaluated using the Infant Listening Skills Assessment (ILIP), Categories of Auditory Performance (CAP) and Speech Intelligibility Rating (SIR).

Results: All children who underwent CI became consistent device users. The most common malformation observed was EVA, while IP-I the least common malformation. In 11%, gusher complications were observed during surgery. Depending on the IEM, an increase was needed for PW, THR and MCL. The most frequent complication was facial nerve stimulation, observed in 50% of cases, along with the need to adjust loudness. 27% of the children had ILIP score <11 and CAP score <5, while the remaining 63% achieved CAP scores of 5–7 and ILIP scores of 12–16. The presence of a larger representation or better distribution of neural tissue correlate with better perceptual and linguistic outcomes. Malformation such as IP-II, with or without EVA, allow for significant perceptual and linguistic improvements.

Conclusions: Cochlear implantation in children with IEM, despite greater challenges and surgical risks, present significant difficulties during the fitting process, such as determining optimal stimulation levels. However, this does not preclude successful implantation or favorable results. In properly selected cases, cochlear implantation can be performed safely and effectively in children with IEM.

Keywords: validation • IEM

(ID-6884) Validation of hearing device fittings in pediatrics: the role of speech-language pathologists

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Introduction: Validating hearing device fittings in pediatric populations is a complex process, especially during early development when optimal device performance is crucial for communication and language acquisition. Hearing devices, such as hearing aids, cochlear implants, or other assistive technologies, require both technical expertise and a deep understanding of children's developmental needs. Speech-language pathologists (SLPs) are essential in ensuring these devices meet the needs of pediatric patients. They play a key role in assessing the functional outcomes of fittings, focusing on speech perception, communication, and language development.

Aim: This presentation outlines the clinical evaluation protocols at the Audiovestibology Unit in Varese, emphasizing the role of the SLP within the audiological team, and critically reviews the existing literature.

Material and methods: A search strategy using MeSH terms was applied to Medline (PubMed) and Web of Science. A systematic review was conducted following the PRISMA 2020 guidelines by two independent reviewers. The review included studies examining the measures used by SLPs to assess the

effectiveness of hearing device fittings in children with hearing loss, with no restrictions on publication year.

Results: The search identified 263 articles, with 11 studies meeting the inclusion criteria. These studies focused on children with sensorineural and conductive hearing loss (bilateral or unilateral) treated with cochlear implants or hearing aids. One study specifically examined children with autism spectrum disorder (ASD). The most frequently assessed domain was auditory skills, evaluated mainly through parental reports using instruments to assess auditory perception and listening in daily activities. Other areas investigated included receptive and expressive language, preverbal communication, intelligibility, speech production, quality of life, fatigue, academic achievement, and neuropsychological abilities.

Conclusions: SLPs are essential in validating hearing device fittings for pediatric populations, ensuring that the devices meet developmental needs. Parental reports play a key role in assessing functional auditory skills, highlighting the significance of family involvement in the process. Within the framework of a connectome model, a comprehensive assessment of other developmental areas, such as language acquisition, speech production, and communication, provides indirect insights into the functional benefits of the fitting, especially in young children.

Keywords: hearing device fitting • speech-language pathologist • pediatrics, outcomes

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(ID-6907) Variability in undergraduate European speech language therapy education with respect to audiology

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Introduction: Whilst European Universities usually follow longstanding 'Bologna Processes' for ECTs in undergraduate courses, ever-changing technologies, politics and staff mobility pressures may create barriers to interdisciplinary collaboration at community service levels – especially if chronic staff shortages exist. Cochlear Implantation teams (MDTs) tend to function and research excellently but don't serve general community clinical populations.

Material and methods: The author reviewed recommended EU standards/ ECTs since 2000, recording audiology content (hours and practical elements) for some European Speech and Language Therapy programmes, and comparing briefly to other jurisdictions like USA and South Africa.

Results: Some key findings will be presented on current course contents, noting the potential impact, for example, upon Auditory Processing assessment availability at Primary and Secondary Care levels in some countries.

Conclusions: Audiologists and Speech and Language Therapists need to work together for optimal efficiency and effectiveness, even if children with Speech or Language disorders have passed Hearing Screens. Educational elements and knowledge of overlap areas are vitally important at Undergraduate level.

Keywords: European Survey Undergraduate Speech+Language Therapy • audiology training elements • interdisciplinary collaboration

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(ID-6901) Variables influencing ITA-Matrix: language and cognitive functions in young adults implanted in childhood

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Introduction: There is little research on how the ability to recognize speech in noise develops over time in young adults implanted in childhood. Executive functions (EFs) are a set of high order cognitive processes and are considered among variables affecting speech perception in noise (SIN).

Aim: To increase knowledge of variables influencing development of speech perception in noise, especially for cognitive variables, to improve theoretical understanding and rehabilitation procedures.

Material and methods: 62 subjects aged 18–27 years have been recruited. 50% implanted with AB, 40% with Cochlear and 10% with Med-El devices respectively, with a mean follow-up 22 years. All of them followed oral rehabilitation, none of them had associated disabilities. Audiological tests included SF-PTA, speech perception in quiet, SIN with fixed SNR and adaptive Matrix sentence test. Language competences included lexicon and morphosyntax, while EF included short term and working memory, verbal working memory (VWM), fluid intelligence and auditory attention.

Results: Subjects showed nearly 100% for words and sentences in quiet and substantial deterioration for sentences in noise at SNR+10. ITA-Matrix values were significantly worse when compared to normative values, with a median SRT of –1.3 dB SNR for the whole sample. ITA-Matrix is strongly correlated to expressive vocabulary and morphosyntax, and with most executive function outcomes. The linear regression model VWM explained 21% of variance for ITA-Matrix, while in linear regression for audiological variables SF-PTA and sentences recognition in quiet explained 44% of variance.

Conclusions: These data contribute to the definition of average SIN long-term outcomes expected in subjects implanted during childhood whilst increasing our knowledge of the effects of variables such as age at CI, language and EF. Innovation of the present study highlights how the development of SIN is influenced by language competences and cognition even adjusting for age at CI and age at implant.

Keywords: Matrix sentence test • verbal working memory • executive function • language

(ID-6970) Vestibular evaluation and management of children with sensorineural hearing loss

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Diagnosing vestibular disorders in children is more challenging than in adults, primarily because young children cannot clearly express symptoms such as vertigo, dizziness, and imbalance. Moreover, children may consciously or unconsciously avoid activities that could reveal impaired balance performance, making it difficult for parents to detect these deficits. While posturomotor development issues resulting from vestibular dysfunction may be recognized, they may not always be attributed to the vestibular system. Moreover, in children, congenital or early-acquired vestibular system disorders may lead the central vestibular system to adapt to dysfunctional inputs and exhibit vestibular compensation, which can prevent symptoms from appearing. Due to vague symptoms, the lack of clear symptomatic expression, and the challenges associated with vestibular function assessments in pediatric populations, balance skills are not routinely evaluated in children diagnosed with sensorineural hearing loss. Vestibular disorders have been reported to cause developmental delays in children, particularly in gross motor skills such as head control, sitting, standing, and independent walking, which are considered fundamental developmental milestones. However, the impact of vestibular system disorders in children extends beyond postural balance. Vestibular input deficiency also affects cognitive functions related to visuospatial tasks, particularly spatial memory, spatial navigation, and mental rotation. Difficulties in spatial navigation and localization, which are often attributed to a lack of auditory input, may actually originate from vestibular and balance disorders or be further aggravated by them. In children with auditory and vestibular impairments, hearing loss interventions support developmental progress, while vestibular-specific interventions further enhance it. In those with postural balance dysfunction, vestibular rehabilitation improves postural stability, static and dynamic balance, and vestibular functions. Considering the prevalence of vestibular disorders in children with sensorineural hearing loss is crucial to prevent these conditions from being overlooked. The possibility of coexisting vestibular disorders in children with sensorineural hearing loss should not be disregarded, as early diagnosis and intervention are essential for optimizing developmental outcomes. Therefore, incorporating vestibular function evaluation into the clinical assessment of these children is of great importance in ensuring timely and appropriate management.

Keywords: balance • children • sensorineural hearing loss • vestibular disorders

(ID-6971) What should we pay attention to in the rehabilitative approach to a hearing loss patient with cognitive developmental delay?

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Cognition: is the brain's processing, storing, retrieving and manipulating information. More specifically, cognition: It refers to the processes by which sensory input is formatted, detailed, stored, recorded and used. Cognitive developmental delay is defined as deficiencies in cognitive skills, as well as deficiencies in the ability to live independently in the areas of social adaptation and self-care, and is classified as mild, moderate, severe and very severe. Hearing loss can affect the auditory perception process, causing negative effects on language acquisition, communication skills and cognitive development. Language has an important place in the cognitive development process. Insufficiency in language skills and lack of auditory stimuli in children with hearing loss also negatively affect the cognitive development (perception, concept formation, thinking skills and problem solving) process. At the same time, it negatively affects areas such as language-related learning disorders, speech disorders, social communication and academic success. Auditory rehabilitation for a child with cognitive developmental delay and hearing loss aims at early diagnosis, appropriate amplification, educational evaluation, individualized education program, appropriate educational environment and environmental regulation, and support in correct communication methods.

Keywords: hearing loss • cognitive developmental delay • auditory rehabilitation

Posters

(ID-7152) Acoustical analysis of timbre in cochlear implant processing strategies incorporating temporal fine structure

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Introduction: This study investigates the impact of cochlear implant (CI) sound processing strategies on timbre perception, focusing on strategies that encode temporal fine structure (TFS). Strategies such as MEDEL's Fine Structure Processing (FSP), designed to preserve TFS cues, were compared with conventional CIs-based strategies (e.g., cochlear's strategies), which predominantly rely on envelope cues. The objective was to assess how these strategies influence key timbre characteristics, including spectral centroid and spectral flux.

Material and methods: Eight musical instrument sounds from the Clinical Assessment of Music Perception (CAMP) test's timbre subtest were processed using MATLAB-simulated CI strategies. TFS information was extracted using the Hilbert transform with a cut-off value of 900 Hz to isolate low-frequency TFS components, closely resembling the characteristics of the FSP strategy. Acoustic parameter extraction was performed both before and after processing to assess changes in timbre features.

Results: Spectral centroid values for unprocessed instruments averaged 823 Hz, for TFS-processed instruments 593 Hz, and

for CIs-processed instruments 823 Hz. The observed reduction in spectral centroid values for TFS-processed stimuli may reflect enhanced low-frequency energy distribution resulting from TFS preservation. In contrast, spectral flux values averaged 0.92 for unprocessed instruments, 0.82 for TFS-processed instruments, and 0.41 for CIs-processed instruments.

Conclusions: Results confirmed that TFS information below 900 Hz had minimal impact on spectral centroid values. Conversely, spectral flux was shown to be more sensitive to TFS coding, particularly in dynamic, transient-rich stimuli. These findings underscore the potential advantage of TFS-encoding strategies in preserving timbre features, particularly for signals with rapid temporal fluctuations. However, previous studies have shown spectral centroid to be a more reliable predictor of timbre perception than spectral flux. This suggests that despite the stronger influence of TFS on spectral flux, the limited effect on spectral centroid may have more substantial implications for timbre perception in CI users.

Keywords: cochlear implant • sound processing strategies • temporal fine structure • timbre perception • spectral centroid • spectral flux • attack time

(ID-6951) Age, phonological processing and cognitive abilities in adult CI users

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Introduction: Phonological processing skills in adults with cochlear implants (CIs) may be influenced by both hearing loss experienced prior to implantation and the spectro-temporally degraded CI signal. Previous research in different listener populations has shown that a nonword repetition task (NWRT) is a useful measure of phonological processing, likely relying on working memory, reading ability, as well as age. However, NWRT performance has not been widely studied in adults with CIs.

Aim: This study aims to assess how age and hearing loss affect phonological processing skills of CI users in NWRT performance compared to normal hearing (NH) peers. We will also investigate the relationship between NWRT performance and cognitive functions that depend on phonological processing, to understand the individual differences in performance.

Material and methods: This study included 73 postlingual adult CI users (aged 24–87) with at least six months of CI experience and 44 NH individuals (aged 50–81). Participants completed the NWRT, which involved 40 nonwords of varying lengths (one to four syllables), presented audio-visually by a male talker and scored based on the percentage of correctly repeated whole nonwords. Participants completed a series of cognitive tasks, such as the spectro-temporal processing (SMRT), reading efficiency (TOWRE), and short-term memory (forward digit-span) tests, to explore their influence on NWRT performance.

Results: The NH group performed better in both total nonword scores ($M = 87.18\%$, $SD = 7.32$) and total phoneme scores ($M = 97.90\%$, $SD = 1.64$), compared to the CI group's total nonword ($M = 42.85\%$, $SD = 20.25$) and total phoneme scores ($M = 81.37\%$, $SD = 15.60$). Age-related declines in NWRT performance were observed within the CI group ($p < .0.05$), but no significant age effects were found in the NH group. Spectro-temporal processing was found to be the strongest predictor of performance ($r = 0.56$), followed by speed of lexical and phonological access ($r = 0.42$) and nonverbal reasoning ($r = 0.39$).

Conclusions: Our preliminary results suggest that auditory, cognitive, and linguistic processes contribute to NWRT performance. NWRT may serve as a reliable assessment of phonological processing in CI users. Future studies could be useful for understanding the relationship between NWRT performance and individual differences in speech recognition outcomes in adult CI users.

Keywords: cochlear implants • auditory processing • phonological skills

(ID-6834) Cochlear implantation in children with congenital herpes simplex virus

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Introduction: Herpes simplex virus is one of the most common viruses, with 90% of the population infected. Depending of the patient's age, type and site of infection, it can cause a variety of clinical syndromes, ranging from mild local infections to life-threating infections involving the central nervous system. Genital herpes in woman is dangerous to the fetus. Infection can occur during fetal life (5–8%), during childbirth (85%) or after birth (8–10%). Congenital herpes infection usually occurs though exposure to the virus during natural birth, through contact with virus-containing genital tract secretions. Infection by the droplet route or through lesions caused by the virus is also possible. Herpes virus infection leads to damage to the eyes and mucous membranes, disseminated disease, mental impairment or hearing loss. Hearing loss following infection is sensorineural and may be congenital, delayed or progressive, so children should have a routine hearing check at least once between 24 and 30 months of age.

Material and methods: The study group consisted 10 patients aged 7–56 months ($M = 22.5$, $SD = 15.222$) operated on between 2010 and 2020. Five patients were implanted bilaterally (with an appropriate intervals). Eight right ears and seven left ears were operated on. All patients had an auditory brainstem potentials (ABR) test before surgery. Postoperatively, the patients had two tests: Adaptive Auditory Speech Test (AAST) and free-field threshold audiometry. Nine patients

were using hearing aids prior to implantation; the average age of onset was 4.5 months.

Results: Preoperatively, the ABR threshold for the operated ear was at 500 Hz – *M* = 88.67 dB, at 1000 Hz – *M* = 98 dB, at 2000 Hz – *M* = 98.67 dB, at 4000 Hz – *M* = 99.29 dB. On the AAST test, the average score was 36.3 dB in quiet and –10.8 dB SNR in noise. The average free field threshold (for frequencies from 250 Hz to 6000 Hz) was 36.5 dB.

Conclusions: Cochlear implantation is an effective treatment for hearing loss in deaf children with congenital herpes virus infection. Patient outcomes can vary depending on the age of the child's implantation, co-morbidities or rehabilitation programme.

Keywords: congenital HSV • cochlear implantation

(ID-6836) Evaluation of auditory outcomes after CI in children with CHARGE syndrome

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Introduction: CHARGE syndrome is a rare syndrome caused by a genetic disorder. The acronym CHARGE came into use for newborn children with the congenital features of coloboma of the eye, heart defects, atresia of the nasal choanae, restricted growth or development, genital or urinary abnormalities, and ear abnormalities and deafness. The incidence is estimated to range from 0.1 to 1.2 per 10,000 live births, though the true incidence is unknown.

Material and methods: The study group consisted 8 patients aged 0–13 years-old (*M* = 4) operated on between 2013 and 2021. All patients had an auditory brainstem potentials (ABR) test before surgery. Postoperatively, the patients had two tests: Adaptive Auditory Speech Test (AAST) and free-field threshold audiometry. All were using hearing aids prior to implantation and had computed tomography performed before operation. Results before surgery hearing thresholds in each patient, across 0.5–4 kHz frequencies, were > 90 dB. All patients had anatomical abnormalities of the middle and inner ears. Mean hearing threshold in free-field audiometry test (after operation) was 49 dB. Average AAST results were: (1) in quiet: 43; (2) in noise: –6.125.

Conclusions: Cochlear implantation is a good way to compensate for hearing loss associated with CHARGE syndrome.

Keywords: CHARGE syndrome • cochlear implantation • auditory outcomes

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(ID-6835) Facial nerve palsy in child as a complication after otitis media

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Introduction: Facial nerve palsy is a serious social and clinical problem and is also the most common condition affecting the n. VII. It manifests as inability to perform certain movements due to lack of nerve stimulation to the muscles. It is a disability that greatly affects the patient's daily functioning and significantly reduces their quality of life. Characteristic symptoms include drooping of the corner of the mouth on the paralyzed side, impaired lacrimation and salivation, or Bell's palsy. Facial paralysis is extremely rare in the course of a middle ear infection.

Case report: In March 2018, when patient was 8, he developed facial nerve palsy. It occurred after suffering from otitis media, which was diagnosed a 8 days before the paresis. Symptoms reported by patient and parents were: blepharospasm, ear pain, dropping of the corner of the mouth and loss of taste sensation. Physical examination of ear was normal for left ear, in right ear visual signs of inflammation. To assess the diagnosis of facial nerve damage the House–Brackmann scale was used. On the left side, the paralysis was classified as grade I, and on the right side as grade IV/V. The patient was referred for pure-tone audiometry. The hearing threshold in the left ear was within normal. In the right ear there was a moderate conductive hearing loss with an average of 37.5 dB for air conduction and approximately 9 dB for bone conduction. The treatment applied: Dexaven 2 × 4 mg for 7 days, Polprazol 1 × 10 mg and Biofazolin 2 × 500 mg. Three weeks after discharge from the unit, the patient reported for follow-up. According to the House–Brackman scale, the paresis was grade I on the right side and grade II/III on the left side. The right ear showed a mild conductive hearing loss with an average air conduction of 28.5 dB and bone conduction of 10 dB.

Conclusions: In patient treated at the Institute of Physiology and Pathology of Hearing (IFPS), recovery was optimised by early diagnosis, application of appropriate treatment and strict adherence to treatment and rehabilitation management recommendations.

Keywords: otitis media • facial nerve palsy

(ID-6956) The audiovestibular evaluation in a patient with minimal change disease-related cerebral sinus venous thrombosis: a case report

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Introduction: Minimal change disease (MCD) is one of the primary causes of nephrotic syndrome (NS), a renal disorder associated with an increased risk of thrombosis. However, its relationship with cerebral sinus venous thrombosis (CSVT) has been rarely reported in the literature. Here, we present the audiovestibular findings of a patient who developed CSVT associated with MCD.

Case report: A female patient was diagnosed with MCD at the age of 17 and underwent repeated corticosteroid treatment. Cranial MRI revealed thrombosis in the left transverse and sigmoid sinuses. Following the thrombosis, she reported persistent non-positional dizziness, a sensation of lightheadedness, and hyperacusis. Audiological examination revealed bilateral hearing within normal limits according to pure-tone averages. The auditory brainstem response (ABR) test showed Wave V at normal latencies at 20 dB nHL for both ears in tonal (1 and 4 kHz) and click stimuli. In the bedside vestibular assessment, the Romberg test was negative, while the Unterberger test showed lateralization to the left. Additionally, a minimal dysmetric pattern was observed in both gait and past-pointing tests with eyes closed. The oculomotor and positional tests were normal in the videonystagmography (VNG) battery. In the video head impulse test (vHIT), a borderline decrease was observed in the left posterior semicircular canal, whereas gains in the other canals were within normal limits. The cervical vestibular evoked myogenic potential (cVEMP) test showed no response in the right ear at maximum intensity, while latencies up to 80 dB nHL in the left ear were within normal limits.

Conclusions: Based on these findings, a central pathology was suspected due to CSVT and cerebrospinal fluid pressure irregularities following MCD. This case represents the first detailed audiovestibular evaluation reported in the literature after an MCD diagnosis. We emphasize that vestibular symptoms in these patients should not be overlooked and that a multidisciplinary approach is essential for appropriate management.

Keywords: dizziness • cerebrospinal fluid • audiovestibular tests • vestibular dysfunction

(ID-6821) The influence of practicing traditional karate on static posturography parameters: observational study in children

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Introduction: Karate is a martial art in which sequences of defenses and attacks are carried out, and its practice requires various skills such as specialized balance. Karate evolution is revealed through the graduation of chromatic belts. Some studies show that practicing sports improves balance and postural control.

Aim: Check if practicing sport with children, namely karate, reveals better static posturography parameters in relation to a higher level of skill, a higher belt ranking.

Material and methods: Initially, otoscopy and screening tonal audiometry were carried out to rule out ear pathologies. Afterwards, each child was weighed and measured and the mCTSIB and LOS tests were carried out on the PhysioSensing® balance static posturography.

Results: The sample consisted of 15 children ($M = 9{,}80$ years; DP = 2,27 years) practicing karate at the MaiaSport club (Porto, Portugal). Statistically significant results were found for the variable oscillation speed with eyes open and closed with sponge using the Wilcoxon test. Spearman's correlation was used to compare the time spent practicing karate to the age of the children, obtaining moderate to strong correlation in the variables of compound swing speed ($r = -0{,}79$), reaction time (r = 0,56) and direction control (0,56; in terms of time spent practicing karate) and compound swing speed ($r = -0{,}83$) and reaction time ($r = 0{,}75$; age of the children).

Conclusions: Age shows a greater significant correlation than the time spent practicing karate, which can be explained by the maturation of the balance sensory systems that develops until adolescence. Future studies in adults with the same protocol or with a control group of children who do not practice any sport are suggested.

Keywords: children • posturography • karate • swing speed • reaction time

XIII International Academic Conference ORLIAC, 13–15 April 2025, Warsaw/Kajetany, Poland

Dear Colleagues,

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XIII INTERNATIONAL ACADEMIC CONFERENCE ORLIAC, 13–15 APRIL 2025, WARSAW/KAJETANY, POLAND

Workshops

Otosclerosis: from standard to challenging cases

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The gradual decrease in primary stapes cases available to the otologic surgeon makes the possibility of unsuccessful procedures more frequent (especially in less experienced surgeons), thus revision stapes surgery may also become more frequent. The aim of this course is to show the surgical technique in detail from the standard to the more challenging cases. The course will be divided in 2 parts: in the first one, after an introduction regarding etiology, physiopathology and clinical aspect of otosclerosis, cases of standard stapes surgery will be shown with the description of the surgical technique, the proper patient and surgeon positioning, the step by step surgery with tips and tricks, results and complications as well as the use the laser and new stapes prosthesis. In the second part, challenging cases (encompassing malleus head fixation, dehiscent facial nerve, narrow oval window, obliterative otosclerosis and round window ossification) will be described with videos and a case series of revision stapes surgery will be shown. The objective of the course will be understand the classical technique of stapes surgery, recognize and manage difficult cases and identify prognostic factors when dealing with revision stapes surgery.

Study of visual-postural integration

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In the formation of static and dynamic balance, a properly conducted process of integration of visual and postural stimuli is necessary. It determines the compatible reading of otolith and visual information. The maculae, vestibular nuclei, cerebellum, medullary reticular structures, thalamus, pol 8,18,19 cortex and thalamus play an important role in it. The integration study allows us to assess the function of otoliths and their central representation. It is used a dynamic posturograph with forward-backward and right-left mobility and a gonioscope or goggles giving visual stimuli of the type of saccadic, tracking movements in the horizontal plane and OPK in the sagittal plane in the up and down directions. Saccadic stimuli are administered in the test at a rate of 40/s with an amplitude of 35 degrees from zero position, tracking stimuli at a rate of 2–3 s in both directions, amplitude of 20–35 degrees from zero position, OPK stimulus at a rate of 40 or 60 degrees per second, resulting in 1 to 2 fixation points per second. According to the given test plan, course participants perform the listed registrations, for each test protocol, the wage and height of the test person should be given.

Keynote Lectures

Advanced head and neck carcinoma, surgical options and limitations

Stankovic M.

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Locally advanced head and cancer represents significant challenge from surgical, and also from other therapeutical aspects. The data on the incidence, etiology, therapy, and survival rate are widely reported. However, the level I evidence is scant or lacking for the most of the affected areas. Different treatment options have evolved, and the decision process is mainly influenced by the tumor, patient, and physician factors. The dominant factors are nowadays centered on patohistology, TNM status and comorbidity. Different guidelines are regularly updated, NCCN being one of them, all showing treatment options, and their indications. Recurrent malignant disease, whether local relapse, or progression from related or independent field, is particularly difficult to treat. Reference data on treatment of recurrent or persistent malignant disease are particularly scant concerning surgical treatment. Treatment options for locally advanced head and neck cancer are: radical resection with adjuvant chemoradiotherapy, organ preservation, or chemoradiotherapy alone for unresectable or unfit patients. Author presents his surgical experience in the treatment of advanced head and neck cancer. Indications and contraindications for surgical treatment are explained. Examples of wrong surgical approach, neglected advanced tumors, or tumors with unknown primary are

presented. Extensive primary tumor is one of the most important challenges, especially for resectability and reconstruction. Extensive neck metastasis, especially bilateral must be adequate concerning TNM status, with preservation of important neurovascular structures. Secondary post irradiation tumor, affection of multiple locations, preservation of jugular vein, carotid artery, subclavian artery, as well as their reconstruction after resection are explained. Prevention and treatment of chylous fistula is presented. Pharyngocutaneous fistula is a relatively frequent complication of extensive resections, so prevention and proper reconstruction are mandatory. Other surgical topics are also discussed. Future treatment of locally advanced head and neck malignant tumors should be based on improvement of surgical options, but also on metastatic potential, chemoradiosensitivity, and growth speed.

