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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 ($r = 0.64$, $p < 0.01$).

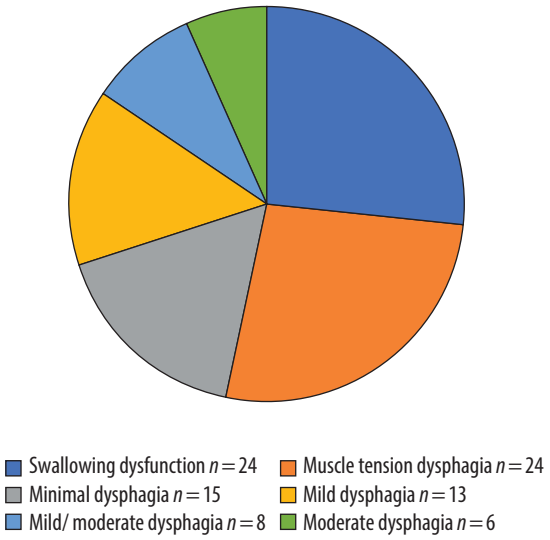

Figure 2. Distribution of patients according to type of dysphagia after endoscopic diagnosis

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	–	$r = 0.81$, $p < 0.05$	$r = 0.26$, $p > 0.05$	$r = 0.06$, $p > 0.05$

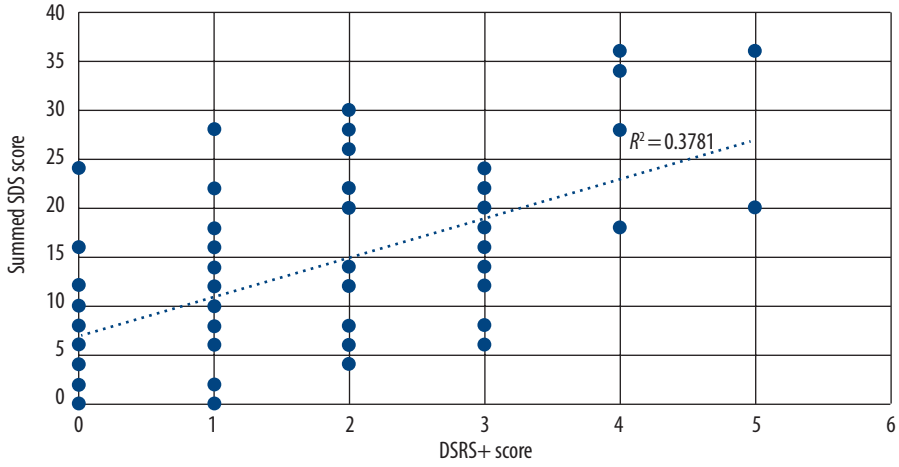

Figure 3. Total scores of all patients on the SDS questionnaire plotted against scores on the DSRS+ questionnaire

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.