Association of senile hearing loss with cognitive impairment in the Polish cohort of the PURE study

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Dementia is a growing public health challenge, especially in the context of aging populations. The increase in the number of people with dementia, as predicted by the WHO, requires the identification of risk factors, including age-related hearing loss (ARHL). Studies indicate a significant association between ARHL and cognitive decline, possibly due to social isolation, reduced cognitive reserve, or common vascular lesions in the brain and inner ear, among other factors. The purpose of this study is to analyze this relationship in the PURE study population and to assess the risk and prevalence of ARHL concerning biological and sociodemographic factors of residents of Wroclaw and the surrounding area.

BCI and CI in patients after cholesteatoma surgery

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Introduction: Cholesteatoma remains a controversial topic in otology. Optimal surgical technique to manage cholesteatoma is not yet defined. Recurrence rate of cholesteatoma varies significantly. Obliteration techniques nowadays offer improved results. Hearing results in cholesteatoma surgery are significantly worse than those in the non-cholesteatoma tympanoplasty. In this presentation the outcome of bone conduction implants and cochlear implants in cholesteatoma patients are evaluated.

Material and methods: *Bone conduction implants*: we evaluate 25 patients (10 patients with BAHA and 15 patients with Bonebridge). Pre- and postoperative audiograms are evaluated as well as the questionnaire evaluating the quality of life and patient's satisfaction are presented. *Cochlear implants*: in retrospective analysis we evaluated 560 patients with cochlear implantation. There were 7 patients with deafness due to cholesteatoma otitis with 9 cochlear implantations. Following parameters were evaluated: hearing loss, type of middle ear surgery before CI, surgical procedure for CI, complications, hearing results after CI.

Conclusions: BCI are powerful instruments to manage conductive and mixed hearing loss. Functional results and acceptance by patients confirm qualification for clinical use. Individual selection of devices based on audiological evaluation is utmost important. Device selection is also changing with time, new studies and new technology.

CI in patients with chronic otitis and severe hearing loss is an excellent method to restore hearing and communication skills. Different surgical procedures bring different outcomes regarding the problems and complication rate. Optimal procedure seems to be lateral petrosectomy with autologous fat obliteration and ear canal blind closure.

Carcinomas of nasal vestibule: setting new standards from classification to treatment

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Introduction: Nasal vestibule squamous cell carcinoma (NVSCC) is an ill-defined underestimated condition.

Aim: To define the current standard of care.

Material and methods: We review recent acquisitions concerning clinical features and therapeutic approaches.

Results: The current AJCC staging system, which attributes to nasal vestibule the same topographic code as nasal cavity proper and the same T-classification criteria as ethmoid, appears inadequate. As for treatment of primary lesions without bone invasion, current evidence suggests that brachytherapy is at least equivalent to surgery and superior to external beams in terms of oncological outcomes, and superior to both modalities in terms of cosmesis and function.

Conclusions: As for classification and staging, the nasal vestibule should be defined as a subsite of the nose and paranasal sinuses, distinct from the "nasal cavity proper and ethmoid", with specific topographic code and T-classification criteria. This will improve the assessment of prognosis and prevalence, underestimated also because of misdiagnosis with skin cancers.

Secondly, brachytherapy should become the new standard for the treatment of primary lesions without bone invasion. To optimize the advantages of brachytherapy, we propose novel anatomic criteria for the implantation. *Significance*: increasing evidence supports a paradigm shift in staging and treatment of NVSCC.

Cochlear implantation in children with congenital cytomegalovirus infection: what can we learn from the outcomes?

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Introduction: Congenital cytomegalovirus (cCMV) infection is a one major cause of sensorineural hearing loss (SNHL) in children under TORCHES infection. This etiology was a relative contraindication for cochlear implantation due to the concerns regarding auditory and speech outcomes due to the co-morbidities and neurological impact of cCMV. This study aims to evaluate auditory performance and speech perception outcomes in children with cCMV infection following cochlear implantation.

Objective: To assess the auditory performance and speech recognition outcomes in children with cCMV infection.

Material and methods: A retrospective review was conducted on 34 children with cCMV infection who underwent cochlear implantation. Patients with either diagnosed with CMV serology, urine or MRI findings suggestive of CMV-related brain abnormalities was reviewed. Pre and post-implantation auditory performance was assessed using the Category of Auditory Performance (CAP-II) and Speech Intelligibility Rating (SIR) score.

Results: Majority of patients showed favourable outcomes following cochlear implantation with CAP-II score of at least 5 at 3 years. Similarly, SIR scores showed improvement in speech intelligibility of at least 3 at 3 years post CI, with many patients attaining intelligibility levels that allow for functional communication. The average CAP-II and SIR score post-implantation indicated improvement which is statistically significant in auditory and speech performance at 3 years and 5 years when compare to preoperative level. Despite the presence of CMV-related brain abnormalities seen on imaging in congenital hearing loss patients, the overall outcomes in terms of auditory performance and speech recognition were encouraging.

Conclusions: This retrospective review showed that cCMV should not be considered as a contraindication for CI. The outcome suggests that CI is an effective hearing rehabilitation for children with congenital CMV infection as they achieve positive auditory and speech outcomes after cochlear implantation. Therefore, all hearing loss children with CMV should have a thorough assessment performed by the CI team and paediatricians, so that the decision on cochlear implantation is made with appropriate expectations. Early intervention is still the key in paediatric hearing loss management.

Cochlear implant revision surgery: analysis of the 30 revision cases

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Today, as the frequency of cochlear implant surgery increases, so does the rate of revision surgery. After 722 cochlear implant surgeries, all performed by the same surgeon at our clinic, patients who require revision surgery have gained insight into the reasons and solutions. Since December 2008, the outcomes of patients who required revision after cochlear implant surgery at our clinic and patients who underwent cochlear implant surgery at different centers but were sent to our clinic for revision have been evaluated. Of the 30 patients who required revision, 13 had undergone primary surgery at other centers. Reimplantation was performed in 26 patients. In the remaining 4 cases, in one patient the problem was solved by replacing the magnet in the patient where the magnet was displaced after magnetic resonance imaging (MRI). In the second case of migration, the problem was solved by changing the position of the receiver in the scalp and reimplantation was not required. In the third case, the ground electrode became visible under the skin. The implant was functional and reimplantation was not possible due to financial reasons. The problem was then solved by a strong repair of the defect with a cartilage sliding flap. One patient with bilateral implants refused revision surgery in one ear. In one patient, where the magnet of the implant was displaced after MRI imaging, the problem was solved without surgery by changing the pole of the magnet in the transmitter. Revision surgery was performed in 2 of the 26 patients who underwent reimplantation due to receiver migration after recurrent infections. These patients were reimplanted. Four patients were found to have active electrode-related device failure and 9 patients were found to have trauma-related damage. Device damage assessments were not completed for the remaining patients. In all patients with traumatic damage, revision surgery showed that new bone formation had almost completely covered the mastoidectomy site and the lead had passed through a tunnel in this new bone and advanced into the mastoid region. The mean time from initial surgery to revision was 39.1 months (range 7–101 months). The revision rate was 2.35% (17/722) in patients who underwent primary surgery at our clinic. Trauma and device failure are the main reasons for reimplantation in our clinical series. In order to reduce the need for reimplantation due to trauma, it is predicted that research to reduce the possibility of traumatising the electrode by preventing new bone formation at the mastoidectomy site may help to solve the problem. Periosteal-preserving techniques may be useful to minimise local flap and infection problems.

COMMeND: a mentoring network within the otitis media research community

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Introduction: Otitis media (OM) is the most common diagnosis among children and remains the main cause of the global burden of hearing loss in children < 5 years old, the age group when the development of speech, language and cognition is most important. OM in childhood also predisposes to sensorineural hearing loss and tinnitus in adults, and ongoing OM may cause permanent hearing loss at any age. OM, therefore, represents a significant health and economic burden, even in developed countries but especially in developing countries where access to advanced and adequate medical care is lacking. However, the false perception that OM is no longer important persists, resulting in less funding for OM research and attrition among OM researchers, with too many of those who completed training migrating to other fields of investigation.

Objective: To present the initiation and progress of the Cross-disciplinary Otitis Media Mentoring Network towards Diversity (COMMeND).

Material and methods: The initial survey assessing feasibility and interest in a mentoring network among otitis media researchers will be described. Additional surveys were also administered among recruited mentees ($n = 14$) and mentors ($n = 21$) during academic year 1.

Results: The development of an otitis media researcher network was funded by the R01 NIH-NIDCD based on preliminary data from the initial survey that demonstrated feasibility and interest in the network. We recruited a diverse network of mentees and mentors, with diversity based on self-reported ethnicity or being part of an under-represented minority in science, gender and career level. Majority of mentees indicated perceived benefit and usefulness of information obtained from bimonthly webinars, and overall satisfaction with mentoring sessions with matched mentors.

Conclusions: Taken together, the COMMeND network has achieved measurable progress towards its goals of enhancing the scientific, career and cultural training of early-career investigators and of strengthening the collaborative environment of the OM community.

Endoscopic DCR with and without silicone intubation

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Introduction: Endoscopic dacryocystorhinostomy (DCR) is a minimally invasive surgical procedure used to treat nasolacrimal duct obstruction (NLDO). A key consideration in endoscopic DCR is whether to use silicone intubation, which may help maintain patency of the newly created lacrimal outflow pathway but also carries potential drawbacks, such as increased inflammation and granulation tissue formation.

Objective: This review aims to compare the outcomes of endoscopic DCR with and without silicone intubation in terms of surgical success rates, symptom resolution, complications, and long-term patency.

Material and methods: A systematic analysis of clinical studies, meta-analyses, and randomized controlled trials was conducted to evaluate the efficacy and safety of endoscopic DCR with and without silicone intubation. Key outcome measures included anatomical success (patency of the nasolacrimal duct), functional success (resolution of epiphora), operative time, and postoperative complications.

Results: Studies indicate that both techniques achieve high success rates, with anatomical and functional success ranging from 80% to 95%. Silicone intubation is particularly beneficial in cases with fibrotic stenosis, canalicular involvement, or revision surgery, as it helps maintain the ostium patency during healing. However, it may be associated with an increased risk of granulation tissue formation, synechiae, and foreign body reaction, which can compromise long-term outcomes. In contrast, primary endoscopic DCR without intubation demonstrates comparable success rates in uncomplicated cases while avoiding the potential drawbacks associated with stent placement.

Conclusions: Endoscopic DCR is an effective treatment for NLDO, with or without silicone intubation. The decision to use intubation should be individualized based on patient factors, the severity of obstruction, and surgical indications. Further high-quality, long-term studies are needed to establish standardized guidelines for the optimal use of silicone intubation in endoscopic DCR.

Epidemiology of HPV-related cancers

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Introduction: The number of new cancers caused by human papillomavirus (HPV) continues to increase in the population that has not been vaccinated against HPV. There is no screening for other HPV-related cancers besides cervical cancer, so monitoring the incidence is important. We aimed to search

for any early decreasing trends in the age-standardized incidence ratios of HPV-related cancers in the Nordic countries.

Material and methods: We examined the age-standardized incidence of HPV-related cancers (cervix, vulva, vagina, anus, penis and oropharynx) in 2015–2023 from both the Finnish Cancer Registry and NORDCAN.

Results: Although the causative role of HPV in these cancers varies, an increase is observed. The age-standardized incidence ratio for cervical cancer showed a plateau or an increasing trend over the study period in Finland and Norway, but a clear decreasing trend in Sweden and Denmark. The annual incidence of oropharyngeal cancer in the Nordic countries is clearly increasing, more sharply in men than in women. This upward trend has been observed in several high-incidence countries in the 21st century. An increase in the incidence of both anal and penile cancer was observed in the Nordic countries, although the numbers are small. For penile cancer only in Denmark a decreasing trend was evident.

Conclusions: The ratios of HVP-related cancers in the Nordic countries are somewhat variable, and no remarkable decreasing incidence can be identified. The increasing cervical cancer rate in Finland was a surprise. Similarly, increasing trends for anal cancer in the Nordic countries were unexpected. The rates of oropharyngeal cancer continue to increase. Around two thirds of them have been reported to be HPV positive. This is in accordance with reports from other high-incidence areas.

Evaluation of the results of transcanal endoscopic ear surgery for treatment of attic retraction pockets

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Objective: Assessment of the results of transcanal endoscopic ear surgery in patients with attic retraction pockets.

Material and methods: A descriptive study of 25 patients with attic retraction pockets were performed transcanal endoscopic ear surgery to take out the retractions pockets at Ear Nose and Throat Hospital of Ho Chi Minh City, Vietnam.

Result: In 25 cases, it was able to preserve the mastoid bone with transcanal endoscopic approach, the clinical symptoms improved a lot after surgery. After mean follow-up time 20.28 ± 8.57 months, our success rate is 96% with 1 recurrent case needed second operation. 11/25 cases with ossicular chain discontinuity have undergone ossicular chain reconstruction with mean PTA improved 10.4 dB.

Conclusions: Transcanal endoscopic ear surgery is an effective method for treatment of attic retraction pockets, improve patient's clinical symptoms. Endoscopic surgery helps preserving the mastoid bone and provide good view and control of the attic space. However, during surgery, checking the facial recess was important to prevent recurrence at this place after surgery.

Genetic background of hearing loss in patients with inner ear malformations

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Introduction: Inner ear malformations (IEMs) can occur in isolation or as part of genetically determined syndromes. Enlarged vestibular aqueduct (EVA) is the most frequently observed IEM, often accompanied by incomplete partition type 2 of the cochlea and a dilated vestibule. SLC26A4 is the major gene associated with IEMs, with 50% of EVA/IP2 patients carrying either two pathogenic SLC26A4 variants or one SLC26A4 pathogenic variant together with the CEVA haplotype. The genetic background of other IEMs is more diverse and remains poorly understood.

Material and methods: DNA was isolated from blood samples of 40 hearing loss (HL) patients with bilateral IEMs. Sequencing was performed using a custom multigene panel (237 or 263 genes).

Results: Genetic testing identified the cause of IEMs in 67.5% (27/40) of individuals. Among EVA/IP2 patients, six carried two pathogenic variants in *SLC26A4*, while another six had one *SLC26A4* pathogenic variant together with the CEVA haplotype. The genetic cause still remains unknown in six EVA/IP2 patients. In patients with other IEMs, pathogenic variants were identified in *POU3F4* as well as genes associated with CHARGE (*CHD7*), BOR (*EYA1*, *SIX1*), Waardenburg (*SOX10*), and Kabuki (*KMT2D*) syndromes. Additionally, a novel pathogenic variant in *HOXA2* was identified in a single patient.

Conclusions: Mutations in *SLC26A4* and the CEVA haplotype account for more than half of EVA/IP2 cases. Patients with other IEMs are frequently diagnosed with syndromic forms of HL. Further research is needed to identify pathogenic variants in noncoding regions of known HL genes or in novel genes.

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Management of petrous bone cholesteatoma

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Petrous bone cholesteatoma is a life threatening disease defined as a presence of squamous epithelium mass in petrous

part of the temporal bone. It may be congenital or acquired. It is also classified as: apical, supralabyrinthine, infralabyrinthine, infralabyrinthine-apical or massive. The symptoms depend on the location and invasion of adjacent structures by the disease. Facial nerve palsy and /or meningitis may be the presenting symptom of the disease.

The treatment involves different surgical techniques adjust to the type of the cholesteatoma and possibility to preserve hearing and/ or facial nerve function. Main features in CT and MRI as well as surgical treatment methods are presented in this lecture.

Mastoid obliteration with bioactive glass: why, when and how?

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This instructional course will delve into the principles and techniques of mastoid obliteration in both canal wall up (CWU) and canal wall down (CWD) mastoidectomy approaches. The course will also encompass the role and technique of obliteration in rehabilitation of an open cavity, subtotal petrosectomy with middle ear exclusion +\– cochlear implant insertion and meningoencephalocele and repair of a tegmen defect. The session will focus on the indications and surgical methods for obliteration, emphasizing the rationale behind these techniques and their impact on clinical outcomes. Participants will gain a comprehensive understanding of the decision-making process, technical nuances, and postoperative considerations essential for successful mastoid obliteration. This course is tailored for otologists aiming to refine their skills and optimize patient care in chronic ear surgery.

Mucin gene regulation by middle ear epithelial cells in otitis media

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Introduction: Mucus secreted by middle ear (ME) epithelial cells forms a first line of defense against infection. Transmembrane mucins shield the ME mucosa from pathogens. Secreted mucins trap pathogens and export them via the Eustachian tube. Which mucins are produced in the ME, and which epithelial cell types of the five traditional categories (secretory, non-secretory, intermediate, ciliated and basal) produce them before and during otitis media (OM), are not well understood.

Material and methods: We assessed single-cell mRNA expression throughout an episode of acute OM, induced in mice by ME inoculation with nontypeable *Haemophilus influenzae* (NTHi). We also assayed transposon-accessible chromatin (ATAC), which detects DNA accessible for binding by regulatory factors, at 24 hours after NTHi infection. This allowed us to compare altered mucin gene expression with changes in genomic DNA accessibility.

Results: Based on gene expression, we classified MER epithelial cells as high-secretory, low-secretory, intermediate, ciliated and basal. They expressed the transmembrane mucin genes *Muc1*, *Muc4*, *Muc16* and *Muc20*, and well as the secreted mucin genes *Muc5ac* and *Muc5b*. Only transmembrane mucin genes were expressed in the normal ME. This expression increased and secreted mucins were added after infection, peaking 24 hours after inoculation. High-secreting epithelial cells expressed the most mucin, including all six types, but all five epithelial cell types expressed mucins. Infection-related changes in mucin gene DNA accessibility were observed for all six mucin genes.

Conclusions: Strong upregulation of mucin genes throughout an episode of OM by all epithelial cell types indicates less specialization for mucus production than might be expected from their morphology. Changes in DNA accessibility during OM likely participate in up-regulated mucin gene expression. Regulatory proteins that bind to the identified accessible sites would also participate. This includes transcription factors such as NFκB and AP1, both of which were upregulated in epithelial cells during OM.

Perioperative care to reduce intraoperative bleeding in rhinosurgery

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Introduction: Intraoperative bleeding is a significant concern in rhinosurgery, as it can obscure the surgical field, prolong operative time, and increase the risk of complications. Effective perioperative management strategies are essential to optimize surgical outcomes and enhance patient safety.

Objective: This review aims to summarize the current evidence on perioperative strategies to minimize intraoperative bleeding in rhinosurgery, focusing on preoperative preparation, intraoperative techniques, and postoperative considerations.

Material and methods: A comprehensive analysis of perioperative interventions, including patient optimization, pharmacological agents, anesthetic techniques, and surgical approaches, was conducted. Evidence from randomized controlled trials, meta-analyses, and expert guidelines was reviewed to identify best practices.

Results: Preoperative measures such as discontinuation of anticoagulants and antiplatelet therapy when appropriate, blood pressure control, and patient hydration play a crucial

role in reducing bleeding risk. Pharmacological agents like tranexamic acid (TXA), corticosteroids, and topical vasoconstrictors (e.g., epinephrine, oxymetazoline) have shown efficacy in minimizing intraoperative hemorrhage. Anesthetic techniques, including controlled hypotension and total intravenous anesthesia (TIVA), contribute to improved surgical visualization. Intraoperative strategies, such as meticulous hemostasis, bipolar cautery, and modern surgical instruments like microdebriders and powered instruments, further aid in reducing blood loss. Postoperative care, including nasal packing and proper patient monitoring, prevents rebleeding and enhances recovery.

Conclusions: A multimodal approach integrating preoperative, intraoperative, and postoperative strategies is essential for reducing intraoperative bleeding in rhinosurgery. Standardized protocols and individualized patient management can significantly improve surgical efficiency and patient outcomes. Further research is needed to refine best practices and establish evidence-based guidelines for perioperative care in rhinosurgical procedures.

Searching for molecular biomarkers of neuroplasticity in congenital deafness treatment in serum and in perilymph

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Introduction: Molecular and genetic biomarkers of neuroplasticity in congenitally deaf children treated with cochlear implantation (CI) would allow to implement better clinical management, taking into account individual, personalized needs, especially giving them better chances of spoken language rehabilitation.

Aim: The objective of the study was to verify the prognostic value of carrying a certain variant of *MMP-9* gene and plasma level of matrix metalloproteinase 9 (*MMP-9*), measured at cochlear implantation, to the outcome of speech and language rehabilitation after 18 months of CI use in long term follow-up.

Material and methods: We performed a prospective observational study analysis of serum activities of *MMP-9* at CI activation, 8, and 18 months after CI activation in the cohort of 61 children, diagnosed with bilateral profound sensory-neural non-syndromic hearing loss, aged below 2, treated with unilateral cochlear implantation. Language acquisition was assessed with Little Ears Questionnaire (LEAQ). We studied associations between serum activities of *MMP-9* and *BDNF* in the aforementioned intervals and LEAQ scores over follow-up intervals of the implanted children. In the other group of 100 deaf born children enrolled according to the same criteria association analysis of functional MMP9 rs3918242 variant and the child's auditory development measured at CI activation and 1, 5, 9, 14 and 24 months post CI activation with LittlEARS Questionnaire (LEAQ) was conducted.

Results: Correlation analysis shows that there is a significant relation between plasma level of MMP-9 measured at cochlear implantation and LEAQ score in 18 month follow up (rho = –0.25, $p < 0.05$). Statistical analysis in the subgroup implanted after 1 year of life ($n = 53$) showed significant association between MMP9 rs3918242 and LEAQ scores at 1 month ($p = 0.01$), at 5 months ($p = 0.01$), at 9 months ($p = 0.01$) and at 24 months ($p = 0.01$) after CI activation. No significant associations in the subgroup implanted before 1 year of life were observed. Multiple regression analysis ($R^2 = 0.73$) in the subgroup implanted after 1 year of life revealed that MMP9 rs3918242 was a significant predictor of treatment outcome.

Conclusions: *MMP-9* plasma level measured at cochlear implantation below 150 ng/ml predisposes deaf children to good response to cochlear implantation after 18 months follow-up. C/C rs3918242 MMP9 predisposes their deaf carriers to better CI outcomes, especially when implanted after the 1st birthday, than carriers of C/T rs3918242MMP9.

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Stapedotomy step by step: a surgical approach

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Introduction: Stapedotomy is a microsurgical procedure performed to treat conductive hearing loss caused by otosclerosis, a condition leading to abnormal bone growth in the middle ear. This procedure involves the creation of a small fenestra in the stapes footplate and placement of a prosthesis to restore sound transmission. Stapedotomy has been shown to significantly improve hearing outcomes, reduce tinnitus, and enhance quality of life in patients with otosclerosis.

Method: Surgical technique – the step-by-step approach to stapedotomy involves several key phases:
1. Patient Preparation and Anesthesia
– The procedure is typically performed under local anesthesia with sedation or general anesthesia, depending on patient preference and surgical conditions.
– The ear is prepared using an antiseptic solution, and an operative microscope is positioned for optimal visualization.
2. Tympanomeatal Flap Elevation
– A postauricular or transcanal approach is used to access the middle ear.
– The tympanomeatal flap is carefully elevated to expose the middle ear structures, particularly the stapes.
3. Stapes Visualization and Mobilization
– The incudostapedial joint is identified and separated using otosurgical microinstruments.
– The stapes suprastructure is removed to provide access to the footplate.

4. Fenestration of the Footplate
– A small hole (fenestra) is created in the stapes footplate using 0,6 mm diamond microdrill to allow sound transmission through the prosthesis.
5. Prosthesis Placement
– A suitable titanium prosthesis is inserted into the fenestra.
– The prosthesis is securely attached to the incus to facilitate effective sound conduction and appropriate sealing with blood cloth.
6. Tympanomeatal Flap Closure and Postoperative Care
– The tympanomeatal flap is repositioned with attachement with fibrin glue, and a small packing of material is placed in the ear canal to stabilize the flap.
– Patients are advised to avoid heavy lifting, straining, and sudden head movements postoperatively.
– Hearing improvement should be typically assessed at follow-up visits after 1, 6 to 12 weeks.

Results: Studies indicate that stapedotomy effectively reduces the air-bone gap, improves auditory thresholds, and enhances the overall quality of life in patients with otosclerosis. Postoperative complications are rare but may include transient dizziness, tinnitus changes, or in rare cases, sensorineural hearing loss. Patient selection, surgical expertise, and appropriate postoperative care play a crucial role in optimizing surgical outcomes.

Conclusions: Stapedotomy is a well-established and effective procedure for the treatment of otosclerosis-related hearing loss. A meticulous, stepwise surgical approach ensures optimal hearing restoration with minimal risks. Further studies on long-term outcomes and innovations in prosthesis design may contribute to enhancing surgical success rates and patient satisfaction.

The changing role of surgery in the multimodality treatment of head and neck cancer

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Historically surgery has been a dominant and sole treatment modality of malignancies arising from head and neck anatomical subsites for decades. The advances in other therapeutic modalities has changed the paradigm of present diagnostic and therapeutic protocols worldwide. Apart from disease with very-low locoregional advancement, the multimodality treatment based on the diagnostic work-up and the recommendation of the multidisciplinary team should be offered to the patient. The development of non-surgical approaches based on modern radiotherapy, systemic treatment including immunotherapy has significantly limited the indications for primary surgical treatment. At the same time, the development of reconstructive options has made the surgery the treatment of choice for salvage of the recurrent disease after non-surgical primary management. On the other hand the development of the minimally invasive approaches with the use of the transoral laser and robotic technologies have become again a gold standard treatment alternative for oropharyngeal tumors particularly linked to the HPV infection. The talk is an overview of the evolving role of the use of surgical treatment as an important modality for head and neck cancer patients.

The clinical effect of steroids for hearing preservation in cochlear implantation: conclusions based on three cochlear implant systems and two administration regimes

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The main aim of this study was to assess the clinical effect of steroids (dexamethasone and prednisone) on hearing preservation in patients who underwent cochlear implantation with different cochlear implant systems (Oticon®, Advanced Bionics®, Med-El®). 147 adult patients met the inclusion criteria and were enrolled to the study and divided into three groups depending on the brand of cochlear implant they received and participated in all follow-up visits regularly. They were also randomly divided into three subgroups depending on the steroid administration regime: (1) intravenous dexamethasone (0.1 mg/kg body weight twice a day for three days); (2) combined intravenous and oral steroids (dexamethasone 0.1 mg/kg body weight twice a day plus prednisone 1 mg/kg weight once a day); and (3) no steroids (control group). The results were measured by pure tone audiometry (PTA) at three time points: (i) before implantation, (ii) at processor activation, and (iii) 12 months after activation. A hearing preservation (HP) figure was also calculated by comparing the preoperative results and the results after 12 months. Further measures collected were electrode impedance and hearing threshold in the non-operated ear. The highest HP measures (partial and complete) were obtained in the subgroups who were given steroids. Of the 102 patients given steroids, HP was partial or complete in 63 of them (62%). In comparison, partial or complete HP was achieved in only 15 patients out of 45 (33%) who were not given steroids. There were differences between the three cochlear implant groups, with the Med-El and Advanced Bionics groups performing better than the Oticon group (45% and 43% of the former two groups achieved partial or complete HP compared to 20% in the latter). Hearing thresholds in the non-operated ear were stable over 12 months. Generally, impedance was slightly lower in the 12 month follow-up in comparison with the activation period, with the exception of the Oticon group. Conclusions: Pharmacological treatment with steroids in patients undergoing cochlear implantation helps to preserve residual hearing.

Update on middle ear implants

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In selected cases with different severity of hearing loss, the surgical application of several devices could be considered as an alternative to conventional hearing aids (cHA) or even the only feasible rehabilitative procedure. Over the last 20 years, these devices have been included in the armamentarium for the otologist to recover the auditory disability close to normality. This latter can be achieved, for example, by the use of bone conduction devices (BCI) in conductive and mixed type of hearing loss in place of conventional middle ear surgery or ear malformations. Differently from BCI, the clinical introduction of active middle ear implants (AMEI) has been object of controversies since they were generally advised when hearing could not be rehabilitated by cHA, that is more and more unlike with the advent of the new generations of digital HA. Differently, when the deaf population is in search of a cosmetically-acceptable solution, fully-implantable devices can surely be helpful. Over last two decades, AMEI have risen and fallen, abandoning most of them from the clinical availability, also leaving in the otologist's responsibility the handling of the already implanted patients. Moreover, among the major concern is the economic burden that derives from the lack of insurance coverage of the AMEI which justifies their withdrawal by many Companies. Surgical training for their application has also to be taken into account, with differences among the AMEI and their clinical indication, that should be routinely part of any temporal bone training course.

Vestibular dysfunction in the sagittal, frontal and horizontal planes

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Vestibular dysfunctions both vestibulocochlear and postural in the frontal or sagittal planes evidence damage at the level of the central part of the vestibular structures, this localization also applies to selected symptoms in the horizontal plane. The dysfunctions discussed in the sagittal plane are primarily vertical nystagmus, postural disorders associated with impaired motion perception and spatial orientation Among their etiologies are MS, spinal or cerebellar strokes, degenerative changes of the cerebellum, poisoning, CNS tumors, syringobulbia, head trauma, Arnold Chiari syndrome. It is important to take into account macular damage, here it is possible to meet otolithic vertigo, disorders of vertical OPK, small amplitude of vertical nystagmus in the rotational test. Vestibular disorders in the frontal plane are mainly torsion reaction of the eyeballs, oblique deviation of the eyes and rotational nystagmus. In addition, oblique head tilt, lateropulsions, and vertical reading disorders. Depending on the location of the lesion, these symptoms are either unilateral (bridge lesion below the junction of the graviceptive pathways) or contralateral (midbrain or interbrain lesions). Torsional eye reaction as the only symptom may be present in sternocleidomastoid lesions, in combination with others described above in spinal and midbrain dysfunctions. In the differential diagnosis of,functional vestibular lesions in these planes, unsupported free rotation testing, OVAR, VEMP, vertical and horizontal reading tests, electrootolithography are recommended. The vestibulo-oculomotor symptoms in the horizontal plane are characteristic of receptor-derived appointments. Central dysfunctions manifesting in this plane, in addition to conjunctival nystagmus, atactic nystagmus, positional nystagmus type I or III, include positional nystagmus – divergent and convergent, as well as canal paresis of medium degree according to Dix–Hallpike. In conclusion, it should be emphasized that the discussed functional tests are an essential component of otoneurological diagnosis in addition to structural tests.

Oral Presentations

APOBR is downregulated in EBV+ tonsils of children with obstructive sleep-disordered breathing

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Introduction: Obstructive sleep-disordered breathing (oSDB) is a heterogeneous phenotype that is increasing in prevalence worldwide and has many potential comorbidities that could severely affect quality of life. There is a need to identify

biomarkers for oSDB and its comorbidities to im-prove clinical management, particularly in children.

Objectives: To describe the tonsillar transcriptome of children with oSDB, according to (1) EBV in tonsil tissues and (2) recommendation for CPAP as treatment.

Material and methods: We performed bulk mRNA-sequencing, differential expression analysis, and qPCR replication of selected differentially expressed genes (DEGs) using RNA samples extracted from tonsils of children with oSDB. Two variables were used as classifier, namely, detection of Epstein-Barr virus (EBV) in tonsils and need for continuous positive airway pressure (CPAP) treatment. Standard statistical tests were used to determine associations across clinical, EBV, and DEG variables.

Results: Nineteen genes were dysregulated in tonsils that are EBV+ or from children needing CPAP. Of these genes, APOBR was downregulated in both EBV+ and CPAP+ tonsils, and this downregulation was replicated by qPCR in an independent set of pediatric samples. In the tonsils of adult patients with oSDB, APOBR was positively correlated with age, and potentially with diastolic blood pressure.

Conclusions: Taken together, APOBR and DEGs in tonsillar tissues may be useful as potential biomarkers of oSDB severity and comorbidity across the lifespan, with APOBR levels being dependent on latent EBV infection.

Cochlear biomechanics after cochlear implantation with hearing preservation

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Introduction: The primary objective is to evaluate if impeded biomechanics affects the hearing preservation after cochlear implantation.

Material and methods: Seventeen adults were implanted with Flex 20 ($n = 1$); Flex 24 ($n = 8$); Flex 28 ($n = 1$); Flex Soft ($n = 5$); Medium ($n = 1$) and Standard electrode array ($n = 1$) with cochlear implants Pulsar, Concerto or Sonata (Med-El). Each of the subjects were implanted using the round window insertion technique. Intracochlear acoustically evoked potentials were recorded from the cochlear implant electrodes. Tone pip of frequency 500 Hz was presented from the inserts and generated by the Nicolet EDX system (Natus). Postoperative CT was performed and evaluated. The audiogram prior the implantation was compared with the audiogram performed at the testing.

Results: Nine patients had the highest amplitude response to 500 Hz tone pip maximum peak matching the 500 Hz excitation area evaluated by the postoperative CT. The impeded biomechanic of basilar membrane was observed in 8 patients. These eight patients had the highest amplitude to 500 Hz tone pip either apically (1 case) or basally shifted (7 cases) from the 500 Hz excitation area evaluated by the postoperative CT. Low frequency pure tone average drop for the tonotopy group of subjects was 12.4 dB, while for the group with impeded biomechanic was 8.4 dB. No difference in mean was found.

Conclusions: These preliminary data suggest that impeded biomechanics of basilar membrane does not necessary influence hearing preservation.

Cochlear implantation in children with congenital herpes virus

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Introduction: The herpes simplex virus belongs to the *Herpesviridae* family (along with cytomegalovirus and varicella-zoster virus). Like cytomegalovirus, it is never completely eliminated from the host's body and has the ability to cause latent infections with periodic reactivation. It is one of the most common viruses, with an infection rate of up to 90% of the population. Depending on the patient's age, the type, and the location of the infection, it can cause a range of clinical symptoms, from mild local infections to life-threatening infections involving the central nervous system. Genital herpes in women is particularly dangerous for the fetus. Infection can occur during fetal life (5–8%), during delivery (85%), or after birth (8–10%). Congenital herpes infection typically results from exposure to the virus during vaginal delivery through contact with genital secretions containing the virus. Infection can also occur via droplet transmission or through lesions caused by the virus. Herpes virus infection can lead to eye and mucous membrane damage, disseminated diseases, intellectual impairment, and hearing loss. The hearing loss that occurs after the infection is sensorineural, and it can be congenital, delayed, or progressive. Therefore, children should undergo routine hearing screening at least once between the 24th and 30th months of life.

Aim: The aim of this study is to present the results of treatment in children who completely lost their hearing due to congenital herpes virus infection and underwent cochlear implantation.

Material and methods: The study group consisted of 10 patients (4 girls and 6 boys) aged from 7 to 56 months, with a mean age of 22.5 months ($SD = 15.222$), operated on

between 2010 and 2020. Five patients were bilaterally implanted (at appropriate time intervals). Eight right ears and seven left ears were operated on. All patients underwent auditory brainstem response (ABR) testing before the surgery. Postoperatively, patients underwent two tests: an adaptive speech understanding threshold test (AAST) and pure tone audiometry in free-field conditions. Nine patients used hearing aids before cochlear implantation, with the average age of hearing aid use initiation being 4.5 months.

Results: Preoperatively, in the ABR test, the hearing threshold for the operated ear was as follows: for 500 Hz, $M = 88.67$ dB; for 1000 Hz, $M = 98$ dB; for 2000 Hz, $M = 98.67$ dB; for 4000 Hz, $M = 99.29$ dB. In the AAST test, the average result in silence was 36.3 dB, and in noise, –10.8 dB SNR. The averaged hearing threshold obtained in pure tone audiometry in the free-field (for frequencies ranging from 250 Hz to 6000 Hz) was 36.5 dB.

Conclusions: Cochlear implantation is an effective method for treating hearing loss in children with congenital herpes virus infection. Patient outcomes may vary depending on the age of implantation, comorbidities, and the rehabilitation approach.

Continuous monitoring of temporal skills during long-term training by cochlear implant users

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Objectives: To evaluate the efficacy of the EARPLANTED platform, a free tool developed for auditory rehabilitation, in monitoring temporal changes in musical perception among cochlear implant users and normally hearing individuals during long-term training.

Material and methods: Participants included 50 cochlear implant users and 45 normally hearing volunteers. The study utilized the EARPLANTED internet application, developed at the Faculty of Physics, University of Bialystok, which features a melodic contour identification test accessible on personal computers and mobile devices. Repeated testing sessions were conducted using the melodic contour identification test. Logistic regression with restricted cubic splines was applied to analyze temporal changes in scores, examining distribution and progression over time.

Results: Continuous temporal monitoring of skills was achieved for binary data (i.e., data representing correct or incorrect melodic contour identification, valued at 0 or 1). Nonlinear dependencies were analyzed, and uncertainties were included. Normally hearing volunteers significantly outperformed cochlear implant users, though many found the test challenging, indicating its inherent complexity. Temporal analysis demonstrated a general improvement in scores among cochlear implant users with extended use of the platform.

Conclusions: The platform has proven to be a valuable tool for monitoring auditory skill development, particularly for unilateral cochlear implant users. The findings emphasize the need for cautious interpretation of melodic contour identification test results due to the difficulty of the task for both cochlear implant users and normally hearing individuals. This study highlights the benefits of continuous monitoring and remote data collection, reinforcing the platform's potential to advance long-term auditory rehabilitation strategies.

COVID-19 – induced acute laryngitis: a case series

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Objectives: The objective of this study is to present a novel clinical manifestation of COVID-19 with characteristic endoscopic laryngeal findings. A group of patients who reported similar symptoms, displayed akin laryngoscopic features, and received appropriate treatment is analyzed. Endoscopic images are provided and the pattern of this entity is discussed.

Material and methods: This single-center descriptive analysis of a case series was performed in the General Hospital of Volos (Greece), during a 6-month period (from April 2022 to September 2022). Twenty-three patients who suffered from COVID-19 and were simultaneously diagnosed with acute laryngitis were enrolled.

Demographic data, clinical and endoscopic findings, laboratory results, and treatment courses were recorded. Descriptive statistics were performed with the statistical package SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.).

Results: The majority of the patients were male and fully vaccinated, as defined by Greek legislation at the time. None of them was a smoker. All patients were infected with Severe Acute Respiratory Syndrome Coronavirus 2 for the first time and presented with acute odynophagia. The characteristic endoscopic finding was an erythematous larynx with white undetachable lesions mainly in the supraglottic area. Pooling of saliva in the pyriform fossae was an independent predicting factor for patients' hospitalization ($P < 0.001$). None of the patients required intubation or tracheostomy and all responded to the systemic treatment with corticosteroids and antibiotics.

Conclusions: COVID-19 – induced laryngitis should be considered in any patient with positive COVID-19 who complains of acute odynophagia. Fiberoptic laryngoscopy is necessary to confirm the diagnosis. In our series, timely initiation of treatment minimized the need to secure the airway and ensured a favorable prognosis.

Exploring the genetic background of autosomal dominant hearing loss

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Introduction: Autosomal dominant hearing loss (ADHL) is the second most common form of hereditary HL, typically manifesting after the first decade of life. It primarily affects high frequencies and worsens over time. Autosomal-dominant genes account for about 20% of prelingual non-syndromic deafness cases, with 63 genes identified to date.

Material and methods: This study included 110 ADHL families. Targeted next-generation sequencing (NGS) of 237 HL-related genes was performed in all probands. In six large unsolved families, linkage analysis and whole genome sequencing (WGS) were conducted. Presence of the selected probably pathogenic variants and their segregation with HL within the family were confirmed by standard Sanger sequencing.

Results: A genetic cause was identified in 51% (56/110) of families. Among 56 HL variants, 27% (15/56) were previously reported, while 73% (41/56) were novel. Variants included missense (35/56, 62%), splice site (8/56, 14%), frameshift (6/56, 11%), nonsense (6/56, 11%), and one synonymous variant (1/56, 2%). The most frequently affected genes were *MYO6* ($n = 11$), *TBC1D24* ($n = 6$), *WFS1* ($n = 6$), *GSDME* ($n = 5$), *POU4F3* ($n = 5$), and *KCNQ4* ($n = 4$). Variants in *NLRP3*, *LMX1A*, *FGFR3*, *CD164*, *GRHL2*, *TMC1*, *COCH*, *ATP2B2*, and *CEACAM16* were found in single families. Linkage analysis and WGS identified non-coding variants in *EYA4* and *ATP11A* and novel candidate genes.

Conclusions: Our custom multigene panel demonstrated good diagnostic performance. Given the frequent discovery of novel variants, clinical assessment and segregation analysis are essential. Linkage analysis and WGS improve variant detection, particularly in non-coding regions, and help identify new HL genes.

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Functional tests as a means to elucidate the role of variants in hearing loss genes – minigene assay in verification of pathogenicity

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Introduction: The next generation sequencing (NGS) is becoming a common tool in diagnostic setting and its especially useful in diagnosing genetically heterogenous diseases, such as hereditary hearing loss (HL). This technique generates thousands of genetic variants for each patients, making it challenging to differentiate between those causative for disease and benign polymorphisms. Notably difficult to interpret are noncoding variants (i.e intronic variants), because their mode of pathogenicity is difficult to determine. Functional studies, such as the minigene assay, might help to define their role in pathogenesis of hereditary hearing loss.

Material and methods: 10 variants detected using dedicated panel of HL genes (237 genes) in HL patients of Genetic Outpatient Clinic of Institute of Physiology and Pathology of Hearing were selected for the minigene assay: *EYA1* c.1475+1G>T, *EYA4* c.1282-12T>A, *GSDME* c.991delT, *GSDME* c.1127A>G, *MYO6* c.816+1G>A, *MYO6* c.1984-1G>A, *MYO6* c.3281-13A>G, *MYO7A* c.2829G>A, *MYO15A* c.9230-4A>T, *SLC26A4* c.1001+1G>A. The fragments of genes of interests were amplified and cloned into expression vector pDEST-pCI-Neo-RHO using Gateway system. Obtained vectors were transfected transiently into HEK293T cell culture. After 48 h of incubation cells were lysed and RNA extraction was performed. Desired transcripts were analysed using RT-PCR and Sanger sequencing.

Results: 9 out of 10 studied variants did show their effect on splicing. Most commonly observed consequence was exon skipping and intron exonisation, resulting mostly in the creation of premature stop codon. Variant MYO15A c.9230-4A>T showed no changes in splicing.

Conclusions: Minigene assay allowed for the determination of the mode of pathogenicity for all studied variants – 9 of them did disrupt the correct splicing of the transcript. In case of variant MYO15A c.9230-4A>T performed assay suggests its benign nature. Splicing may be influenced not only by variants disrupting canonical splice sites but also coding variants and variants in deeper intron sequence. Both isolated HL (*EYA4*, *GSDME*, *MYO6*, *MYO7A*, *MYO15A*) and syndromic HL (*EYA1*, *SLC26A4*) can be caused by splicing affecting variants.

Local delivery of steroids to inner ear via medical device INCAT in partial deafness patients during cochlear implantation

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Introduction: The administration of steroids to preserve residual hearing during cochlear implantation has been described, although the results are mixed. Nevertheless, according to current knowledge, steroids may have an important role in reducing post implantation fibrosis and loss of hearing due to electrode insertion trauma and progressive effects of inflammation. The aim of the study was to assess separately the effectiveness and safety of three different algorithms of using steroids and INCAT (a medical device) Med-El® in partial deafness patients who underwent cochlear implantation and secondly – the assessment of the impact of the depth of the catheter (INCAT) on hearing preservation after cochlear implantation.

Material and methods: Ten patients underwent a cochlear implantation with an inner ear catheter Steroid administration followed three different algorithms: 1) methylprednisolone 62 5 mg/ml in solution – 3 patients; 2) methylprednisolone 40 mg/ml in suspension – 4 patients 3) dexamethasone 4 mg/ml in solution – 3 patients. Pure tone audiometry (0.125 – 8 kHz) was performed preoperatively and at the cochlear implant activation (one month after surgery). Hearing preservation was assessed according to the HEARRING group formula. Impedance measurements were taken at two days and one month after surgery.

Results: Patients treated with methylprednisolone 40 mg/ml in suspension showed the best hearing preservation, with 50% achieving complete preservation and 50% partial preservation. This group also had the lowest impedance changes (ranging from 1.06 to 2.11 kΩ). A shorter INCAT insertion depth appeared to be more favorable than a longer one. The smallest changes in the hearing thresholds were observed in the second group (methylprednisolone 40 mg/ml in suspension, Depo-Medrol). Hearing preservation (HP) in all patients at the CI activation was as follows: complete hearing preservation (HP) was observed in 2 patients (20%), partial HP in 5 patients (50%), and minimal HP in 3 patients (30%). No patients experienced total hearing loss at the time of CI activation.

Conclusions: All these considerations suggest that patients treated with methylprednisolone 40 mg/ml in suspension had better outcomes compared to others. The generalizability of the results is limited due to the small sample size and the inability to control for.

Otitis media in children with Down syndrome is associated with shifts in the nasopharyngeal and middle ear microbiotas

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Introduction: Otitis media (OM) is defined as middle ear (ME) inflammation that is usually due to infection. Globally, OM is a leading cause of hearing loss and is the most frequently diagnosed disease in young children. For OM, pediatric patients with Down syndrome (DS) demonstrate higher incidence rates, greater severity, and poorer outcomes. However, to date, no studies have investigated the bacterial profiles of children with DS and OM.

Objective: We aimed to determine if there are differences in composition of bacterial profiles or the relative abundance of individual taxa within the ME and nasopharyngeal (NP) microbiotas of pediatric OM patients with DS ($n = 11$) compared with those without DS ($n = 84$).

Material and methods: We sequenced the 16S rRNA genes and analyzed the sequence data for diversity indices and relative abundance of individual taxa.

Results: Individuals with DS demonstrated increased biodiversity in their ME and NP microbiotas. In children with OM, DS was associated with increased biodiversity and higher relative abundance of specific taxa in the ME.

Conclusions: Our findings indicate that dysbiosis in the ME of children with DS contributes to their increased susceptibility to OM compared with controls. These findings suggest that DS influences regulation of the mucosal microbiota and contributes to OM pathology.

Results of cochlear implantation in patients with congenital rubella

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Introduction: Congenital rubella syndrome (CRS) is an infection caused by rubella virus that transmitted to the fetus during pregnancy which can cause congenital hearing loss. Cochlear implant can be an effective therapy in patients with severe to profound bilateral hearing loss. The aim of this study was to evaluate the benefits of cochlear implantation in patients with profound hearing loss caused by congenital rubella syndrome.

Aim: The aim of this study was to evaluate the benefits of cochlear implantation in patients with profound hearing loss caused by congenital rubella syndrome.

Material and methods: 38 patients with profound hearing loss caused by intrauterine rubella virus infection were considered for cochlear implantation. Patients ranged in age from 8 to 72 years on the day of surgery, with a mean age of 27 years (*SD* = 13.2). Preoperatively, all patients underwent pure-tone audiometry and was free-field speech audiometry conducted in a quiet environment with the patient wearing a fitted hearing aid. Postoperatively patients underwent pure-tone audiometry, to assess residual hearing, and free-field speech audiometry conducted when the patient had an active implant.

Results: The average preoperative hearing threshold (averaged across the seven frequencies from 0.125 to 8 kHz was 99.2 dB HL (*SD* = 6.79), while the average postoperative hearing threshold was 103.4 dB HL (*SD* = 5.74). Twelve months after the operation patients achieved WRS scores ranging from 10% to 90%, with an average of 59.1% (*SD* = 25.8).

Conclusions: Rubella during pregnancy can lead to severe congenital defects, with sensorineural hearing loss being the most common. Cochlear implants appear to be an effective treatment for profound hearing loss caused by congenital rubella syndrome.

Revisiting musculoclavicular bone graft reconstruction for post-hemimandibulectomy ameloblastoma in a tertiary government hospital: a case series

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Ameloblastomas are uncommon odontogenic tumors originating from ectodermal epithelium. These tumors are benign in nature but may demonstrate aggressive behavior undergoing malignant transformation. Radical surgical intervention is considered the most effective treatment approach for ameloblastoma but can lead to functional impairments, cosmetic deficiencies, and psychological discomfort. The defect caused by hemimandibulectomy may result in impaired mastication, speech disability, and loss of mandibular contour. Vascularized free bone grafts from the fibula, ilium, scapula, or radius are the gold standard for mandibular repair. In some instances, free flaps may not be feasible within the local context due to lack of expertise, insufficient equipment, or nonviable donor sites among subjects. The paper discussed outcomes associated with musculoclavicular bone graft for the reconstruction of mandibular defect after hemimandibulectomy among mandibular ameloblastoma patients. This is a case series of mandibular ameloblastoma requiring hemimandibulectomy in a tertiary public hospital in the Philippines. All six patients underwent hemimandibulectomy and were subjected to musculoclavicular bone flap reconstruction. Successful integration of the clavicular flap to the mandible was monitored through Orthopantomography done 1 month post-surgery. Two out of six cases exhibited protrusion of the clavicle bone edge in its recipient site, repaired through debridement and rotational skin flaps. Four out of six cases had no post-operative complications. Mandibular contour was maintained with the use of the clavicular flap attached by mandibular titanium plates. Favorable cosmetic results were attained, and the potential for post-operative dental reconstruction remains an option. The musculoclavicular flap remains a viable alternative for reconstructing mandibular defects after hemimandibulectomy, especially in settings where microvascular free flaps are not applicable.

Subjective evaluation of the advantages of the new middle ear implant processor compared to the older generation processors

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Objectives: Vibrant Soundbridge (VSB) middle ear implant is a partially implantable solution available in Poland for over 20 years for patients with various types of hearing loss. It consists of an internal part (implanted under the skin behind the ear) and an external part (audio processor). As technology advances, audio processors are continually improved to provide users with better auditory performance. The aim of the study is to compare the subjective benefits of using the Samba 2 processor and previous generation processors. The assessment was made using the SSQ12 and APSQ questionnaires.

Material and methods: Forty-five experienced VSB users (average VSB use time 9 years, *SD* = 2) who replaced their previously used processor (D404, Amadé©, Samba 1) with the model Samba 2. The average age is 56 years, *SD* = 20 years.

Results: The results of the questionnaire evaluation confirm the benefits of using the latest processor compared to the previous generation processors. On the SSQ questionnaire, both the total score and the subscale scores were statistically significantly better on the new processor than on the previous generation processor. In the APSQ questionnaire, statistically significant differences were observed for the Usability subscale.

Conclusions: The new audio processor is subjectively rated better than the previous generation processors. Access to modern technologies for patients with VSB implants brings measurable benefits.

Success of targeted sequencing in the search for genetic causes of Usher syndrome type 2

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Objectives: Usher syndrome is one of the most common rare diseases in which both hearing impairment and retinitis pigmentosa coexist. Currently, four types of Usher syndrome are known and they are genetically and clinically heterogenous. The aim of the study was to characterize the genetic background of Usher syndrome type 2 (USH2) in a group of Polish patients.

Material and methods: A total of 55 patients with a clinical diagnosis of USH2 were recruited to the study. The DNA was isolated from blood and genetic testing was performed using three different methods: RT-PCR genotyping, targeted sequencing of the USH2A gene, and a multigene panel (237 genes). Segregation analysis was performed using Sanger sequencing and RT-qPCR.

Results: The cause of USH2 was identified in all patients. In 98% (54/55) of the individuals, causative variants were located in the *USH2A* gene. In one patient (2%; 1/55), a new homozygous terminating variant in the *ADGRV1* gene was identified. In *USH2A* gene, 42 different genetic variants were identified (28 known and 14 novel). A total of 74% (31/42) of the variants were deleterious. The most frequently identified genetic cause of *USH2* was c.11864G>A (p.Trp3955Ter) (29 alleles). Deletions of exons 22–24 (17 alleles) and 10–11 (8 alleles) of the *USH2A* gene also contributed frequently to *USH2* development.

Conclusions: Genetic testing of *USH2* patients should be based on high-throughput tests that enable simultaneous identification of SNVs and CNVs. The gathered data can serve as a starting point for further genotype-phenotype association analyses.

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Taste disorders after various otosurgical operations

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Introduction: One of the nerves involved in the transmission of taste stimuli is the chorda tympani. This nerve runs through the tympanic cavity. During middle ear surgery, the chorda tympani can become irritated or damaged, which can be associated with taste disorders.

Aim of the study: To assess the incidence of taste disorders after different types of otosurgery.

Material and methods: Patients who required middle ear surgery were included in the study. Before surgery, a screening Taste Test was performed in patients. Those with normal results were given a retest one week after surgery (97 participants). The study participants were divided into three groups according to the type of surgery performed. Group 1 included patients who underwent surgery with access to the tympanic cavity via anterior tympanotomy, except for stapedotomy. Patients in group 2 underwent stapedotomy, while patients in group 3 required a posterior tympanotomy.

Results: One week after surgery, taste disturbances were detected in 17 patients (17.5%). The results in each group were as follows: group 1–4 patients (10.3%) with taste disorders after surgery, group 2–9 patients (27.3%), group 3–4 patients (16.0%). 3 months after surgery, the disorder persisted in 1 person (1.0%). None of the operated patients had damage to the chorda tympani during surgery.

Conclusions: Taste disorders can occur after any middle ear surgery. They are more common in patients undergoing stapedotomy than other surgeries, which may be related to the course of the chorda tympani and the surgical technique, requiring widening of the external auditory canal posteriorly.

The AMSA® manosonic nebulizer for ENT diseases among children in Poland

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Introduction: The AMSA® manosonic nebulizer uses acoustic vibration and a flow of air to create an aerosol from a solution or suspension of a drug. The aerosol created this way is claimed to have enhanced penetration and drug delivery. It is administered under short-term overpressure, meaning that the aerosol is able to penetrate into the middle ear through the Eustachian tube (ET).

Aim: The aim of this study is to identify the active substances used in AMSA® manosonic nebulization for treating common ENT diseases in children aged 2–17 years and to evaluate the overall effectiveness of AMSA® manosonic nebulization in this context. Assessments were done by comparing conditions before and after nebulization using the following tests: (1) Eustachian tube function test, (2) tympanometry, and (3) otoscopy.

Material and methods: This study was a retrospective study with ethics committee consent. 129 children, comprising 56 girls and 73 boys. They were aged between 2 and 17 years, with a mean age of 6.9 years (*SD* = 3.0). There were 74 children up to 6 years and 55 children over 6 years of age. Children had the following conditions: (1) chronic otitis media with effusion, OME ($n = 86$), (2) Eustachian tube dysfunction, ETD ($n = 34$), (3) other conditions, e.g., cholesteatoma, retraction pocket ($n = 9$). Combination of medicines administered in this study was: Budesonide + Ambroxol (with or without NaCl), Budesonide (with or without NaCl), Budesonide + N-acetylcysteine (with or without NaCl), Budesonide + Hyaluronic acid, Budesonide + Ambroxol (with hyaluronic acid), Ambroxol (with or without NaCl).

Results: The number of nebulizations ordered was between 1 and 20 treatments, but most commonly, patients were given a nebulization series of 10 treatments. This was the case for 80.6% of the patients. Most patients with OME and ETD had 10 treatments ordered (79% and 79.5%, respectively), while all patients with other conditions had 10 treatments. Analysis of the tympanometry results was done in terms of the number of affected ears (not by individual). There were 210 ears with complete tympanometry (both pre and post), including 142 ears with OME, 54 with ETD, and 14 others. Statistically significant changes (improvements) after AMSA nebulizations were found for statistic compliance and middle ear pressure. Otoscopy assessments were done in all ears. The results were abnormal in 155 ears (73.8%) and normal in 55 ears (26.2%). After AMSA nebulizations, the number of abnormal results decreased to 117 ears (55.7%) and normal results were found in 93 ears (44.7%).

Conclusions: Use of the AMSA manosonic nebulizer appears to be an effective way of improving chronic medical conditions in children – such as chronic otitis media with effusion and Eustachian tube defect – but only if patient compliance can be achieved. The most frequently used active substance was budesonide, irrespective of whether additional secretolic/mucolytic agent was administered.

The Bonebridge active bone conduction hearing implant: safety, effectiveness and outcomes based on a largest cohort study – 355 patients

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Introduction: Hearing loss is often associated with a lower quality of life, leading to communication difficulties, social isolation and stigma. The scale of difficulties faced by people with hearing loss has, over the years, driven professionals to seek increasingly advanced treatments. Rapid technological advancements have enabled the development of implantable devices for patients who do not benefit from or cannot use traditional hearing aids. The Bonebridge implant is a major advancement in bone conduction technology, offering a safe and effective hearing loss solution. However, limited sample sizes in studies highlight the need for further research on its long-term efficacy and safety.

Aim: The aim of this study is to evaluate the safety, efficacy and audiological outcomes of the Bonebridge implant in a large cohort of patients with different types of hearing loss.

Material and methods: A total of 355 patients across a wide age range underwent Bonebridge implantation. Pre- and post-implantation evaluations included pure-tone audiometry, speech recognition tests and free-field audiometry. Word recognition was measured using the Polish Monosyllabic Word Test, while speech reception in noise was assessed using the Polish Sentence Matrix Test. Subjective benefit was assessed using the APHAB questionnaire. Follow-up tests were performed 3–6 months after activation.

Results: Revision surgery was required in 17 patients (4.8%) due to complications, including implant removal in five cases. Reimplantation was successful in four of these cases. The APHAB questionnaire showed improved hearing function and all hearing tests such as free field thresholds, speech discrimination and matrix tests showed significant improvement after implantation.

Conclusions: Active bone conduction implantation is an effective method for the rehabilitation of conductive hearing loss, mixed hearing loss and unilateral deafness. The large cohort study confirms significant hearing improvements and subjective benefits. The low complication rate supports the reliability of the Bonebridge system.

The role of the rhomboid lip and choroid plexus in microvascular decompression (MVD) for vestibulocochlear diseases

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Introduction: Microvascular decompression (MVD) is a surgical intervention for functional vestibulocochlear diseases, but its efficacy and the underlying mechanisms remain incompletely understood. Recent studies have focused primarily on neurovascular compression, while other potential factors, such as abnormalities in the rhomboid lip (RL) and choroid plexus (CP), have been largely overlooked. This study investigates the role of RL and CP in the development of vestibulocochlear symptoms and evaluates the surgical outcomes of MVD with and without addressing these structures.

Material and methods: We retrospectively reviewed 15 patients who underwent MVD for vestibulocochlear diseases between 2013 and 2022. Patients were categorized into four groups: vestibular paroxysmia (VP), benign positional paroxysmal vertigo (BPPV), Ménière disease (MD), and a "tinnitus" group. Preoperative imaging, intraoperative findings, symptom relief, recurrence rates, and patient satisfaction were analyzed. Additionally, we evaluated the impact of RL incision and CP excision on surgical outcomes.

Results: Following MVD, 6 of 7 patients with VP, 1 patient with BPPV, and 1 of 2 patients with MD achieved complete relief from vertigo. Notably, 4 patients who underwent RL incision and CP excision were also free of vertigo, despite the absence of confirmed vascular compression. In these cases, we hypothesize that abnormalities in the RL and CP, such as an elongated RL and overexpanded CP, may contribute to vertigo by obstructing cerebrospinal fluid (CSF) flow and stimulating the eighth nerve. Furthermore, some patients reported improved hearing postoperatively, suggesting that addressing these anatomical abnormalities may have additional benefits beyond vertigo relief. However, patients in the "tinnitus" group showed no significant improvement, indicating that tinnitus may have different underlying mechanisms and requires further investigation.

Conclusions: Our study highlights the potential role of RL and CP abnormalities in the pathogenesis of vestibulocochlear diseases. MVD is effective for treating VP and may also benefit patients with BPPV and MD, especially when RL and CP abnormalities are addressed. These findings suggest that preoperative imaging of the RL and CP should be considered in patients with refractory vestibulocochlear symptoms. Future research should focus on elucidating the anatomical and physiological interactions between these structures and the eighth nerve, as well as exploring targeted interventions to improve surgical outcomes.

Posters

Brown–Vialetto–Van Laere Syndrome – a case report of riboflavin treatment and cochlear implants in a 4-year-old girl with progressive hearing loss and delayed speech development

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Introduction: Brown–Vialetto–Van Laere (BVVL) syndrome is a rare autosomal recessive disorder caused by mutations in intestinal riboflavin transporter genes, resulting in a motor neuron disorder of childhood, which can be associated with sensorineural deafness. This report describes a 4-year-old Polish girl with progressive hearing loss and delayed speech development diagnosed with Brown–Vialetto–Van Laere syndrome who was treated with riboflavin (vitamin B2) and cochlear implants.

Case report: The case report concerns a girl from Poland who, at the age of 2 years 10 months, developed progressive atypical neurological symptoms of unknown etiology: ataxia of the upper and lower limbs, gait abnormalities, generalized muscle weakness, visual and hearing problems, and regression of speech development. A karyotype study (whole-exome sequencing) revealed alterations within SLC52A2, leading to the diagnosis of Brown–Vialetto–Van Laere syndrome and initiation of high-dose riboflavin treatment. As a 4-year-old child, she presented to the Institute of Physiology and Pathology of Hearing, Poland with progressive hearing loss and speech regression. Hearing tests revealed bilateral profound sensorineural hearing loss with auditory neuropathy. Surgical treatment was applied in the form of bilateral cochlear implantation.

Conclusions: This report shows the importance of genetic testing in infants who present with atypical symptoms or signs. In this case, the diagnosis of Brown–Vialetto–Van Laere syndrome resulted in timely correction of the genetic riboflavin (vitamin B2) deficiency and improved hearing following the use of cochlear implants.

Disrupted *GRHL2* transcriptional activity as a mechanism of autosomal dominant hearing loss development (DFNA28)

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Introduction: *GRHL2* is one of over 50 genes linked to autosomal dominant hearing loss (ADHL) and is also implicated in cancers. It encodes a transcription factor. Only few ADHL-related *GRHL2* pathogenic variants have been reported and their mode of action remains unclear. This study aimed to identify the genetic basis of ADHL in a multigeneration family with progressive hearing loss (HL) and explore the molecular mechanism of DFNA28 *GRHL2* mutations.

Material and methods: Genomic DNA from the proband and family members ($n = 8$) was analyzed using a 237-gene HL panel and Sanger sequencing. Expression vectors for four ADHL-related *GRHL2* variants were generated, and their transcriptional activity was assessed in HEK293T cells using a luciferase reporter assay.

Results: A novel heterozygous *GRHL2* variant (c.1061C>T; p.Ala354Val) segregating with HL was identified within the DNA-binding domain. Functional assays showed reduced transcriptional activity for this variant and two others (c.1258-1G>A, p.Gly420Glufs*111; c.1276C>T, p.Arg426*). In contrast, a variant affecting the dimerization domain (c.1609_1610insC, p.Arg537Profs*11) strongly activated the GRHL-responsive promoter.

Conclusions: The pathogenicity of novel missense variant was supported by functional assays. *GRHL2* mutations can suppress or activate transcription depending on variant location – DNA-binding domain variant causes haploinsufficiency, while dimerization domain variant shows gain-of-function effect. This study provides new insights into *GRHL2*-related hearing loss mechanisms.

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Duplication of internal auditory canal as a pathognomonic sign of severe cochlear nerve hypoplasia or aplasia and Bone Conductive Implant Bonebridge implantation in CROS configuration – a case report

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Introduction: Duplication of the internal auditory canal, i.e. separate canals for the cochlear and facial nerves, is a very rare congenital anomaly arising during embryonic development. The aim of this study was to present the case of a patient with internal auditory canal duplication (separate canals for the cochlear and facial nerves), unilateral cochlear nerve aplasia, and a method of treatment for single-sided deafness (SSD) with a Bonebridge implant as CROS (contralateral routing of signal).

Case report: The Institute of Physiology and Pathology of Hearing, Poland was visited by a 14-year-old female patient who was diagnosed with unilateral hearing loss during a school balance sheet. Her hearing screening at birth was normal. Pure tone audiometry revealed unilateral deafness of the right ear. Computed tomography scan showed asymmetry of the internal auditory canals: the right canal was duplicated – divided into a separate canal for the facial nerve (2.2 mm) and the vestibulocochlear nerve (<1 mm). Magnetic resonance imaging confirmed a right bipartite canal with severe stenosis of the duct to VIII nerve, without identification of the VIII nerve on that side. Unilateral aplasia or severe hypoplasia of the right nerve VIII was suspected. In view of the test results obtained, the patient was referred for diagnosis of an implant using bone conduction as a CROS, taking advantage of the phenomenon of bone conduction of sound from the deaf ear to the well-functioning ear. During the simulation performed with a bone conduction sound device mounted on a soft band, the patient achieved MATRIX test results (in SSD configuration): with the device SRT threshold = –0.4 dB SNR, without the device SRT = 3.5 dB SNR. At the age of 14, the patient was implanted with a Bonebridge 602 implant in the right ear as a CROS. During implant activation in the Matrix test with the Bonebridge implant, the patient achieved SRT= –10.3 dB SNR.

Conclusions: Duplication of the internal auditory canal is pathognomonic for severe cochlear nerve hypoplasia or aplasia, which may have a significant impact on the choice of treatment and implant. It is essential to perform an imaging study before deciding on implantation. In the case of an isolated canal anomaly without a cochlear defect, hearing screening at birth may not detect a hearing loss. In this defect, it is possible to record otoacoustic emissions in an unaltered cochlea with impaired conduction through the hypo- or aplastic auditory nerve, as the embryogenesis of the inner ear and the auditory canal proceeds independently. In the case of a unilateral anomaly with no hearing impairment on the opposite side, bone conduction implantation should be considered as a CROS.

Effectiveness of bone conduction implants in patients with single-sided deafness (SSD)

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Introduction: Single-sided deafness (SSD) significantly affects speech understanding in noisy environments and spatial hearing, reducing overall quality of life. Traditional hearing solutions such as contralateral routing of sound (CROS) hearing aids or cochlear implants may not be suitable for some patients due to anatomical constraints or intolerance. Bone conduction implants offer an alternative rehabilitation approach by transmitting sound from the non-hearing side to the functioning cochlea. This study evaluates the audiological and subjective benefits of active transcutaneous bone conduction implants in SSD patients.

Material and methods: A prospective study was conducted at a tertiary referral center, including 40 participants aged 13 to 48 years (mean: 32.5 years) diagnosed with SSD. The leading causes of SSD were congenital deafness and mumps-related deafness. All participants were deemed unsuitable for CROS hearing aids or cochlear implants due to anatomical limitations or intolerance. Each patient underwent surgical implantation of a bone conduction device on the deaf side, allowing sound transmission to the functioning ear. Speech recognition in noise was assessed using the Polish Sentence Matrix Test. Patient satisfaction and quality of life were evaluated before and after implantation using the Abbreviated Profile of Hearing Aid Benefit (APHAB) questionnaire.

Results: Patients demonstrated a significant improvement in speech recognition in noisy environments. The mean Polish Sentence Matrix Test scores improved from +0.4 dB SNR at the initial assessment to –3.9 dB SNR six months after activation. The APHAB questionnaire results indicated enhanced communication abilities, with a mean benefit score of 20.5 points. The surgical procedures were well tolerated and no major complications were reported.

Conclusions: Bone conduction implants provide an effective and safe rehabilitation option for SSD patients, significantly enhancing speech understanding in noisy environments and overall quality of life. Early intervention with this technology may improve hearing outcomes in individuals with SSD who are not candidates for traditional hearing solutions. Further research is needed to assess long-term benefits and refine patient selection criteria.

First results of the new bone conduction implant SENTIO in patients with conductive hearing loss and patients with mixed hearing loss

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Poland is the third country in the world and the second in Europe where the Sentio implant has been used. The paper describes the efficacy of the implant in a group of 20 patients diagnosed with conductive or mixed hearing loss. The Sentio device is the smallest transcutaneous implant available on the market and consists of an external Sentio 1 Mini sound processor and a Sentio Ti implant placed under the skin. The system works by transmitting vibrations through the skull bone to the inner ear, which is particularly helpful for patients with problems in the outer ear (microtia, atresia). Sentio is also used in patients with hearing loss due to chronic ear infections and after surgery. The size of the device opens up a wide field for a large group of people with hearing loss, including younger patients in the future. The system is comfortable to wear due to its size and convenience. Bone conduction overcomes the limitations of hearing loss in the outer and/or middle ear. Patients implanted with the Sentio implant experience a significant improvement in hearing in a variety of acoustic conditions. Audiological tests show improved hearing and speech understanding. Patients report improvements in sound localisation and reduced noise-induced fatigue. This is confirmed by the Abbreviated Profile of Hearing Aid Benefit (APHAB) questionnaire, which patients complete before and after implantation. Verbal audiometry using Demenko and Pruszewicz one-syllable words was used to assess speech in quiet. Speech understanding in noise was assessed using the Polish Sentence Matrix Test (SNR). The many advantages of the Sentio system make bone conduction technology particularly valuable for people with certain hearing problems who cannot use conventional hearing aids.

Long-term results of bilateral cochlear implantation in a patient with congenital inner ear malformation: incomplete partition type I – a case report

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Introduction: Incomplete partition type I (IP I), also known as cystic cochleovestibular anomaly (CCVA), accounts for approximately 20% of congenital defects of the inner ear and is characterised by: a cochlea lacking the modiolus and spiral lamina, giving it the appearance of an 'empty cyst', an enlarged cystic vestibule and a wide connection between them. The modiolus defect may be subtotal or total, with the latter – total modiolus aplasia – resulting in communication between the cochlea and the internal auditory canal, with associated hypertension of the inner ear fluids and an increased risk of recurrent meningitis. The pathomechanism of the defect is most likely due to the defective structure of the inner layer of the cochlea (endosteum), which is abraded or absent from the cochlea and vestibule, resulting in a defect in the stapes plate.

Case report: A 13-month-old female patient presented to the Institute of Physiology and Pathology of Hearing, Poland with bilateral profound hearing loss. During surgery, after opening the mastoid process, a defect in the area of the stapes plate was found to be leaking intense fluid – the fistula was successfully repaired. CT and MR imaging revealed a bilateral congenital inner ear defect of incomplete partition type I. Treatment with bilateral cochlear implants followed. During 12 years of follow-up, the patient achieved a speech understanding threshold of mild hearing loss with both implants.

Conclusions: Patients with congenital malformation of the inner ear (incomplete partition type I) may be suitable candidates for cochlear implantation. The results of implantation after long-term follow-up may be satisfactory and comparable to those of patients with other defects. Pre-operative CT and MRI scans are essential to better plan for possible intra-operative complications, fluid leak, stapes plate defect, selection of an appropriate implant electrode. Of particular note in intraoperative management are careful inspection of the stapes plate for a defect with CSF leakage, with possible removal of the cyst and provision of a fistula to prevent the development of recurrent meningitis, and careful sealing of the cochleostomy after insertion of the cochlear implant electrode.

Removal of a metallic foreign body from the Eustachian tube by anthromastoidectomy – posterior tympanotomy in a welder with a cerebellopontine angle tumour: a case report

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Introduction: Metallic spatters generated during welding that reach small sizes, high velocities and high temperatures can penetrate the middle ear and the Eustachian tube.

Case report: A case report of the surgical treatment of a welder treated at the Institute of Physiology and Pathology of Hearing, Poland who had to remove a ferromagnetic foreign body from the Eustachian tube due to the need to monitor a tumor of the cerebellopontine angle. This is the first such case report of removal of a metallic foreign body from the Eustachian tube by anthromastoidectomy – posterior tympanotomy.

Conclusions: Difficult to heal chronic otitis externa or otitis media in a welder should prompt a search for a retained foreign body in this location. If the foreign body has penetrated the Eustachian tube, there is a possibility of removal by anthromastoidectomy – posterior tympanotomy. Use personal protective equipment: ear protection with ear muffs or ear plugs during welding.

Sentio system used in CROS configuration in patient with unilateral deafness – case report

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The paper describes the first case of a patient with unilateral deafness treated with the Sentio device, an implant that uses bone conduction of sound. The operation was performed at the World Hearing Centre at the Institute of Physiology and Pathology of Hearing in Kajetany.

Single-sided deafness (SSD) is described as a profound hearing loss in one ear with normal hearing in the other. For many years it was thought that patients with unilateral hearing loss did not need any treatment, hearing aids or implants. It was also believed that speech in SSD patients developed normally and that there were no problems with understanding speech. However, recent reports have shown that patients with unilateral deafness face many difficulties in everyday life, including sound localisation, understanding speech over noise and lack of binaural hearing. Due to various factors, it is not always possible to use a cochlear implant in patients with profound hearing loss. These difficulties were addressed by Prof. Henryk Skarzynski and Prof. Piotr H. Skarzynski and their team who implanted the Sentio system in the CROS configuration in a patient suffering from SSD. The implant is implanted on the side of the deaf ear and uses vibrations to stimulate the opposite ear. Normal hearing in the better ear is required for use of the implant in the CROS configuration. With this solution, it is possible to improve speech understanding in difficult acoustic conditions and reduce the "head shadow" effect. The benefits associated with the Sentio implant are confirmed by the APHAB (Abbreviated Profile of Hearing Aid Benefit) subjective hearing assessment questionnaire. Among the most important are: improvement in hearing ability, support in learning and working, and overall improvement in quality of life. The Polish Sentio Matrix Test was used to assess understanding in noise. The Sentio system is one of the latest developments in hearing technology. It is an effective form of treatment for SSD patients for whom a cochlear implant is not an option and classic hearing aids are not profitable. The Sentio implant in CROS configuration facilitates daily functioning and reduces the problems caused by hearing loss.

The A2ml1-knockout mouse as an animal model for non-syndromic otitis media

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Introduction: Inflammation and infection of the middle ear, known as otitis media (OM), is a leading cause of hearing loss and the most frequently diagnosed disease in children worldwide. Traditionally, mouse models for OM rely on inducing acute infection through inoculation of the middle ear, e.g. with the human otopathogen non-typeable Haemophilus influenzae, and with very few genetic models with spontaneous or chronic OM. A2ML1 variants, including loss-of-function variants, were associated with susceptibility to OM in humans, but no animal model has been reported for A2ml1-related OM. Here, we report our middle ear findings in a mouse line with a CRISPR-induced knockout (KO) of A2ml1.

Objectives: The objectives of this project were to determine the presence of spontaneous OM and any phenotypes consistent with a Noonan-like syndrome via body morphology measurements, cranial x-rays, and histologic examination of the ME mucosa of KO mice.

Material and methods: Mice were X-rayed prior to harvest to determine if there are craniofacial or skeletal abnormalities. Tissues from mouse middle ears, as well as other upper respiratory mucosal tissues, were harvested. The harvested middle ear bullae were examined under microscope and submitted for histologic preparation to study phenotypic indications of OM. RNA samples isolated from middle ear tissue were assayed for expression of genes correlated with A2ML1 expression in humans.

Results: Data from a total of 119 mice (35 wildtype, 40 heterozygous, 44 homozygous) will be presented, with each analysis being performed on subsets of these mice. There were no significant craniofacial differences by genotype ($n = 22$). Findings in mice with the A2ml1-KO indicated an increased incidence of OM ($n = 29$; Fisher exact two-sided $p = 0.02$) with tympanic membrane perforations or thickening, as well as cases of middle ear effusion, inflammatory cells, or fluid from histologic sections. Dsp was upregulated in the middle ear tissues of homozygous mice (Wilcoxon test $p = 0.001$).

Conclusions: Thus far, our results in this A2ml1-KO mouse line indicate spontaneous occurrence of OM and dysregulation of Dsp in the middle ear as a potential disease mechanism for A2ml1-related OM.

The Stimulation of Polymodal Sensory Perception by Skarzynski 2.0 (SPPS-S 2.0)

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Introduction: Central auditory processing disorders are a set of symptoms that can significantly affect an individual's daily functioning. According to current guidelines, the primary and most important pillar on which rehabilitation interventions for patients with central auditory processing disorders should be based is the use of auditory training. One such method is the Skarzynski Method of Polymodal Sensory Perception Stimulation.

Objective: The aim of this study is to present new therapeutic possibilities through the introduction of the new version of the Skarzynski Method of Polymodal Sensory Perception Stimulation 2.0.

Conclusions: The continuous progress in technological capabilities and ongoing research leads to the development of various diagnostic and therapeutic tools. The introduction of the Skarzynski Method of Polymodal Sensory Perception Stimulation 2.0 significantly expands therapeutic options for patients with central auditory processing disorders.

The use of bone-conduction implants in patients with rare genetic syndromes associated with ear malformations

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Introduction: Bone-conduction implants have emerged as a viable solution for patients with conductive or mixed hearing loss who are unable to use conventional hearing aids due to anatomical abnormalities. Individuals with rare genetic syndromes, such as Treacher Collins, Goldenhar, Klippel–Feil, Charge syndromes, and mandibulofacial dysostosis with microcephaly, often experience significant hearing impairments due to external and middle ear malformations. This study evaluates the effectiveness and safety of bone-conduction implants in this patient population.

Material and methods: A retrospective cohort study was conducted at a tertiary referral center, including nine patients diagnosed with the aforementioned syndromes. All patients exhibited conductive or mixed hearing loss and were not candidates for conventional hearing aids. Bone-conduction implants were surgically placed, and hearing improvement was assessed through pure-tone audiometry and speech audiometry. Additionally, subjective satisfaction was measured using the Abbreviated Profile of Hearing Aid Benefit (APHAB) questionnaire.

Results: The results demonstrated significant hearing improvements following implantation. Audiometric assessments showed enhanced hearing thresholds and speech recognition in both quiet and noisy environments. Patients reported high satisfaction levels, noting improved daily communication abilities. The surgical procedures were performed safely, with a low incidence of minor complications.

Conclusions: These findings highlight the importance of bone-conduction implants as an effective intervention for managing hearing loss in patients with rare genetic syndromes associated with ear malformations. Early implantation supports auditory rehabilitation, facilitates speech development, and enhances overall quality of life. Further research and clinical application of this technology may improve outcomes for this unique patient population.

The use of the new OSIA OSI300 in adults and children with conductive hearing loss and mixed hearing loss

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The study will evaluate the effects of the Osia OSI300 implant in a group of 20 patients with conductive or mixed hearing loss. The Osia device is a percutaneous active bone conduction implant. In 2024, the first operation with the Osia OSI300 in a child was performed at the Institute of Hearing Physiology and Pathology, representing a breakthrough in the treatment and rehabilitation of hearing loss in a younger group of patients. Thanks to the piezoelectric stimulation used, the implant has exceptional high frequency sensitivity compared to other bone anchored implants. In addition to hearing benefits, the Osia OSI300's advanced technology allows for full diagnostic imaging (MRI) without the need to remove the implant. A number of benefits in the treatment of hearing loss have been observed in patients who have received the implant. The first is an improvement in hearing quality in both quiet and noisy environments, with a consequent reduction in speech difficulties. Audiological studies show a significant improvement in speech understanding in both quiet and noise. The degree of speech discrimination was assessed using the Polish Demenko and Pruszewicz Verbal Test, while the Polish Matrix Sentence Test was used to assess understanding in noise. Patients' subjective impressions based on the APHAB (Abbreviated Profile of Hearing Aid Benefit) questionnaire include better discrimination of sounds in noise, improved sound quality and clearer perception of high

frequency sounds. Patients appreciate the aesthetics and the lack of restrictions in daily use. The Osia OSI300 system opens up new possibilities for hearing impaired people, thanks to its advanced technology. This is especially true for those who have not been successful with traditional hearing aids.

Valsalva maneuver during computed tomography for the diagnosis of tracheal diverticulum: a case report

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Objectives: Tracheal diverticula constitute a subtype of paratracheal air cysts (PACs) that are characterized by a connection with the trachea through a thin neck. Patients with tracheal diverticulum rarely develop symptoms and are usually diagnosed on computed tomography (CT) performed for an unrelated indication. However, identifying the communication with the trachea on imaging may be challenging.

Material and methods: This report presents the case of a 55-year-old male patient who was referred to the emergency department with a possible fracture of the scapula caused by a fall from a height of three meters and was diagnosed, incidentally, with a paratracheal air cyst on thoracic CT.

Results: The paratracheal air cyst was recognized as a tracheal diverticulum by having the patient perform the Valsalva maneuver during CT. The cyst's volume increased in all three dimensions and a communication with the lateral tracheal wall was revealed, confirming the suspicion of tracheal diverticulum.

Conclusions: Diagnosing and distinguishing tracheal diverticula from other PACs is challenging, even with advanced imaging techniques such as multidetector CT and multiplanar or 3D reconstruction. Accurate identification of tracheal diverticula is crucial for effective patient management, as early diagnosis may inform monitoring strategies and surgical considerations if symptoms arise. This case report proposes that differential diagnosis can be accomplished safely and effectively by utilizing the Valsalva maneuver during CT scans.

XIV International Tinnitus Seminar and 3rd World Tinnitus Congress, 13–15 April 2025, Warsaw/Kajetany, Poland

Dear Colleagues,

We are proud to present the collected abstracts of the **3rd World Tinnitus Congress** and the **XIV International Tinnitus Seminar**.

Tinnitus research meets with growing social and clinical interest, as the number of people suffering from tinnitus is growing steadily worldwide. The patients and therapists demand strategies and therapies to prevent and alleviate tinnitus. The Organizers of this Congress aim to bring together scientists and clinicians to discuss the latest ideas, results, and challenges and to spark new insights for research and clinical work.

We welcome you to the Congress and wish you a successful meeting!

Prof. Henryk Skarzynski, MD, PhD, dr. h.c. multi
President

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XIV INTERNATIONAL TINNITUS SEMINAR AND 3RD WORLD TINNITUS CONGRESS, 13–15 APRIL 2025, WARSAW/KAJETANY, POLAND

The Tonndorf Lecture

Cognitive behavioural therapy (CBT): from the Greek stoics in the first millennium BC to the modern medicine for treatment of tinnitus and sound intolerance

Aazh H.

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Tinnitus is the perception of sound(s) in the absence of acoustic stimuli, while hyperacusis and misophonia can be defined briefly as the perception of certain sounds as too loud (for hyperacusis) or as extremely annoying (for misophonia). When tinnitus, hyperacusis, and misophonia cause significant distress and impairment in the individual's social, occupational, recreational, and other day-to-day activities, then they are classified as tinnitus disorder or clinical hyperacusis/misophonia, respectively, which warrants therapeutic interventions. One of the most evidence-based interventions for management of the distress caused by tinnitus, hyperacusis and misophonia is cognitive behavioural therapy (CBT). The philosophical underpinnings of CBT can be traced back thousands of years to the time of the Greek Stoics, who believed that destructive emotions result from errors in judgment. In CBT, the distress caused by tinnitus or certain sounds (in the case of hyperacusis/misophonia) is conceptualised in the following way. Tinnitus/certain sound(s) can trigger an initial reaction that encompasses emotions, bodily sensations, and behaviors. This initial reaction is often followed by automatic thoughts and appraisal of those thoughts which leads to follow-on reactions that also have components related to emotions (e.g., fear or disappointment), behaviour (e.g., avoiding certain places or activities or reassurance seeking) and bodily sensations (tension or palpitations). The follow-on reactions may lead to further evaluative thoughts which will feed back to the reactions, creating a vicious cycle of distress. When tinnitus or certain sounds trigger the vicious cycle, this brings them to the focus of attention as opposed to allowing the habituation process to take place. CBT helps the patients to understand and modify the relevant cognitive processes and behavioural patterns in order to break the vicious cycle of tinnitus/hyperacusis/misophonia-induced anxiety and annoyance. The aim of this Tonndorf Lecture is to reflect on the theoretical and philosophical underpinnings of CBT and its application for management of tinnitus and sound intolerance, the progress to date regarding providing CBT in clinical practice for this population, and the actions needed to further that progress in future.

Dr. Hashir Aazh PhD is the director of Hashir International Institute for Misophonia, Tinnitus & Hyperacusis. He has published over 60 research papers in the field of audiology. He is the founder of the biennial International Hyperacusis and Misophonia Conference.

Invited Lecture

Neurobiology of tinnitus and hyperacusis

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According to conservative estimates, tinnitus causes annual socio-economic costs (e.g. in Germany) of almost 22 billion euros (around 4,800 euros per patient), mainly due to twice as many sick days (26 days) as the average in the population (11 days) by tinnitus patients. To date, there is no causal tinnitus therapy, probably due to a lack of differentiation between tinnitus with and without hyperacusis, which has made it difficult to identify a neuronal correlate of tinnitus. Important in the context that it is mainly tinnitus patients with hyperacusis who suffer significantly more from their disease and therefore primarily require therapy. (Knipper et al., J Neuroscience 2020; Knipper et al., JARO 2022). Using objective diagnostic procedures and a differentiation step of tinnitus without and with hyperacusis, an impairment of fast (high-SR) auditory processing was proposed as a neural correlate of tinnitus, that via a loss of tonic inhibition in feedforward and feedback PV-IN networks through reduced noise suppression and reinforced attention to the resulting noise in the affected frequency region makes tinnitus explainable (Knipper et al., J Neuroscience 2020; Knipper et al., JARO 2022). Our aim here is to better identify the intracortical network changes in the auditory and associated brain regions (if with or without hyperacusis) using the high-resolution time-sensitive

MEG-OPM technique. We are explicitly interested in whether and how specific peripheral cochlear synaptopathies can cause attention-controlled perceptual disorders such as tinnitus and hyperacusis via changing resting or evoked high-frequency brain oscillation patterns, the prerequisite to use this diagnostic approach for screening for individualized, targeted interventional therapies.

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Workshops

Assessment and management of tinnitus and hyperacusis in children

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Although tinnitus and hyperacusis are often considered a problem associated with adulthood, they are also observed in children and young people, with prevalence estimates suggesting that approximate 3% of children can experience either. Tinnitus and hyperacusis cause problems in many different aspects of life, such as psychological health, cognitive performance and isolation and in different areas of life such as home and school. Despite this, tinnitus and hyperacusis in children are relatively unrecognised problems with resources for assessment and management often being adult based.

The aim of this workshop is to provide an update on the current position of research on tinnitus and hyperacusis in children. It will highlight the problems reported by children and young people. Whilst there are many questionnaires available to measure different aspects of tinnitus complaint in adults, until recently, there were no self-report questionnaire measure of tinnitus or hyperacusis that has been developed for or is suitable for use with children. This workshop will introduce the newly developed self-report measures of tinnitus and hyperacusis impact for use by children and young people aged 8-16 years old (Impact of Tinnitus in Children Questionnaire (iTICQ) and Hyperacusis in Children Questionnaire (HICQ). Use of these self-report measures can support clinical practice by highlighting the specific impacts of these conditions on the individual child and young person to both facilitate discussions with children/ young people and parents in clinical appointments and inform decisions regarding the most appropriate treatment.

The keynote lecture within this session will provide an update on the UK guidance for management of tinnitus in children based on the UK National Institute for Health and Care Excellence Guidelines on Tinnitus Assessment and Management and the British Society of Audiology's multidisciplinary Practice Guidance on Management of Tinnitus in Children currently in redevelopment. The Practice Guidance aims to provide guidance on a child friendly approach to assessing a child or young person with tinnitus, practical supportive strategies and a toolkit of resources to help children and young people manage troublesome tinnitus.

How can we learn about tinnitus neuro correlates from our daily observations? Interactive workshop

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In this interactive workshop, we will discuss how our daily observations can give us insight to neural correlates of tinnitus. We will discuss topics comprising e.g: (i) Is it true that tinnitus does not occur with congenital deafness? (ii) Is it correct that tinnitus occurs in CI-implanted children and adults when the CI is turned off? (iii) Are or are not these phenomena related to the so-called Heller and Bergman experiment from 1953, which states that almost everyone in a soundproof chamber experiences tinnitus? The aim is to provide an engaging session and encourage participants to discuss and share their views and experiences about the connections between tinnitus and how it develops. The workshop instructors will facilitate the discussions and introduce the topics.

Acknowledgment and funding: This work was supported by the Deutsche Forschungsgemeinschaft DFG KN 316/13-1, DFG RU 713/6-1, ERA-NET NEURON JTC 2020: BMBF 01EW2102 CoSySpeech and FWO G0H6420N.

Introduction to audiologist-delivered cognitive behavioural therapy (CBT) for tinnitus, hyperacusis and misophonia

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Tinnitus is the perception of sound(s) for which there is no identifiable corresponding acoustic source. Hyperacusis is the perception of certain everyday sounds, such as domestic noise or noise in public places, as too loud or painful in such a way that it causes significant distress and impairment in social, occupational, recreational, and other day-to-day activities. Misophonia is defined as the experience of

extreme annoyance, disgust, anger, and anxiety when hearing one or more specific sounds often related to chewing, lip smacking, breathing, and so on. Several studies support the efficacy of cognitive behavioural therapy (CBT) for the rehabilitation of patients with misophonia, hyperacusis and tinnitus. In this workshop, a programme of audiologist-delivered CBT comprising 14 therapy sessions will be introduced. This is a specialised therapy for tinnitus, hyperacusis and misophonia rehabilitation and comprises four stages: I) Assessment, II) Preparation, III) Active treatment, and IV) Maintenance stage. The content of the intervention is consistent with the key CBT theories and methods. However, unlike general CBT, the strategies used in these 14 sessions are fine-tuned to address the issues that are specific to the distress caused by the tinnitus, hyperacusis, and misophonia. The first 10 sessions are weekly. Then the gap between the sessions increases to 2 weeks, 1 month, 3 months, and 6 months. Each session lasts between 45 and 60 minutes. The content of the therapy briefly comprises (1) education about tinnitus, hyperacusis and misophonia and relevance of CBT, (2) enhancing patient's motivation to engage with the therapy process, (3) setting goals, (4) formulation, (5) identifying upsetting automatic thoughts, (6) identifying avoidance and ritualistic behaviors, (7) SEL (Stop Avoidance, Exposure, & Learn from it), (8) KKIS (Know, Keep on, Identify, Substitute), (9) identify and challenge deeper thoughts and beliefs, and (10) integrating CBT into lifestyle (CBStyle).

Keynote Lectures

Children's Tinnitus Questionnaire

Raj-Koziak D.[1], Gos E.[2], Skarzynski P.H.[2,3], Skarzynski H.[4]

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Introduction: Tinnitus in children occurs more frequently than is diagnosed. If a child, accompanied by guardians, reports experiencing tinnitus, it indicates that it is clinically significant and requires further diagnostics. Tinnitus is usually subjective, and questionnaires are used to assess the severity of tinnitus.

Aim: The aim of this work is to present process of creating and promoting the Children's Tinnitus Questionnaire.

Material and methods: The development of the tool consisted of several stages. After a pilot study involving 12 children suffering from tinnitus, a validation study was conducted with 192 children aged 11 to 14 years with tinnitus. The children underwent audiometric testing, completed the Visual Analog Scale (VAS), and filled out the beta version of the questionnaire.

Results: As a result of the validation process, a new 11-item questionnaire concerning tinnitus in children was created. It includes items related to the impact of tinnitus on functional, cognitive, emotional, and social spheres. The validity of the new tool was established by finding significant correlations between it and the VAS loudness ($r = 0.42$), VAS annoyance ($r = 0.67$), and VAS coping ($r = -0.41$). Validity was also confirmed by measuring differences in CTQ scores among four groups of children with graded frequencies of tinnitus. Internal consistency, assessed using Cronbach's alpha, was high ($\alpha = 0.82$).

Conclusions: The Children's Tinnitus Questionnaire is the first fully validated, multi-item tool designed specifically for children. The questionnaire can provide essential insights and foster better strategies for prevention, treatment, and, improved outcomes for children with tinnitus.

COVID-19 and tinnitus

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COVID-19 is a respiratory disease caused by the new coronavirus SARS-CoV-2, for which the first cases were reported in China, by December 2019. The spectrum of clinical presentations is wide, ranging from asymptomatic cases to a severe acute respiratory syndrome, sometimes with multiple systems involvement. Viral infections, including those related to respiratory virus, may cause hearing loss and, by extent, considering its pathophysiology, tinnitus. The lecture will provide a comprehensive review on COVID-related tinnitus, its prevalence along the pandemics timeline, effects of vaccination, vaccine-related tinnitus and the speaker personal experience on the subject, supported by published data and ongoing research.

Facts and fables of TMD-related somatic tinnitus

van der Wal A.[1,2]

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Somatic tinnitus (ST) is pathophysiologically linked to neural activity in connecting fibers between the dorsal cochlear

nucleus (DCN) and the somatosensory medullary nuclei. This mechanism may explain the relatively high prevalence of tinnitus among patients with temporomandibular disorders (TMD) (30.4–64%) and suggests that TMD treatment could benefit individuals with ST. However, managing TMD can be complex, as multiple healthcare providers offer various treatment approaches, making it difficult for clinicians to determine the most appropriate referral pathway. Despite increasing interest in this field, misconceptions persist regarding the diagnosis and management of TMD-related somatic tinnitus. This presentation aims to distinguish evidence-based knowledge from common myths, providing a critical evaluation of the current understanding of its pathophysiology, diagnostic criteria, and treatment strategies while addressing prevailing misconceptions. Conclusions: While TMD-related somatic tinnitus is a recognized condition, misconceptions persist regarding its mechanisms and management. This presentation highlights evidence-based insights and challenges widespread myths, emphasizing the need for interdisciplinary diagnose and treatment.

Intratympanic injections in tinnitus

Elzayat S.

ORL-HNS, Kafelsheikh University, Kafr El Sheikh, Egypt

Tinnitus is annoying sensation and has no definite treatment due to varies mechanisms of pathogeneses. One modality of treatment is local medication by intratympanic injections. We experienced two clinical trials for this point. I will demonstrate this object in my talk.

Medical treatment of tinnitus: evidence-based evaluation

Elzayat S.

ORL-HNS, Kafelsheikh University, Kafr El Sheikh, Egypt

Although tinnitus has a prevalence between 20 and 48%, the currently recommended management for tinnitus, such as tinnitus support and psychologic therapies, are relatively time-consuming and expensive. Several new pharmacologic treatments designed for tinnitus patients without specific origin had been developed but their efficacy remains unclear. We will conduct a review about the latest drugs used in primary tinnitus and the results in brief.

Personality traits and pharmacological treatment with Olanzapine: a double blind study

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Introduction: Psychological factors were previously related to tinnitus perception and distress, playing a modulatory role. Previous work demonstrated that personality traits may be a predictor of the severity of tinnitus, with impact on the individual response to tinnitus measuring personality, behavior and neurobiological techniques. The big Five model can classify personality traits in order to be evaluated neuroscientifically. Several medications have been used over the last few decades to treat tinnitus, always with partial results. To date, there is no medication approved by the FDA for the treatment of tinnitus; all medications used have been prescribed "off-label". Glutamate antagonists, GABA agonists, dopaminergic agonists and antagonists and serotonergic antagonists have already been evaluated in several studies, with results that are often not replicated, which may be the result of methodological differences, but also the heterogeneity of tinnitus itself. Olanzapine is an antipsychotic drug with a broad pharmacological profile, through action on several receptor systems. In preclinical studies, olanzapine demonstrated affinity for serotonin receptors 5HT2A/C, 5HT3, 5HT6; dopamine D1, D2, D3,D4, D5; muscarinics M1-5; a1-adrenergic and histamine H1. Olanzapine is well absorbed after oral administration, reaching maximum plasma concentrations within 5 to 8 hours. The perception of tinnitus occurs in the prefrontal region, temporal region and temporoparietal association areas, as well as in the Limbic System. Dopaminergic neurotransmitters are present in these same areas responsible for the perception of tinnitus, which control attention, stress, emotions, learning, memory and motivational behavior.

The dopaminergic pathway can be modulated by receptors and their agonists and antagonists, reducing the perception of tinnitus.

Dopamine (DA) and norepinephrine (NE) have been repeatedly implicated in neuropsychiatric vulnerability, in part through their roles in mediating decision-making processes. [Cathy Chen et al, August 2024]

Aim: To analyze tinnitus severity amongst different personality traits. Personality neuroscience indicates that differences between individuals related to thoughts, cognition, motivation and emotion imply different patterns of brain functioning. The model of the 5 personality factors known as Big Five

or Five Factor Model (FFM) has offered hypotheses serving as a guide for research in personality neuroscience. Research in the field of personality has employed several methods.

Material and methods: Fifty tinnitus patients with tinnitus lasting for at least 6 months filled out the questionnaires NEO-FFI and THI, and also VAS scales for volume and distress and Clinical Global Impressions Scale (CGI). The THI and VAS scores were statistically correlated to the personality traits. The drug treatment chosen was olanzapine at a dose of 5 mg daily for 3 months. The research lasted 7 months, being cross over against placebo with a 1 month wash out.

Results: Most frequent personality trait scored was neuroticism (36% high and 32% very high). For the other four personality traits, high and very high scores ranged from 16% to 18%. No correlation was found concerning VAS for distress. Graph 1 shows correlation between VAS for volume and the traits and Graph 2 between THI scores and the traits. For statistical reasons, patients with neuroticism trait were divided in subgroups "Low" (including very low, low and medium; in blue), "High" (in orange) and "Very High" (in green), while the other traits were divided in subgroups "Low" (including very low and low; in blue), "Medium" (in orange) and "High" (including high and very high; in green). Olanzapine treated period: Significant effect of the "time" component. Significant reduction from the initial to the final moment in the VAS volume ($p < 0.0001$), in the VAS nuisance ($p < 0.0001$), in the CGI ($p = 0.002$) and in the THI ($p < 0.0001$), regardless of the initial drug. Association of personality traits with response to olanzapine treatment. It was possible to observe clinical trend (12 patients off):

- VAS volume and discomfort drop > 50% – more significant improvement, high level of neuroticism, agreeableness and conscientiousness;
- THI drop > 50% – significant improvement, high level of neuroticism and conscientiousness.

Somatosensory tinnitus: recent developments in diagnosis and treatment

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Somatosensory or somatic tinnitus (ST) is a type of tinnitus where changes in somatosensory input from the head-neck area are one of the influencing factors of a patient's tinnitus. As there are often several influencing factors, identifying a clear somatosensory influence on an individual patient's tinnitus is often a challenge. Therefore, a decision tree using four clinical criteria has been proposed that can help diagnose ST with an accuracy of 82.2%, a sensitivity of 82.5%, and a specificity of 79%. Once correctly diagnosed, patients can be successfully treated using a musculoskeletal physical therapy treatment. This type of treatment can either be directed at cervical spine dysfunctions, temporomandibular disorders, or both and consists of a combination of counselling, exercises, and manual techniques to restore normal function of the cervical spine and temporomandibular area. Other techniques have been suggested but often need further investigation in larger RCTs. This lecture will give an overview of current knowledge on ST diagnosis and treatment options.

The "missing" relationship between OAEs and tinnitus

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Back in 1990, Susan Norton described the tinnitus + OAE relationship as follows "Attempts to identify the mechanisms underlying tinnitus and to develop effective treatments have been frustrating, in part because there are no objective measures of tinnitus. Following Kemp's initial reports of evoked and spontaneous otoacoustic emissions (OAEs), many people hoped that OAEs were an objective correlate of tinnitus." Thirty-five years later, the relationship between OAEs and tinnitus remains as phantomatic as it was in the early 90s. The actual problem stems from two main causes: (1) the difficulty of identifying correctly the genesis mechanism of tinnitus and its location in the auditory pathway, per studied case; (2) The spontaneous otoacoustic emissions (SOAEs), which are primarily considered in this relationship are difficult to record efficiently in the second, third, fourth decade of life. This in-depth review presents old and modern data, representing both sides of the coin (there is and there isn't a relationship) of this continuing argument.

Translating non-invasive brain stimulation into a treatment for tinnitus

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Introduction: Neuromodulation therapies aim to interfere with abnormal neural activity and drive neuroplastic changes. Non-invasive brain stimulation aims to interrupt neuronal activity associated with tinnitus and restore typical levels of activity. This change in activity should alter or interrupt tinnitus percept. Neuromodulation therapies use electromagnetic, electrical, acoustic and more recently ultrasound stimulation. However, precise neuronal mechanisms of those interventions are not fully understood, and evidence of their effectiveness is limited.

Material and methods: A comprehensive research programme at NIHR Nottingham Biomedical Research Centre aims to identify the most promising non-invasive therapies for tinnitus, optimise the stimulation protocols and conduct trials of those interventions in participants with tinnitus. Two systematic reviews have been conducted looking at effectiveness of neuromodulation therapies and optimal stimulation protocols. We used magnetoencephalography (MEG) to investigate changes in the brain activity of people with tinnitus while undergoing transcranial direct current stimulation (tDCS) and are currently conducting a pilot study of multiple sessions of tDCS for tinnitus. A current modelling study explored the inter individual variability in current reaching the bran during the tDCS stimulation and the feasibility of individualised dose-controlled stimulation in people with tinnitus. Our new strand of work is assessing

safety and feasibility of ultrasound vagal nerve stimulation (U-VNS) for tinnitus.

Results: Systematic reviews identified tDCS as the most promising non-invasive brain stimulation method for the treatment of tinnitus and co-morbid symptoms. A set of optimal stimulation parameters has been established and the trial protocol formulated. MEG revealed that tDCS stimulation induced oscillatory changes in some frequency bands that could be localised to the frontal or temporal regions and at the whole brain level. Anatomical differences between participants affected the level of the current reaching the brain, indicating the potential need for individualised stimulation protocols. New methods, such as U-VNS open new avenues for non-invasive treatments for tinnitus.

Conclusions: This research programme is an important step towards developing safe and minimally invasive treatment for tinnitus. It provides insight into tinnitus mechanisms and treatment-related changes and informs the design of the future trials of non-invasive brain stimulation for tinnitus.

Treating tinnitus with electrical stimulation

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Introduction: Tinnitus is the perception of sound without an external source and can severely impair individuals. Currently, no pharmacological treatments exist. Our study evaluated the immediate effects of non-invasive electrical stimulation through the ear canal on tinnitus loudness and distress to identify factors influencing the outcomes.

Material and methods: Sixty-six chronic tinnitus patients (29 women, 37 men, mean age 54.4 ± 10.4) were enrolled at a tertiary hospital from December 2019 to December 2021. They received 10 minutes of stimulation through the ear canal over three days. Loudness and distress were assessed using visual analog scales before and after stimulation.

Results: After three days, loudness decreased in 47% of patients; 45.5% had no change, and 7.6% reported worsening. Tinnitus severity improved in 36.4%, while 59.1% had no change, and 4.5% worsened. Women responded positively to therapy sooner than men. Notably, patients with compensated tinnitus showed reduced distress, unlike those with uncompensated tinnitus. Those with bilateral tinnitus improved earlier than unilateral cases, and age did not affect outcomes.

Conclusions: This study suggests that non-invasive electrical stimulation may be a promising strategy for identifying patients suited for advanced therapies like extracochlear anti-tinnitus implants, significantly impacting tinnitus management and patient care.

Oral Presentations

An experimental study on optimal bone cement thickness for passive acoustic reduction for pulsatile tinnitus

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Objective: To determine the ideal bone cement thickness for optimal passive sound reduction in pulsatile tinnitus (PT) and to minimize surgical invasiveness when resurfacing sigmoid sinus wall anomalies (SSWA).

Material and methods: An acoustical impedance tube was used to measure the transmission loss of bone cement discs (15 mm in diameter), which were trimmed to various thicknesses (2.5, 5.0, 7.5, 10.0, 12.5, 15.0 mm) and averaged over three trials. Additionally, PT loudness in 18 subjects with SSWA was measured using the EAC-R technique and spectrotemporal analysis.

Results: At a thickness of 2.5 mm, transmission loss was less than 10 dB for frequencies above 180 Hz. Thicknesses of 5.0 mm and 7.5 mm achieved transmission losses of over 15 dB across all frequency ranges. When the bone cement thickness reached 10 mm or more, transmission loss at frequencies below 500 Hz was at least 35 dB. The average PT loudness measured was 4.7 dB.

Conclusions: A bone cement thickness of less than 5.0 mm may indicate a risk of surgical failure. A thickness greater than 5.0 mm, along with complete resurfacing of all dehiscences, is recommended to effectively prevent PT.

Coping strategies among tinnitus patients in Malaysia: an early phase approach

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Introduction: Tinnitus is a condition where patients will hear sounds without an external stimulus. A large part of the adult population experiences this symptom but never seeks professional help, while others have devastating complaints in daily life. To some extent, it can cause stress, attention breakdown, and psychological distress. This suggests that the impact of tinnitus varies among patients and may be influenced by coping strategies and multiple psychological factors.

Material and methods: This study attempts to understand how patients cope with tinnitus prior to seeking professional help. Cross-sectional study of patients visiting the tertiary tinnitus referral center in hospitals under the Malaysia Ministry of Health (KKM). 12 centers were involved, and data was obtained from a total of 56 patients from January 2024 till June 2024. The interview focus is on obtaining the information on early responses of patients toward tinnitus prior to seeking a professional or audiologist's help.

Result: The finding showed most of the patients did not know what to do and hoped tinnitus would disappear by itself (65%), applied relaxation activities (21%), sought a doctor's treatment (57%) and found information about tinnitus in social media (16%). This finding will help a clinician with in-depth knowledge related to the management of tinnitus. This data showed the importance of awareness regarding tinnitus needs to be improved.

Conclusions: The majority of patients in the early stage/phase of tinnitus are unclear about how to overcome it. This study also suggested that information related to tinnitus in the Malaysian population is low. Tinnitus-related awareness programs need to be improved and expanded.

Development of an innovative app for the diagnosis and treatment of tinnitus using sound therapy and nutritional supplements

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Tinnitus is a prevalent hearing condition characterized by the perception of ringing in the ears, significantly affecting the quality of life of individuals. In response to this clinical need, we have developed an advanced mobile app that facilitates both the diagnosis and treatment of tinnitus. Using artificial intelligence algorithms, the app accurately diagnoses the level and nature of tinnitus according to tone, intensity, frequency and its impact on the quality of life through a series of interactive hearing tests and personalized questionnaires. Once diagnosed, the user is guided through a comprehensive treatment plan that combines sound therapy and nutritional supplements. Sound therapy employs a library of therapeutic sounds that can be customized to mask tinnitus and promote habituation. In addition, the app suggests specific nutritional supplements based on scientific evidence supporting their efficacy in mitigating tinnitus. Users can track their progress through the app, adjust their treatments as needed, and access additional educational resources. This app represents a significant advancement in tinnitus self-management, offering a holistic and accessible approach to improving hearing wellbeing. Results: Participants who achieved masking with their hearing aids had a greater reduction in THI-TQ-VAS scores. Masking was more likely to be achieved when participants had good low-frequency hearing and the tinnitus pitch fell within the hearing aid frequency range. Conclusions: The results support that the use of hearing aids with masking and counseling for tinnitus management may be a significant contributor to hearing aid success, implying that high-frequency amplification may be effective in acute tinnitus.

Development of an unguided digital intervention for hyperacusis: internet Self-Help, Understanding and Support for Hyperacusis (iSHUSH)

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Introduction: Hyperacusis, a reduced tolerance to sounds, can be complicated and challenging to live with. People can become distressed, anxious, and often isolated. These problems are exacerbated by the lack of information and knowledge of appropriate coping strategies. Digital health interventions provide an important platform to improve accessibility to education, support, and coping strategies for hyperacusis, and offer an alternative option for those unable or unwilling to attend clinics.

Aim: The aim of this project was to develop an unguided educational, self-help website for hyperacusis.

Material and methods: Intervention planning included qualitative interviews to identify patients and healthcare professional's (HCPs) experiences, needs and challenges of hyperacusis, and a meta-ethnography review to identify barriers and facilitators to engaging with digital interventions. Evidence was triangulated with expert consultation to inform the interventions guiding principles and logic model. The intervention was optimised through think-aloud interviews with patients and HCPs, and named the internet Self-Help, Understanding and Support for Hyperacusis (iSHUSH).

Results: Key hyperacusis-related challenges highlighted during development of the website included the use of safety behaviors (e.g. avoidance), uncertainty of risks associated with ear protection, and difficulties managing emotions. Considerations for the intervention design included a need to legitimise the hyperacusis experience, increase confidence in engaging with different sound environments and setting goals, and recognising that some intervention content might only be relevant to some people who have hyperacusis. Feedback informed intervention modifications to maximise acceptability.

Conclusions: Our systematic approach to intervention development enabled us to understand the experiences of adults with hyperacusis, target the key challenges/behaviors, and anticipate potential barriers to engagement during development. Through this, we have developed an unguided digital intervention for hyperacusis that appears to be acceptable and potentially engaging to our intended users. The next stage of this research will be to test the acceptability and feasibility of the iSHUSH with intended user and HCPs.

Effectiveness of hearing aids, masking and counselling for tinnitus therapy in sudden sensorineural hearing loss

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Introduction: Tinnitus is a common symptom of sudden sensorineural hearing loss (ISSHL).

Objective: This study aimed to investigate the characteristics and outcomes of acute tinnitus in patients with ISSHL.

Material and methods: To assess the benefits of amplifying hearing aids and tinnitus masking using the Tinnitus Reaction Questionnaire (TQ), Tinnitus Handicap Inventory (THI) and Visual Analogue Scale (VAS) in combination with counselling, to assess whether the degree of masking with hearing aid amplification influenced test scores, to examine whether matched tinnitus pitch predicted the effectiveness of hearing aids in masking tinnitus, and to determine whether prescription of amplification might be desirable in the management of tinnitus when tinnitus pitch is loud. A retrospective evaluation of the clinical outcomes of 185 tinnitus patients fitted with hearing aids was undertaken. The primary outcome measure was the TQ-THIR VAS, with a secondary subjective measure of tinnitus masking.

Efficacy and safety of pharmacological treatment in tinnitus patients

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Introduction: The problem of tinnitus is an important health problem for patients suffering from this disease. Currently, there are no drugs approved by the FDA or EMA for the treatment of tinnitus of various etiologies.

Aim: The aim of the study is to review currently used pharmacological treatment strategies for tinnitus in terms of their effectiveness and safety.

Material and methods: A review study based on the analysis of results from randomized clinical trials (RTC) assessing the effectiveness and safety of tinnitus treatment. The drugs analyzed include: antidepressants (e.g. amitriptyline), melatonin, steroids (dexamethasone), acamprosate, nicergoline, vinpocetine, piracetam, memotropil, ginkgo biloba betahistine, pentoxifylline, anticonvulsants (e.g. gabapentin). The effect of supplementation was also analyzed (e.g. vitamin C, zinc, B vitamins, selenium).

Results: As a result of the analysis, drugs with the highest effectiveness and safety were selected. For example, very good results in patients with no clear etiology of tinnitus were achieved when using antidepressants (amitriptyline), antiepileptic drugs (gabapentin) or a topically applied steroid (dexamethasone) with the simultaneous use of oral melatonim (according to the clinical trilas).

Conclusions: It is still recommended to conduct new clinical trials in the area of drugs and tinnitus. The choice of drug treatment depends on the causes of tinnitus.

Electrophysiological exams and tinnitus

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Tinnitus, the perception of sound without external auditory stimulus can be a devastating disorder. Despite many advances in our understanding of tinnitus, there are limited options for effective treatments and objective diagnostic tests to check the neurotransmitters involved in the cause of tinnitus. When it comes to the symptom of tinnitus, we have the involvement of the auditory pathways and the neurotransmitters present in each area, which can exert inhibitory and/or excitatory effects on different areas in the same system.

The need for an objective examination of tinnitus is increasingly necessary so that we can identify the neurotransmitters that are out of balance in the auditory system so that we can reduce the difficulty in diagnosing and treating tinnitus. I will show that a noninvasive electrophysiological measure can help direct the etiological diagnosis and treatment of tinnitus. An objective examination is desperately needed to elucidate tinnitus.

Embracing teleaudiology for tinnitus management: preliminary insights from Malaysian audiologists and tinnitus patients

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Introduction: Teleaudiology for tinnitus management has yet to be extensively explored in Malaysia, highlighting the need for preliminary insights from key users, particularly audiologists and patients with tinnitus.

Objective: This study aimed to evaluate the acceptance of teleaudiology for tinnitus management among audiologists and patients with tinnitus in Malaysia.

Material and methods: A cross-sectional study was conducted using the validated and reliable MyTUQ-T to assess the acceptance of teleaudiology for tinnitus management among 42 audiologists (mean age: 36.71 ± 4.74) and 84 patients with tinnitus (mean age: 46.04 ± 14.52) across Malaysia.

Results: Both audiologists and patients with tinnitus demonstrated a tendency to accept teleaudiology for tinnitus management in Malaysia. The "Usefulness" subscale achieved the highest average score, while the "Reliability" subscale recorded the lowest score in both groups.

Conclusions: Although there is still a gap in the full acceptance of teleaudiology for tinnitus management, the findings indicate that both audiologists and patients are moving closer to accepting its use. This initial insight lays a crucial foundation for the integration of teleaudiology into tinnitus management in Malaysia.

How to manage tinnitus – a personal experience from Jordan

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Aim: Tinnitus, a prevalent auditory condition characterized by the perception of sound without an external source, presents significant diagnostic and therapeutic challenges. This presentation explores my clinical experience in my clinic in Jordan, focusing on the evaluation and management of tinnitus with an emphasis on tinnitus matching.

Material and methods: Retrospective chart review for patients visited the clinic mainly for tinnitus over the last 4 years.

Results: More than 300 cases were reviewed. We have encountered diverse cases, ranging from mild to severe, often linked to hearing loss, noise exposure, or underlying medical conditions. Tinnitus matching has proven to be a crucial step in the diagnostic process, allowing for precise characterization of pitch and loudness, which informs personalized treatment strategies.

Conclusions: In my practice, I have found that accurate tinnitus matching enhances patient understanding and facilitates targeted interventions, including counselling, sound therapy, and hearing aid adjustments. The use of standardized audiological techniques and patient-centered approaches has significantly improved outcomes. Challenges such as patient subjectivity, variability in response, and limited local awareness remain obstacles in tinnitus management in Jordan.

Intracranial dural arteriovenous fistula can mimic sigmoid sinus wall anomalies induced pulsatile tinnitus

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Objective: (1) To highlight that dural arteriovenous fistula (DAVF) can exist in subjects with unilateral vascular pulsatile tinnitus (PT), positive internal jugular vein (IJV) compression tests, and radiologic evidence of sigmoid sinus wall anomalies (SSWA). (2) To introduce the "moth-eaten sigmoid plate" sign and emphasize the importance of retroauricular compression in diagnosing PT.

Material and methods: Retrospective data analysis on 81 subjects with PT as sole symptom and intracranial DAVF was studied using high-resolution temporal bone CT and magnetic resonance angiography (MRA). The moth-eaten sigmoid plate sign and DAVF-induced SSWA were defined, and their correlation with PT duration was studied.

Results: Significant differences were observed between ipsilateral IJV and retroauricular compression outcomes in DAVFs located at the transverse-sigmoid sinus ($p < 0.01$) and hypoglossal canal ($p < 0.01$). Among 71 subjects with CT data, the moth-eaten sign was found in 29 of 37 subjects (78.4%) with DAVFs at the transverse-sigmoid sinus. SSWA and JB anomalies were observed in 40.8% of subjects. PT duration significantly differed between subjects with SSWA and those without SSWA ($p < 0.01$).

Conclusions: The presence of SSWA on CT and a positive IJV compression test should not be considered conclusive for diagnosing venous PT. The "moth-eaten sigmoid plate" sign on non-contrast CT and positive retroauricular compression are strong indicators of DAVF as the primary cause of PT.

Investigation of the effects of long-term binaural beats application on tinnitus patients

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Introduction: Binaural beats (BB) are one of the neuromodulation methods that have recently come to the fore in the treatment of tinnitus. The effects of long-term use of this method, which basically uses the auditory entrainment mechanism, are controversial.

Aim: This study aimed to evaluate whether a 6-week theta-band BB intervention, in which neural plasticity can be achieved, would lead to improvements in tinnitus discomfort and associated depression scores in individuals.

Material and methods: A total of 52 people with tinnitus participated in this study, but 18 patients completed theta band BB for 6 weeks. 18 patients applied theta band BB for 20 minutes a day for a period of 6 weeks. Tinnitus Handicap Inventory (THI), 10-point VAS scale for tinnitus discomfort rating and Beck Depression Inventory (BDI) were used to evaluate the depression scores of the participants before and after the BB application. Pre and post-test scores were compared to determine the effectiveness of the intervention. Paired samples *t*-test was used in the pre-post evaluation of THI and BDI.

Results: Before the 6-week theta band BB application, the THI score, which was at the level of moderate handicap with an average of 52.7 points, decreased to the level of mild handicap with 34.3 points after the application ($p = 0.004$). Also, the level of discomfort from tinnitus decreased from 6.7 to 4.0 points ($p < 0.001$). We observed that patients with mild depression with an average of 10.8 points before the application decreased to normal depression level with 5.3 points after the application ($p = 0.007$).

Conclusions: The results of our study showed that theta-band BB applied for 6 weeks can provide significant improvements in tinnitus discomfort and depression symptoms, and that this method can be effective especially in individuals with moderate tinnitus. The fact that depression levels associated with tinnitus decreased after theta-band BB application indicates that this treatment method also contributes to psychological improvements. These results suggest that theta-band BB, a non-invasive intervention, may be a clinically effective option for the treatment of tinnitus. However, more comprehensive studies examining its long-term effects and its effects on neuroplasticity are needed.

Microscopic and endoscopic transtemporal surgical techniques for effective resolution of venous pulsatile tinnitus: insights from a 253-case surgical series

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Objective: To provide insights into the curative effects and identify reasons for surgical failure in subjects with recurrent venous pulsatile tinnitus (PT) caused by sigmoid sinus wall anomalies (SSWA).

Material and methods: This study is a retrospective data analysis of 253 subjects diagnosed with venous PT due to SSWA who underwent transtemporal resurfacing surgery. Among these subjects, we compared the curative effects between those who underwent extraluminal compression of the sigmoid sinus wall and those who did not. Additionally, new surgical techniques were applied to address venous PT caused by oblique occipital sinus, sylvian vein alongside tegmen dehiscence, and transverse sinus stenosis.

Results: Among the 230 cases followed up, PT was resolved in 208 cases (90%). In the 22 cases where PT recurred, the most common finding was incomplete resurfacing of the dehiscence, observed in 17 subjects with recurrent PT. There was no statistical significance between extraluminal compression and mere resurfacing of the dehiscence. PT and papilledema in two subjects with concomitant idiopathic intracranial hypertension (IIH) were resolved and reversed following dehiscence resurfacing and transtemporal transverse sinus decompression surgery. The transverse sinus lumen experienced its largest area expansion, increasing by approximately 31.2%. However, two subjects experienced tympanic membrane perforation following jugular bulb reconstruction using excessive bone cement.

Conclusions: The primary cause of recurrent PT is incomplete resurfacing of the dehiscence. PT can be eliminated without reducing a diverticulum; resurfacing its dehiscent surface is sufficient.

Pharmacological treatment of tinnitus

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For many patients and health care providers, one of the most desirable tinnitus treatment should be a sort of "magic pill", capable of providing relief for the majority of patients. Although many attempts have been made to find such a pill, we are still too far away, and, in fact, probably never will be able to discover it, being that tinnitus is a multi-factorial symptom, requiring distinct, individualized treatment strategies. Treatment should be, at first, directed at the cause of tinnitus, if a cause may be ruled. These causes include

metabolic and cardiovascular disease treatments, tumor resections, nois-induced hearing loss, etc. If a cause cannot be determined or if the cause is no longer present (tinnitus as a sequela) then treatment of the sequel (tinnitus, in this case) should be pursued. Pharmacological treatment is one of the possibilities, albeit, controversial. Many drug trials have succeeded in alleviating tinnitus but failed to be replicated. As yet, no drug is approved by the FDA to treat tinnitus, but, on the other hand, some studies cited pharmacological treatment as the most frequent to eliminate tinnitus. On this lecture, the speaker will provide a quick summary of the drugs available to treat tinnitus, based on his experience supported by many controlled trials, and also present a tentative guideline based on the subtyping of tinnitus.

Polish results of tinnitus therapy using bimodal stimulation with the Lenire device in patients with tinnitus

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Introduction: Tinnitus is defined as the perception of sound without an external acoustic stimulus. Currently, there is no single effective treatment method for tinnitus that works for all patients. One of the newer approaches is bimodal stimulation, which combines acoustic stimulation with somatosensory pathway stimulation. The goal of therapy is to reduce the severity of tinnitus and improve the quality of life for patients suffering from tinnitus.

Objective: The aim of this study was to evaluate the effectiveness of bimodal stimulation using the Lenire device in reducing tinnitus severity in 30 patients.

Material and methods: The authors present the results of their own research on the use of bimodal stimulation therapy in 30 patients with tinnitus. The results of the Tinnitus Handicap Inventory (THI) questionnaire were analyzed.

Results: The results of the authors own research on the use of bimodal stimulation with the Lenire device showed an effectiveness of 76%. After the first follow-up visit, 66% of patients reported improvement, with an average decrease in THI score of 16.6 points. After the second follow-up visit, 76% of patients reported improvement, with an average decrease in THI score of 20.9 points.

Conclusions: Bimodal stimulation using the Lenire device may be an effective treatment method for patients with tinnitus.

Relationship between trait mindfulness and tinnitus severity: evidence from a clinical sample

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Aim: Mindfulness is paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally. Due to bringing attention to bodily sensations, thoughts and feelings, it supports developing greater interoceptive awareness, emotion regulation and reduces stress sensitivity. The study aims was to determine whether there was a relationship between the mindfulness trait and perceived tinnitus severity. The research hypothesis was that such a relationship exists and is negative in nature, i.e. the high level of mindfulness trait is accompanied by the low level of tinnitus severity.

Material and methods: The study group consisted of 99 patients with chronic tinnitus. There were 54 women and 45 men. They were aged between 19 and 79 years ($M = 52.7$; $SD = 13.4$; women: $M = 44.9$; $SD = 12.8$). The audiological examination included pure-tone audiometry and measuring the pitch and loudness of tinnitus. The Five Facet Mindfulness Questionnaire (FFMQ), Tinnitus Handicap Inventory (THI), and Skarzynski Tinnitus Scale (STS) were used.

Results: There was a significant and positive correlation between trait mindfulness and tinnitus severity. Patients with higher level of acting with awareness had lower tinnitus severity ($r = -0.34$; $p = 0.001$). Also greater nonreactivity to inner experience was associated with lower tinnitus severity (rho = –0.27; $p = 0.007$). Acting with awareness was a significant and negative predictor of tinnitus severity ($\beta = -0.26$; $p = 0.020$).

Conclusions: The study confirms a significant negative relationship between trait mindfulness and perceived tinnitus severity. These findings suggest that trait mindfulness may be a valuable psychological resource in managing tinnitus and reducing its subjective impact.

Revealing the struggle for silence: highlighting the mental health crisis in people living with tinnitus

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Introduction & objectives: Tinnitus – the perception of sound when there is no corresponding external sound – affects around one in seven adults in the UK. Tinnitus UK wished to examine the experiences of people living with

tinnitus, including accessing healthcare support for the condition.

Material and methods: In December 2023 Tinnitus UK members, mailing list subscribers and social media followers were invited to answer questions about their tinnitus, its impact and the support received in primary and secondary care. 478 people completed an online survey.

Results: Patient experiences – symptoms varied across the respondents, but the impact of tinnitus on quality of life and mental health could be severe.
- over 1 in 5 of respondents had had thoughts of suicide or harming themselves in the last year;
- more than 8 out of 10 respondents experienced low mood or anxiety in the last year, with 7 out of 10 feeling hopeless or helpless;
- sleep disturbances affect 85.7% of respondents;
- the emotional impact of tinnitus is significant, with 68.4% reporting low self-esteem and 54.9% struggling to think rationally.

Healthcare support:
- half of respondents obtained GP appointments within a week, but 16% waited over a month;
- referrals to secondary care decreased to 57.9% (2020: 64%) with 11.7% not offered a referral;
- the number of people reporting that they waited more than 12 months for an appointment in secondary care has tripled from 2019 to 2023, with 1 in 6 facing waits of more than a year;
- the increase in waiting times for audiology appointments impacted quality of life for two thirds of respondents;
- there is limited mental health support from GPs;
- only 5% of respondents were offered cognitive behavioural therapy (CBT) as recommended in the NICE guidelines for tinnitus.

Conclusions: The survey starkly revealed the substantial toll tinnitus can take on mental health, emphasising the urgent need for comprehensive support and intervention measures to address the psychological challenges associated with this condition. The findings underscore the imperative for enhancements in the initial stages of tinnitus care, including timely access to appointments, improved reassurance, increased dissemination of information by healthcare professionals and increased access to psychological support.

Sigmoid sinus wall anomalies can progress and may not be congenital

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Objective: Sigmoid sinus wall anomalies (SSWA) are closely linked to venous pulsatile tinnitus (PT). This study aims to demonstrate that SSWA develops progressively rather than being congenital.

Material and methods: We retrospectively analyzed 42 PT patients with SSWA who had at least two non-operative CT scans at our clinic. CT images were longitudinally assessed to track SSWA progression, while MRI and Doppler ultrasound evaluated transverse sinus stenosis and venous hemodynamics. Changes in PT perception were tracked using the tinnitus handicap inventory (THI) questionnaire.

Results: Among the 42 SSWA patients, 12 (28.6%) exhibited progression. Anastomosis between diploic vein and diverticulum was significantly higher compared to the dehiscence cohort ($p < 0.01$). Within the diverticulum group, seven individuals (30.4%) experienced enlargement, with a mean diverticular wall expansion of 5.9% ± 11.4%. Progressive erosion was observed in two cases (12.5%) in the dehiscence cohort, with a mean sigmoid plate erosion of 3.8% ± 10.1%. In cases progressing from dehiscence to diverticulum, three subjects transitioned, with a mean sigmoid sinus wall length expansion of 43.8% ± 31.9%. SSWA progression showed a significant negative correlation with QBILATERAL ($r = –0.857$, $p = 0.014$), and there was a significant difference between initial and revisit THI scores ($p < 0.01$).

Conclusions: SSWA can undergo morphological progression, indicating it is a progressive clinical condition rather than congenital.

Sleep intermittent tinnitus patients exhibit infradian circasemiseptan tinnitus loudness periodicity

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Introduction: A subpopulation of tinnitus patients experiences complete intermittence of their tinnitus in relation to sleep. On some days, they report perceiving higher tinnitus loudness immediately after waking, which persists throughout the day. On other days, they wake up without tinnitus and may remain tinnitus-free until the next sleep episode, unless they take a nap. To date, and to our knowledge, no study has attempted to determine whether such alternations are purely random or periodical.

Material and methods: 17 tinnitus patients exhibiting this symptomatology were prospectively recruited and reported daily tinnitus loudness and sleep diary for two months through an online questionnaire. Lomb-Scargle periodogram was used to determine whether periodic oscillations in their tinnitus were present. A confirmatory analysis was conducted on a retrospective database of 1851 patients, from which were extracted a test group ($N = 17$) and two control groups ($N = 17$ and $N = 22$). Additionally, tinnitus intensities in relation to sleep durations were analyzed.

Results: A periodicity between 2.5 and 4.5 days was significantly present in the prospective sample and in the test group of the retrospective sample ($p < 0.001$). Tinnitus loudness absolute variations were more important during the night than the day without naps ($p < 0.001$).

Conclusions: The alternation between the presence and absence of tinnitus in this subpopulation does not appear to be random. While it is evident that sleep plays a precipitating role in the loudness transitions of tinnitus reported by this subpopulation, the observed infradian rhythmicity suggests an underlying endogenous physiological phenomenon such as sleep pressure or sleep debt.

Spontaneous otoacoustic emission as a novel method to screen pulsatile tinnitus caused by sigmoid sinus wall abnormalities: a prospective study

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Objective: To evaluate the diagnostic potential of spontaneous otoacoustic emissions (SOAE), distortion product otoacoustic emissions (DPOAE), and pure-tone audiometry (PTA) in patients with pulsatile tinnitus (PT) caused by sigmoid sinus wall anomalies (SSWA).

Material and methods: This study included 20 PT patients and 20 matched healthy controls. SOAE, DPOAE, and PTA were assessed before and after compression of the internal jugular vein. Statistical analysis included paired t-tests to compare differences in SOAE amplitude, DPOAE signal-to-noise ratios, and PTA thresholds, while independent t-tests assessed age differences, and one-way ANOVA evaluated mean PTA thresholds.

Results: SOAE amplitudes were significantly higher in ipsilesional ears compared to contralesional and control ears. DPOAE showed a significant difference in 0.5 kHz S/N-ratio between ipsilesional and contralesional ears. PTA revealed higher thresholds in ipsilesional ears at low frequencies, with differences decreasing after compression.

Conclusions: Besides radiological modalities, SOAE is a sensitive tool for diagnosing and assessing the severity of PT in patients with SSWA, with DPOAE and PTA providing supplementary information. These findings suggest a multimodal approach for the diagnosis of PT related to SSWA.

Tinnitus in patients with nasal obstruction – preliminary results

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Introduction: One of the causes of tinnitus is Eustachian tube dysfunction (ETD). The etiology of ETD is multifactorial, and can be caused by, among other things, swelling and inflammation, observed in patients with nasal obstruction due to chronic sinusitis or deviation of the nasal septum.

Aim: The purpose of this study was to evaluate the prevalence of tinnitus in patients requiring surgery to improve nasal passage and the effect of the presence of ETD on the presence of tinnitus.

Material and methods: 37 patients of the Institute of Physiology and Pathology of Hearing who presented for surgical treatment for nasal obstruction were recruited for the study. Prior to surgery, patients completed the Eustachian Tube Dysfunction Questionnaire (ETDQ-7) and were also asked about the presence of tinnitus. An Eustachian Tube Function Test (ETF) test was then performed. Patients with abnormal ETFs were classified into the study group, while the others were classified into the control group.

Results: Among the patients participating in the study, an abnormal ETF score was observed in 23 (62.2%), while an abnormal ETDQ-7 score was observed in 13 (35.1%). Tinnitus was more common in patients with ETD (60.9% in the study group, 28.6% in the control group). Tinnitus was also more common in patients with abnormal ETDQ-7 score (76.9% versus 37.5% of patients with normal ETDQ-7).

Conclusions: Preliminary results suggest that nasal patency disorders may indirectly influence the occurrence of tinnitus in patients by inducing ETD. Further analysis is needed, and further recruitment of patients for the study and comparison of preoperative and postoperative results are planned.

Tinnitus severity assessment in cerebellopontine angle tumors before and after treatment

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Introduction: The most common initial symptom of cerebellopontine angle tumors is unilateral tinnitus. This condition

should always be a signal to initiate diagnostic evaluation of central nervous system (CNS) abnormalities, particularly to exclude the presence of a cerebellopontine angle tumor. Patients with such tumors often experience prolonged symptoms, primarily due to unilateral tinnitus, which can be challenging to treat. The aim of the study was to assess the severity of tinnitus in patients with cerebellopontine angle tumors before and after treatment.

Material and methods: The study group consisted of 95 patients diagnosed with a unilateral cerebellopontine angle tumor, aged between 18 and 86 years, who were treated at the Greater Poland Cancer Center. Most patients, depending on tumor size and the severity of subjective symptoms, were qualified for treatment using the CyberKnife method. After treatment, some patients were fitted with a hearing aid with a noise generator, and its effectiveness was evaluated six months after its implementation. Patients undergoing treatment were assessed based on an analysis of subjective symptoms using a prepared questionnaire before and after treatment. The results were compared before treatment, at least 3–6 months after the initial radiotherapy, and six months after the use of hearing aids.

Results: The vast majority of patients assessed the treatment as effective. A significant improvement in tinnitus severity was reported following CyberKnife therapy. Additionally, patients who received a hearing aid with a sound generator after radiotherapy noted a substantial enhancement in their hearing condition and a reduction in tinnitus symptoms.

Conclusions: CyberKnife therapy proved to be an effective treatment for reducing tinnitus severity in patients with cerebellopontine angle tumors. The addition of hearing aids with sound generators further contributed to symptom relief and auditory improvement, highlighting the benefits of a combined therapeutic approach for managing tinnitus in these patients.

Trends in the advancement of mobile applications for the diagnosis and treatment of tinnitus – a look to the future

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Introduction: Audiological aliments like tinnitus require multidisciplinary care. Therapy for tinnitus should be available on a daily basis because of its troublesomeness in everyday functioning. To meet this challenge, specialists are looking for solutions in increasingly common access to the Internet and increasingly widespread use of mobile devices. Furthermore, smartphones have an application ecosystem that can be extended by new apps programmed for a particular health problem.

Aim: Assessment of the scale and direction of creating and using mobile applications to diagnose and treat tinnitus.

Material and methods: Google Scholar, PubMed, ReserchGate published in the period 2010–2023 were searched. The search strategy used the following keywords: "mobile/smartphone apps-tinnitus-identification-analysis-evaluation", „mobile/smartphone apps-tinnitus-diagnosis", „mobile/smartphone apps-tinnitus-self management", „mobile/smartphone apps-device-tinnitus-therapy-treatment, „mobile/smartphone apps-tinnitus-digital technologies", „mobile health-mental health-CBT". The results of the review were catalogued and organized into themes.

Results: Results were organized into the following themes: (1) ranking evaluation and analysis of applications supporting tinnitus therapy existing in the Internet space, (2) mobile applications supporting the diagnosis of tinnitus, (3) applications supporting the therapy of tinnitus (4) a look to the future – the use of sensors, the use of artificial intelligence (AI), big data technology, just-in-time interventions.

Conclusions: Smartphone-based applications with EMAs (ecological momentary assessments), sensors, possibility of using different wearable diagnostic devices can be helpful in better understanding the tinnitus variability and its causes. Combining the mobile applications with a mobile crowd sensing, central database and the support of AI techniques is a valuable source for developing scientific research. Clinically verified methods provided by mobile applications can become a part of the therapeutic process proposed by specialists and enable easy, cost-free and wide range of therapeutic support in dealing with tinnitus. In tinnitus therapy multifunctional smart devices managed by mobile applications such as: smart hearing aids, cochlear implants, hearables may be equally important. The development of mobile technologies and AI techniques will contribute to the creation of smart therapy platforms for tinnitus in the future The platforms could offer personalized prediction models based on a real time assessment with AI support, as well as personalized care with constant, wide availability and just-in-time interventions.

Validation and adaptation of the Arabic version of the Skarzynski Tinnitus Scale

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Purpose: This study aimed to translate the Skarzynski Tinnitus Scale (STS) into Arabic, conduct a cross-cultural adaptation, and validate its psychometric properties.

Material and methods: The translation and cross-cultural adaptation of the STS was carried out in five main steps. 152 participants were divided into two groups: 79 (52%) cases complaining of tinnitus and 73 (48%) in the control group without tinnitus.

Results: The scale required no substantial modifications during the translation process. Cronbach α measured the internal consistency for each of the three subscales and the total

score. The overall psychological distress subscale, Cronbach α was 0.815; for the functional scale α was 0.787; for the coping subscale α was 0.555; and for global STS, α was 0.921. The STS global score and the psychological distress subscale had extremely high consistency.

Conclusions: The translation and adaptation of the STS established linguistic and Arabic cultural equivalence with the original version. Furthermore, the adapted version demonstrated good internal consistency. The results suggest that the STS is suitable for use in a clinical setting.

Why does tinnitus vary with naps? Exploring somatosensory, central and autonomic involvement

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Introduction & objective: Tinnitus, defined as the conscious awareness of a noise without any identifiable corresponding external acoustic source, can be modulated by various factors. Among these factors, tinnitus patients commonly report drastic increases of tinnitus loudness following nap sleep. Previous studies have suggested that this clinical pattern could be induced by covert jaw and neck musculoskeletal modulations, often referred to as somatosensory modulation of tinnitus. To our knowledge, no polysomnographic study has been carried out to assess this hypothesis, nor potential central or autonomic involvement.

Material and methods: For this observational prospective study, 37 participants reporting frequent increases of tinnitus following naps were recruited. They participated to six full-polysomnography nap attempts over two days. Audiological and kinesiologic tests were conducted before and after each nap attempt.

Results: 197 naps were collected. Each nap at each time of day elicited an overall significant increase in tinnitus minimum masking level (MML). Each inter nap period elicited an overall significant decrease. Tinnitus modulations were found significantly correlated with nap sleep duration (Visual numeric scale on tinnitus loudness, VNS-L, $p < 0.05$), with snoring duration (MML, $p < 0.001$), with snoring average sound level (VNS on tinnitus intrusiveness, VNS-I, $p < 0.05$) and with sleep apnea count (VNS-I, $p < 0.001$). MML variations over the nap exhibited significant correlations with Heart rate ($p < 0.01$), theta ($p < 0.001$) and sigma ($p < 0.001$) EEG power bands as well as sleep spindle characteristics such as average duration ($p < 0.001$), frequency ($p < 0.05$) and density ($p < 0.01$).

Conclusions: This study confirms objectively that tinnitus may increase following naps. Several scenarios are compatible to explain the observed correlations highlighted in the present study: nap-induced tinnitus modulations could be covert somatosensory modulations as snoring and sleep apnea events are often related to tensor veli palatini muscle dysfunction or they could be associated with sympathetic and/or central activations. These possibilities will be presented and discussed.

Posters

A noise that comes from inside: cognitive behavior therapy in the treatment of tinnitus

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This work intended to investigate the contribution of cognitive behavior therapy (CBT) in treatment of tinnitus, a symptom that affects around 20% of the world's population. The hypothesis was that CBT would be configured as the main approach in psychology, in reducing symptoms of depression and anxiety, related to tinnitus, improving the quality of life of patients. To respond to the general objective, we try to develop the following specific objectives: a) reflect on the relationships between tinnitus and suffering psychic regarding anxiety and depression; b) characterize the techniques of CBT in reducing the discomfort caused by tinnitus; c) introduce mindfulness as a therapeutic strategy for tinnitus. To this end, the theoretical foundation was anchored in the CBT, in mindfulness studies, in otoneurology and in the literature that deals with tinnitus. As methodology, the choice was for a systematic literature review, through data collection, in specialized electronic databases. The results showed that the literature has confirmed that CBT strategies/techniques contribute to the reduction of symptoms and an improvement in quality of life of patients with tinnitus, who start to live less problem with the symptom. Furthermore, mindfulness, as a therapeutic strategy for tinnitus, was considered beneficial for chronic tinnitus in adult patients, with the finding

that mindfulness brings a significant reduction in the severity, volume and negative impact caused by this symptom.

A novel clinical model for tinnitus: exploring pathophysiology and therapeutic possibilities

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This model provides a framework for understanding and managing tinnitus by integrating biological mechanisms, patient-specific characteristics, and potential therapeutic pathways.

The model identifies four primary domains influencing tinnitus:
– hearing: the auditory system creates the possibility for tinnitus perception;
– attention: dysregulated attention sustains the perception, particularly when attention cannot disengage from the auditory stimulus;
– psychic/emotional: emotional and psychological factors significantly aggravate the condition, often amplifying distress;
– muscular: physical influences, including temporomandibular joint dysfunction (tmj) or bruxism, play a contributory role.

Underlying these domains, personal biology (life history) and personality traits combined with neuroinflammation and potentially unconscious mind involvement (psychological trauma history), with the possibility that autonomic symptoms may also manifest.

This model recognizes that tinnitus rarely exists in isolation. Key associations include:
– dizziness, balance issues, and proprioceptive dysfunction;
– sleep disturbances, such as insomnia or apnea;
– headache and chronic pain syndromes;
– global or auditory attention deficits;
– visual dysfunction.

Severity could be suspected in presence of hyperacusis, depression, obsessive compulsive disorder, general anxiety disorder, personality disorders, chronic pain, unconscious life traumas emphasizing the interaction between mental health, life history and tinnitus long lasting perception.

The model considers exploratory links with:
– diet: Could nutritional habits influence symptom severity?
– gut-brain axis: potential connections between gastrointestinal health and tinnitus, as it has to the brain. Is it possible?
– immunity: Is the immune system a contributing factor, since it is related to emotional status?
– hormonal changes, such as menopause in women, as a neurohormonal disorder.

Triggers virtually can be any life event, most commonly with negative and stressful experiences, exacerbating symptoms.

Implications for treatment: this clinical framework invites a sequential approach to tinnitus management, by identifying the patient's unique physiological and psychological profile, interventions can target specific pathways – whether through auditory therapies, psychological counseling, neuroinflammatory modulation, or lifestyle adjustments. This model advocates for a holistic perspective, combining evidence-based practices with innovative strategies to improve patient outcomes (not only tinnitus distress but also tinnitus volume and pensiveness).

Assessment of the effectiveness of tinnitus treatment using various therapeutic methods

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Introduction: Tinnitus is an auditory phantom perception that occurs in one or both ears in the absence of an acoustic stimulus in the environment. It is "a sensation of sound that results solely from pathological activity within the nervous system, without any corresponding mechanical activity within the cochlea." This condition is a significant social and clinical problem due to its high incidence, lack of a fully effective treatment method and frequent occurrence of emotional problems in patients with tinnitus. Despite many years of intensive research on its etiology, it is still unclear what factor is directly responsible for the perception of noise. This, in turn, results in the lack of an appropriate therapeutic method based on causal action.

Material and methods: The basis for the diagnosis of tinnitus should be a medical interview and appropriate audiological tests (tonal and impedance audiometry) in order to assess the condition of the hearing organ. In special cases, it is also recommended to perform magnetic resonance imaging and ultrasound, computed tomography, magnetic resonance angiography-MRA or conventional angiography.

Results and conclusions: The authors assessed the effectiveness of tinnitus treatment using various therapeutic methods: pharmacotherapy, the use of hearing aids, noise generators, the TRT (Tinnitus Retraining Therapy) method, cognitive-behavioral therapy, vagus nerve stimulation, bimodal stimulation, a prototype device for electromagnetic ear stimulation and mobile applications. The guidelines for the management of patients with tinnitus in clinical practice, published in October 2014 by the American Academy of Otolaryngology and Head and Neck Surgery, include a recommendation against the use of pharmacotherapy in the initial stage of treatment of chronic, bothersome tinnitus. Based on the analyzed scientific works and own research, the newest and most effective methods used in tinnitus therapy include: tVNS vagus nerve stimulation and bimodal stimulation combining auditory and somatosensory stimulation, as well as an innovative method of electromagnetostimulation of the ear using a prototype device of our own design.

Bilateral vestibular insufficiency in a teenager after cochlear implantation and comorbid conditions

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Introduction: Bilateral vestibular hypofunction (VH) is characterized by a pronounced decrease in the function of the vestibular receptors of both labyrinths. Such patients suffer from impaired balance, which worsens in the dark or on a soft, uneven surface, and decreased clarity of vision when moving the head.

Aim: The purpose of our study is a 14-year-old child with severe instability and unsteadiness when walking after meningitis, car accident and cochlear implantation.

Material and methods: The patient, born in 2010, complained of instability and pronounced swaying when walking. From the medical history, 6 months ago he suffered from bacterial meningitis – with severe headaches, persistent fever and coma for 1 week. After the disease, the child developed bilateral sensorineural deafness. A month after being discharged from the hospital, the boy gets into an accident. Only a year later the boy underwent a CI.

Results: The child came to the appointment with the support of his parents. General condition is satisfactory. Romberg's pose is unstable, the torso is deviated in different directions, Romberg's sensitized test is unstable, the Fukuda test is performed slowly, the torso is deviated in different directions. Spontaneous nystagmus – absent. Head shaking test – nystagmus absent. There is no pathological nystagmus on the Dix–Hallpike test. V-HIT – THIEF subdued. LARP 0.20/0.23, RALP 0.23/0.12, lateral channels 0.16/0.26. Severe bilateral hypofunction of the vestibular apparatus. Halmagi test – corrective saccade to the right and left.

Conclusions: These three undesirable pathogenetic factors caused severe bilateral hypofunction in this patient, which is difficult to compensate. Due to the risk of cochlear ossification following meningitis, CI could not be postponed. A triple trigger in the pathogenesis of CH: meningitis, a traffic accident and the post-CI condition led to a condition in the patient that made it difficult even to ride a bicycle. The patient has to undergo not only a course of auditory-speech, but also full-fledged vestibular rehabilitation.

Effects of the COVID-19 pandemic on brain activity in individuals with chronic tinnitus

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This study examined the potential impact of the COVID-19 pandemic on individuals seeking treatment for tinnitus. We compared the performance of tinnitus patients evaluated during the pandemic with those assessed before its onset. The study included 50 adults with chronic tinnitus, divided into a study group (24 individuals tested during the COVID-19 pandemic in 2020–2021) and a control group (26 individuals tested before the pandemic, from 2013 to 2017). None of the study group participants reported having contracted COVID-19. Data collection involved the Tinnitus Handicap Inventory (THI) questionnaire, audiological tests, and quantitative electroencephalography (qEEG). While THI scores did not show statistically significant differences between the groups, qEEG analysis revealed notable changes. Specifically, the study group exhibited significant decreases in alpha and beta band activity, particularly over the auditory cortex, compared to the control group. Our findings suggest that while the COVID-19 pandemic did not significantly affect the perceived severity of tinnitus, it was associated with measurable alterations in brain activity. These results highlight the need for further research to understand the underlying mechanisms and potential long-term effects of these neural changes.

Evaluating the auditory models for predicting speech reception threshold in individuals with tinnitus

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Tinnitus is a phantom auditory perception arising from neural activity without corresponding mechanical activation within the cochlea (Jastreboff, 1995). Tinnitus is frequently associated with hearing loss but can also occur in individuals with clinically normal hearing. Research shows that individuals with tinnitus and normal hearing exhibit higher speech reception thresholds (SRT) compared to those without tinnitus (Niewiarowicz et al., 2022). This presentation explores the effectiveness of two auditory models (Vicente et al., 2020; Lavandier et al., 2022) in predicting SRT for individuals with tinnitus. The model developed by Vincent et al.,

2020, originally designed to estimate SRT in noise for groups of listeners with hearing loss or normal hearing. However, this model do not explicitly account for tinnitus-related factors. The study assesses the models predictive performance for predicting SRT for groups of subjects with and without tinnitus. Preliminary findings suggest that while the Vicente et al. model performs well in predicting SRT for subjects without tinnitus, but its accuracy diminishes when applied to tinnitus subjects, probably due to the lack of model of tinnitus-specific mechanisms. While the Vicente et al. model provides a valuable foundation for SRT prediction, extensions incorporating tinnitus-specific auditory mechanisms and including individual variability between subjects are necessary to improve its accuracy and applicability. The findings will guide efforts to enhance predictive accuracy and support the design of tinnitus maskers that will have the least impact on communication abilities of tinnitus subjects.

Evaluation of factors predicting tinnitus outcomes following cochlear implantation: a prospective quasi-experimental study

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Background and aims: Cochlear implantation is an effective intervention to restore useful aspects of hearing function in adults with severe-to-profound hearing loss. Tinnitus, the perception of sound in the absence of an external source, is common in people with severe-to-profound hearing loss. Existing evidence suggests cochlear implantation may be effective in reducing the negative impact of tinnitus in this population. However, this is contradicted by data suggesting that up to half of cochlear implant recipients experience tinnitus, and that some of these patients who did not have tinnitus before cochlear implantation experience it after surgery or cochlear implant activation. Most evidence on the effects of cochlear implantation on tinnitus comes from secondary data in cochlear implant studies primarily concerned with hearing-related outcomes. Hence, the quality of the evidence for effects on tinnitus is low and not suitable to inform clinical recommendations or decision-making.

Material and methods: Data on tinnitus symptom severity, tinnitus case characteristics, hearing ability, depression, anxiety, insomnia and quality of life will be collected from cochlear implant recipients using the Tinnitus Functional Index (TFI), a tinnitus profiling questionnaire (ESiT-SQ), the Speech, Spatial and Qualities 12 (SSQ-12) Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder (GAD-7), Insomnia Severity Index (ISI), Health Utilities Index Mark 3 and EuroQol EQ-5D-5L respectively. Data will be collected before cochlear implantation, 2 weeks after cochlear implantation, immediately after cochlear implant activation, and one, three, and six months post-activation.

Results: An interim analysis on a subset of participants reveals short and long-term changes is tinnitus and related outcomes following implantation.

Conclusions: This study improves our understanding of the effects of cochlear implantation for tinnitus in adults with severe to profound hearing loss and inform the design of clinical trials of cochlear implantation for tinnitus.

Experience with functional near-infrared spectroscopy in patients with tinnitus

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Introduction: Functional near-infrared spectroscopy (fNIRS) is a non-invasive and safe method that allows recording neural activity in the cerebral cortex by measuring the concentration of oxy-, deoxy- and total hemoglobin. Unlike fMRI, it allows studies in motion, with children, in the presence of implants (CI, pacemakers) and is independent of head position.

Material and methods: The study included 14 participants aged 26 to 54 years suffering from tinitus. Functional near-infrared spectroscopy was performed using Cortivision PHOTON CAP equipment. Stimulation scripts were written in Python using PsychoPy software. Stimulation was performed with broadband noise and sound signals at 500 Hz and 6000 Hz, 65 dB. The stimulus was presented for 15 seconds. The pause between stimuli ranged from 30 to 60 seconds at random intervals. A total of 20 presentations were made. Data were analyzed using CortiPrism, Homer3 (Matlab) and AtlasViewer (Matlab).

Results: Functional brain imaging studies in tinnitus showed that it is associated with changes in cortical parts of the auditory pathway, including non-auditory brain regions. This suggests that non-auditory neural connections play a role in the pathogenesis of tinnitus including: frontoparietal area for awareness/attention, temporal cortical lobes.

Conclusions:
1. FNIRS provides distinct advantages in the diagnosis of hearing impairment, subjective tinnitus, and rehabilitation of cochlear implant patients.
2. Despite the current imaging limitations of this method – penetration depth (3 cm) and spatial resolution (1 cm) – fNIRS offers significant advantages with virtually silent recordings that are non-invasive and compatible with cochlear implants in both adults and children.
3. fNIRS overcomes the limitations of other neuroimaging techniques for studying the central auditory system.

Hyperacusis questionnaire – a new tool for assessment of hyperacusis in tinnitus patients

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Introduction: Hyperacusis is a kind of decreased tolerance to sound and is difficult to measure objectively. It often co-occurs with tinnitus. There is a need for valid and reliable patient-reported outcome measures to capture this subjective phenomenon.

Objective: The aim of the study to create a questionnaire capturing hyperacusis in terms of loudness, fear, and pain and then to evaluate its psychometric properties.

Material and methods: The study group consisted of 106 patients, made up of 51 men and 55 women. They were aged between 19 and 72 years, mean 45.2 years (*SD* = 12.4). An initial pool of 33 questions capturing hyperacusis was subjected to expert evaluation and pilot testing. Then, a shortened 19-item version of the tool was checked out. Medical interview, audiological examination and a set of questionnaires: Tinnitus Handicap Inventory, Hyperacusis Questionnaire, State-Trait Anxiety Inventory, and Visual Analogue Scale was completed by all subjects.

Results: The final 14-item Hyperacusis Assessment Questionnaire showed an appropriate three-factor structure that explained 70.5% of the variance. Convergent validity and divergent validity were confirmed by correlations with other measures of hyperacusis, anxiety, tinnitus severity, misophonia, and hearing thresholds. Internal consistency as assessed with Cronbach's alpha was excellent ($\alpha = 0.91$) as was reproducibility (intra-class correlation, ICC = 0.96).

Conclusions: The new Hyperacusis Assessment Questionnaire is a reliable tool that can assess the severity of hyperacusis in terms of loudness, fear, and pain. It can be used in clinical practice and scientific research for patients with hyperacusis and tinnitus.

Magnetoencephalography reveals changes in oscillatory activity and functional connectivity in people with tinnitus undergoing transcranial direct current stimulation

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Background and aims: Transcranial direct current stimulation (tDCS) is a technique involving a low-intensity electric current delivered via electrodes on the head. It is postulated to suppress or enhance neural activity in the region between electrodes. It represents a potential treatment option for tinnitus. Magnetoencephalography (MEG) is a neuroimaging technique that allows for the mapping of brain activity by recording magnetic fields produced by electrical currents occurring naturally in the brain. In this study, MEG was used to investigate changes in the brain activity of people with tinnitus while undergoing tDCS.

Material and methods: 35 participants with tinnitus were randomly assigned to received either real or sham tDCS. Resting state MEG recordings were collected for 10 minutes before, 20 minutes during, and 10 minutes after stimulation. Oscillatory brain activity was assessed at the level of the whole brain and two regions of interest: the frontal cortices – immediately below the electrodes – and the temporal cortices – containing the auditory cortices.

Results: There was no statistically significant change in tinnitus loudness scores after verum tDCS compared to the sham condition. Localised changes in spectral power were observed in: beta and delta bands, and in the gamma band at the level of the whole brain. No changes in functional connectivity were observed.

Conclusions: This study was the first to combine tDCS with MEG in a tinnitus population. Oscillatory changes in some frequency bands could be localised to the frontal or temporal regions. Some observed changes, most notably in the gamma band could only be detected at the whole-brain level. This suggests tDCS can induce changes in oscillatory brain activity in regions not directly affected by tDCS. These changes in activity do not translate to changes in functional connectivity. The design of future studies of tDCS for tinnitus should be informed by these findings.

Microstructural and histopathological analysis of sigmoid sinus plate harvested from pulsatile tinnitus patients with sigmoid sinus wall anomalies using Micro-CT

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Objective: To assess whether bone morphology changes in venous pulsatile tinnitus (PT) subjects with sigmoid sinus wall anomalies (SSWA) are influenced by hemodynamic forces, contributing to the understanding of this condition's development.

Material and methods: A total of 15 subjects was diagnosed with venous PT due to SSWA who underwent transtemporal sigmoid sinus wall surgery. CSF pressure was evaluated in participants using manometry. Sinus hemodynamics were assessed using the Arietta 60 ultrasound system coupling with a continuity equation. Surgically harvested dehiscent/diverticular sigmoid plate specimens were analyzed using micro-CT (μCT) and scanning electron microscope (SEM). Quantitative and qualitative analysis of the correlation between CSFP and μCT outcomes of the harvested sigmoid plate.

Results: Postoperatively, there was a significant reduction in PT intensity in all patients. CSF manometry revealed varying pressures, with a mean of 241.1 mmH_2O. Micro-CT analysis showed significant differences in bone volume and trabecular parameters between harvested sigmoid plate specimens and mastoid controls. Correlation analysis indicated a strong relationship between CSF pressure and trabecular thickness/number. These findings underscore the impact of SSWA on intracranial venous dynamics and the efficacy of surgical reconstruction in alleviating PT.

Conclusions: Our study indicates that SSWA is associated with increased osteometabolism, with μCT revealing higher bone volume and more efficient stress distribution in the sigmoid plate. Elevated CSF pressure may contribute to bone structural changes, and osteoclast activity appears influenced by sinus flow impaction. These findings suggest a complex interplay between hemodynamics and bone metabolism in SSWA pathogenesis.

Preliminary reports on the use of palatal electromyography in the diagnosis of somatosensory tinnitus

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Introduction: The tensor and levator palatine muscles are palatal muscles that influence ear function via the auditory tube. The use of electromyography (EMG) in diagnosing paratubal muscle activity was first reported in 1978. Since then, several studies have suggested that EMG is more effective than endoscopy of the Eustachian tube orifice in assessing the muscular components of movement. However, numerous studies have also shown that Eustachian tube dysfunction is not necessarily related to muscle dysfunction in patients with chronic middle ear conditions or temporomandibular disorders. A PubMed database search using the keywords tinnitus, EMG, and palate identified 15 publications. Few of these studies describe the diagnostic value of palatal EMG in ear disorders. Tinnitus is primarily mentioned as an accompanying symptom of chronic inflammatory ear diseases rather than as the main complaint. Most publications focus on the use of EMG-guided botulinum toxin injections into the palatal muscles for treating tinnitus caused by palatal myoclonus.

Aim: This study aims to present palatal electromyographic findings in patients with unilateral somatosensory tinnitus.

Material and methods: We describe one patient with unilateral tinnitus who was referred for palatal EMG. The patient had undergone a comprehensive audiological evaluation.

Results: EMG recordings from the levator palatini muscles at rest were within normal limits. However, recordings from the tensor palatini muscles were abnormal, indicating tetany. Additionally, asymmetries were observed during effort.

Conclusions: EMG appears to be a promising complementary method for diagnosing somatosensory tinnitus.

Protocol for a randomised controlled pilot study of multiple sessions of transcranial direct current stimulation (tDCS) for tinnitus: the WHITBY study

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Background and aims: Tinnitus – the awareness of sound in the absence of an external source – is a common condition associated with hearing loss, mood disorders, insomnia and reduced quality of life. Current treatment options are limited and do not address the tinnitus percept itself. Transcranial direct current stimulation (tDCS) may be a future treatment option, based on the limited available evidence. This protocol outlines a randomised controlled pilot study which seeks to inform a future clinical trial.

Material and methods: Forty participants will be recruited and randomised to receive ten sessions of either active tDCS or sham over a two-week period. Proof of concept will be measured by protocol compliance and attrition. Tinnitus loudness, tinnitus symptom severity, depression, anxiety, treatment satisfaction, adverse effects and spontaneous and auditory-evoked oscillatory brain activity will be measured using self-report measures and electroencephalography (EEG).

Results: This study seeks to establish the tolerability of multiple sessions of tDCS, devise an evidence-based treatment regimen, pilot the collection of long-term follow-up data and explore the feasibility of individualised head modelling and computational current flow modelling, using MRI, to inform an optimal treatment regimen. The findings will contribute towards the design of a statistically powered randomised sham-controlled trial to determine the efficacy of repeated sessions tDCS to dorsolateral prefrontal cortex (DLPFC) in reducing tinnitus symptom severity.

Conclusions: This study represents an important step towards developing a viable device-based tinnitus treatment that is both safe and minimally invasive. Its results will yield new insights into tinnitus mechanism and treatment-related changes.

Relationship between cognitive fusion and tinnitus severity

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Purpose: Cognitive fusion is a transdiagnostic and important process of psychological inflexibility. That is the tendency to become too entangled in thoughts, beliefs, or judgments that may often leads to rigid thinking and increases psychological distress. The aim of the study is to investigate the relationship between cognitive fusion and tinnitus severity in patients with tinnitus. The research hypothesis was that the high level of cognitive fusion is accompanied by the high level of tinnitus severity.

Material and methods: The study group consisted of 105 patients with tinnitus (57 women and 48 men) aged between 19 and 79 years; mean age was 52.3 years ($SD = 13.3$). The study was conducted in the Tinnitus Department of Institute of Physiology and Pathology of Hearing.

The audiological examination included pure-tone audiometry. Two questionnaires were also used: the Cognitive Fusion Questionnaire (CFQ) and Tinnitus Handicap Inventory (THI).

Results: There was a significant and positive correlation between cognitive fusion and tinnitus severity ($r = 0.36$; $p < 0.001$). This relationship was stronger in men ($r = 0.47$; $p < 0.001$) than in women ($r = 0.26$; $p = 0.053$). While cognitive fusion levels were similar between men and women, tinnitus severity was higher in women than in men.

Conclusions: The results of the study highlight the potential importance of addressing cognitive fusion in the psychological management of tinnitus, particularly in male patients.

The impact of dietary factors on tinnitus: a systematic review

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Introduction: Tinnitus, the subjective perception of sound without an external source, affects a significant portion of the global population. Despite its prevalence and substantial impact on quality of life, the underlying mechanisms of tinnitus remain unclear, and treatment strategies primarily focus on symptom management.

Aim: The objective of this study was to perform a systematic review of all relevant studies investigating the potential role of diet, micro- and macronutrients intake and BMI in risk of developing or reducing existing tinnitus.

Material: This systematic review synthesizes findings from eight studies.

Results: This systematic review synthesizes findings from eight studies investigating the potential link between dietary factors, including macronutrients, micronutrients, antioxidants, and body mass index (BMI), and their role in influencing the risk, onset, and severity of tinnitus symptoms. Findings from the review reveal that high protein intake and low-fat diets are associated with a reduced risk of tinnitus development and alleviating the severity of symptoms. Among micronutrients, vitamins B2, B3, zinc, and iron were linked to prevalence and severity of tinnitus symptoms. Antioxidant supplementation showed promising results, reducing tinnitus loudness and discomfort. Additionally, weight loss interventions were effective in alleviating tinnitus symptoms and improving the quality of life. Results emphasize the role of dietary and lifestyle factors in the prevention and management of tinnitus symptoms.

Conclusions: Incorporating therapeutic dietary interventions, micronutrient, antioxidant intake and weight loss interventions into existing treatment strategies can provide promising results reducing tinnitus and could be comprehensive foundation for further research.

The Stimulation of Polymodal Sensory Perception by Skarzynski 2.0 (SPPS-S 2.0)

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Introduction: Central auditory processing disorders are a set of symptoms that can significantly affect an individual's daily functioning. According to current guidelines, the primary and most important pillar on which rehabilitation interventions for patients with central auditory processing disorders should be based is the use of auditory training. One such method is the Skarzynski Method of Polymodal Sensory Perception Stimulation.

Objective: The aim of this study is to present new therapeutic possibilities through the introduction of the new version of the Skarzynski Method of Polymodal Sensory Perception Stimulation 2.0.

Conclusions: The continuous progress in technological capabilities and ongoing research leads to the development of various diagnostic and therapeutic tools. The introduction of the Skarzynski Method of Polymodal Sensory Perception Stimulation 2.0 significantly expands therapeutic options for patients with central auditory processing disorders.

Funding: "Enhancement of an innovative device and the therapy implemented with its use, dedicated to patients with auditory processing disorders" – A project co-financed by the European Union from the European Regional Development Fund under the Smart Growth Operational Programme, Priority Axis 1, Measure 1.1, Sub-measure 1.1.1 "Industrial research and experimental development carried out by enterprises", within the framework of the National Centre for Research and Development competition No. 2/1.1.1/2019 – Fast Track.
[„Udoskonalenie innowacyjnego urządzenia oraz realizowanej za jego pomocą terapii, dedykowanej pacjentom z zaburzeniami przetwarzania słuchowego" – Projekt współfinansowany przez Unię Europejską ze środków Europejskiego Funduszu Rozwoju Regionalnego w ramach Programu Operacyjnego Inteligentny Rozwój, Oś Priorytetowa 1, Działanie 1.1, Poddziałanie 1.1.1 „Badania przemysłowe i prace rozwojowe realizowane przez przedsiębiorstwa", w ramach konkursu Narodowego Centrum Badań i Rozwoju 2/1.1.1/2019 – Szybka Ścieżka"].

The use of bone-conduction implants in patients with rare genetic syndromes associated with ear malformations

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Introduction: Bone-conduction implants have emerged as a viable solution for patients with conductive or mixed hearing loss who are unable to use conventional hearing aids due to anatomical abnormalities. Individuals with rare genetic syndromes, such as Treacher Collins, Goldenhar, Klippel–Feil, Charge syndromes, and mandibulofacial dysostosis with microcephaly, often experience significant hearing impairments due to external and middle ear malformations. This study evaluates the effectiveness and safety of bone-conduction implants in this patient population.

Material and methods: A retrospective cohort study was conducted at a tertiary referral center, including nine patients diagnosed with the aforementioned syndromes. All patients exhibited conductive or mixed hearing loss and were not candidates for conventional hearing aids. Bone-conduction implants were surgically placed, and hearing improvement was assessed through pure-tone audiometry and speech audiometry. Additionally, subjective satisfaction was measured using the Abbreviated Profile of Hearing Aid Benefit (APHAB) questionnaire.

Results: The results demonstrated significant hearing improvements following implantation. Audiometric assessments showed enhanced hearing thresholds and speech recognition in both quiet and noisy environments. Patients reported high satisfaction levels, noting improved daily communication abilities. The surgical procedures were performed safely, with a low incidence of minor complications.

Conclusions: These findings highlight the importance of bone-conduction implants as an effective intervention for managing hearing loss in patients with rare genetic syndromes associated with ear malformations. Early implantation supports auditory rehabilitation, facilitates speech development, and enhances overall quality of life. Further research and clinical application of this technology may improve outcomes for this unique patient population.

The use of the new OSIA OSI300 in adults and children with conductive hearing loss and mixed hearing loss

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The study will evaluate the effects of the Osia OSI300 implant in a group of 20 patients with conductive or mixed hearing loss. The Osia device is a percutaneous active bone conduction implant. In 2024, the first operation with the Osia OSI300 in a child was performed at the Institute of Hearing Physiology and Pathology, representing a breakthrough in the treatment and rehabilitation of hearing loss in a younger group of patients. Thanks to the piezoelectric stimulation used, the implant has exceptional high frequency sensitivity compared to other bone anchored implants. In addition to hearing benefits, the Osia OSI300's advanced technology allows for full diagnostic imaging (MRI) without the need to remove the implant. A number of benefits in the treatment of hearing loss have been observed in patients who have received the implant. The first is an improvement in hearing quality in both quiet and noisy environments, with a consequent reduction in speech difficulties. Audiological studies show a significant improvement in speech understanding in both quiet and noise. The degree of speech discrimination was assessed using the Polish Demenko and Pruszewicz Verbal Test, while the Polish Matrix Sentence Test was used to assess understanding in noise. Patients' subjective impressions based on the APHAB (Abbreviated Profile of Hearing Aid Benefit) questionnaire include better discrimination of sounds in noise, improved sound quality and clearer perception of high frequency sounds. Patients appreciate the aesthetics and the lack of restrictions in daily use. The Osia OSI300 system opens up new possibilities for hearing impaired people, thanks to its advanced technology. This is especially true for those who have not been successful with traditional hearing aids.

Valsalva maneuver during computed tomography for the diagnosis of tracheal diverticulum: a case report

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Objectives: Tracheal diverticula constitute a subtype of paratracheal air cysts (PACs) that are characterized by a connection with the trachea through a thin neck. Patients with tracheal diverticulum rarely develop symptoms and are usually diagnosed on computed tomography (CT) performed for an unrelated indication. However, identifying the communication with the trachea on imaging may be challenging.

Material and methods: This report presents the case of a 55-year-old male patient who was referred to the emergency department with a possible fracture of the scapula caused by a fall from a height of three meters and was diagnosed, incidentally, with a paratracheal air cyst on thoracic CT.

Results: The paratracheal air cyst was recognized as a tracheal diverticulum by having the patient perform the Valsalva maneuver during CT. The cyst's volume increased in all three dimensions and a communication with the lateral tracheal wall was revealed, confirming the suspicion of tracheal diverticulum.

Conclusions: Diagnosing and distinguishing tracheal diverticula from other PACs is challenging, even with advanced imaging techniques such as multidetector CT and multiplanar or 3D reconstruction. Accurate identification of tracheal diverticula is crucial for effective patient management, as early diagnosis may inform monitoring strategies and surgical considerations if symptoms arise. This case report proposes that differential diagnosis can be accomplished safely and effectively by utilizing the Valsalva maneuver during CT scans.

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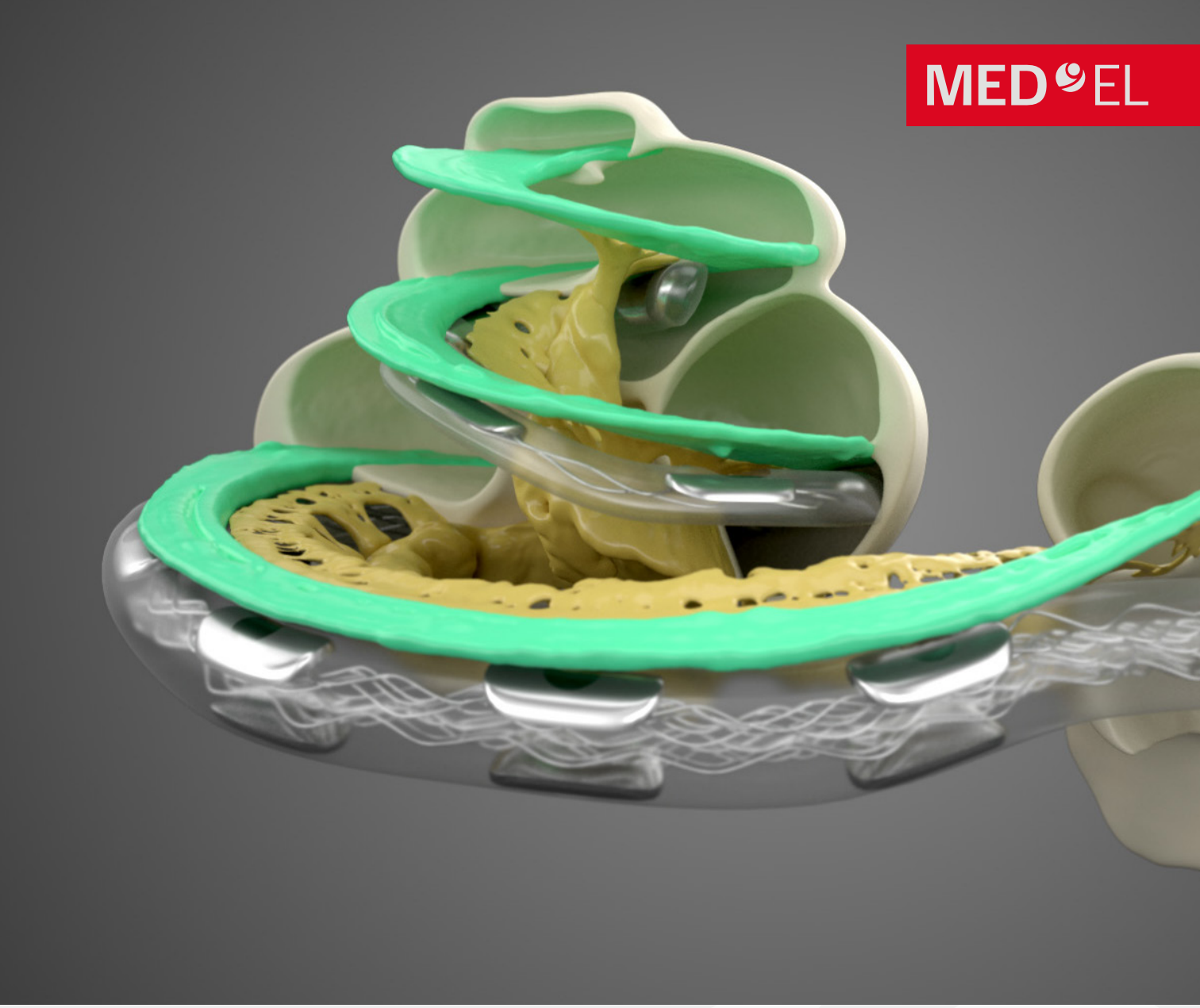

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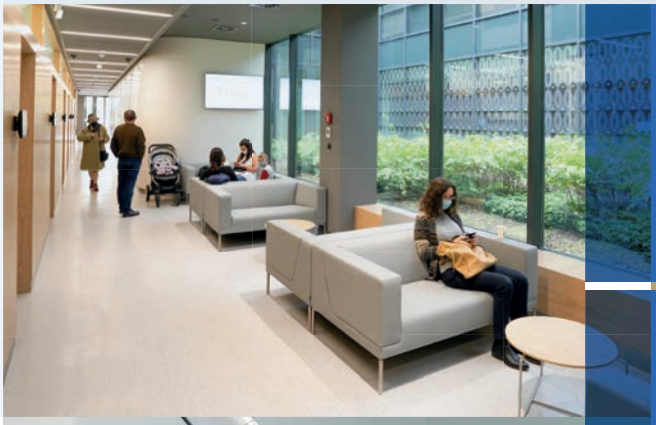

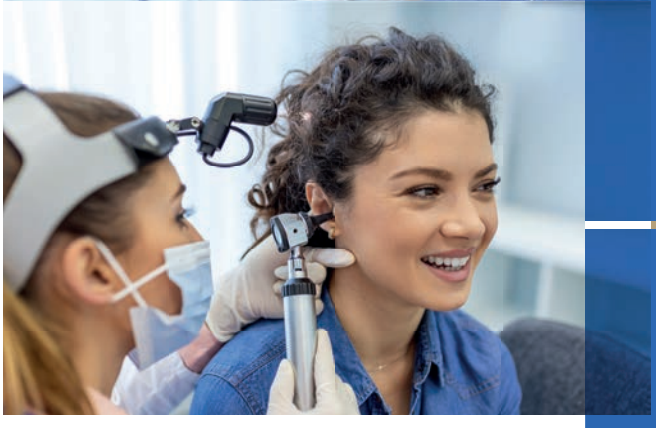

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IN POLAND

1
HOSPITAL

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BRANCHES
ABROAD

THE CENTER OF HEARING AND SPEECH MEDINCUS IS A HIGHLY SPECIALIZED NETWORK OF 25 MEDICAL FACILITIES

providing diagnostic and treatment services for ear, nose, throat, and balance disorders in children and adults.

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- SPPS-S THERAPY (POLYMODAL SENSORY PERCEPTION STIMULATION BY SKARŻYŃSKI'S METHOD)
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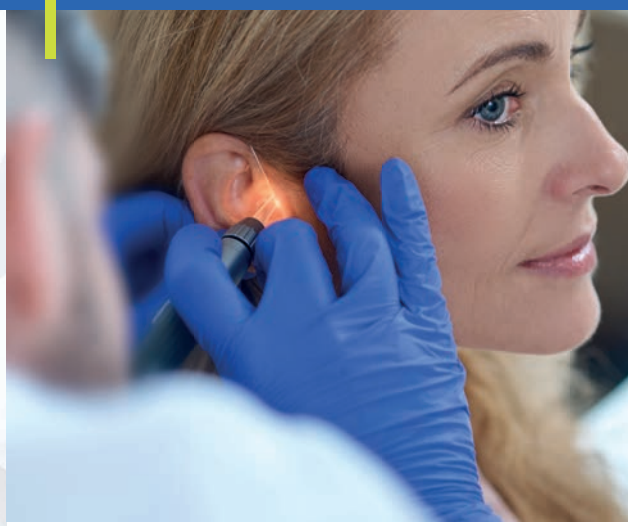

SPPS

STIMULATOR OF THE POLYMODAL SENSORY PERCEPTION (SPPS-S) by Skarzynski method

helps children with various groups of disorders that coexist with the auditory processing disorders, such as:

- delayed speech development,
- dyslalia,
- auditory attention disorders,
- difficulties in reading and writing,
- stuttering,
- voice disorders.

SPPS-S combines auditory stimulation with psychological training.

- It stimulates the various functions and senses in attractive way.
- It engages hearing, sight and touch simultaneously.
- It influences improvement of concentration, coordination and integration different senses.

More information on the web: https://csim.pl/en/offer/

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Hearing is the main sense stimulated with the help of the SPPS. The method is based on the improvement and integration of auditory perception with other senses.

Vision is one of the senses which is additionally stimulated with the help of the SPPS. Visual perception enables to recognize reality just as hearing does. The sessions on multimedia iPad panel enable the development of coordination and integration with other senses.

Touch is another sense which is stimulated with the help of the SPPS. The use of this sense in exercises emphasizes polysensory impact in this method.

1001 Cases in Otology

Editor: prof. Henryk Skarżyński, M.D., Ph.D., Dr. h.c. multi

A unique compendium of cases in otology described by prominent doctors – practitioners and specialists who on everyday basis deal with hearing impairments in the Wold Hearing Centre in Kajetany and in other leading ontological clinics and otosurgical centres in the world. This manual contains among others a detailed presentation of outer, middle and inner ear abnormalities, guidelines for their treatment and obtained results. It is an invaluable source of practical knowledge for all doctors and specialists who, relaying on prominent experts' experience, want to improve their skills in the treatment of hearing disorders.

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1001 Cases_200x285 2022-02

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World Hearing Center

OF THE INSTITUTE OF PHYSIOLOGY AND PATHOLOGY OF HEARING

The World Hearing Center is a modern specialized hospital providing medical care at the highest quality level in the fields of otolaryngology, audiology, phoniatrics, rehabilitation and biomedical engineering. It is superbly equipped for research and education, and includes modern conference facilities. The Center conducts a wide range of research and educational activities addressed to specialists from Poland and other countries. The Center is one of the leading medical institutions in the field of hearing disorders treatment, running, among others, one of the largest hearing implant programs in the world and performing 15,000 to 21,000 surgical procedures yearly.

The Center provides its patients with comprehensive diagnostics, conservative treatments, and surgery for the rehabilitation of:

- congenital and acquired malformations of the external, middle and inner ear,
- hearing, speech and balance disorders of different etiologies,
- disorders of the mouth cavity, throat and larynx,
- disorders of the nose and paranasal sinuses,
- sleep disorders.

World Hearing Center:

- is a global leader in terms of the number of performed otorhinolaryngological surgeries and the number of outpatient consultations (more than 200,000 consultations per year),
- is the place where unique and highly specialized medical procedures are performed, including reconstruction surgeries of congenital defects of the outer ear, treatment of profound and partial deafness with various hearing implants, phonosurgeries, endoscopic sinus surgeries under image guidance, and many others,
- employs a team of highly qualified and experienced specialists,
- has state-of-the-art medical equipment and instrumentation,
- offers comfortable conditions for hospital stays,
- uses the most modern telemedical solutions providing remote consultations via the world-first National Network of Teleaudiology.

The team of the Institute of Physiology and Pathology of Hearing and its individual employees are winners of numerous international and national awards.

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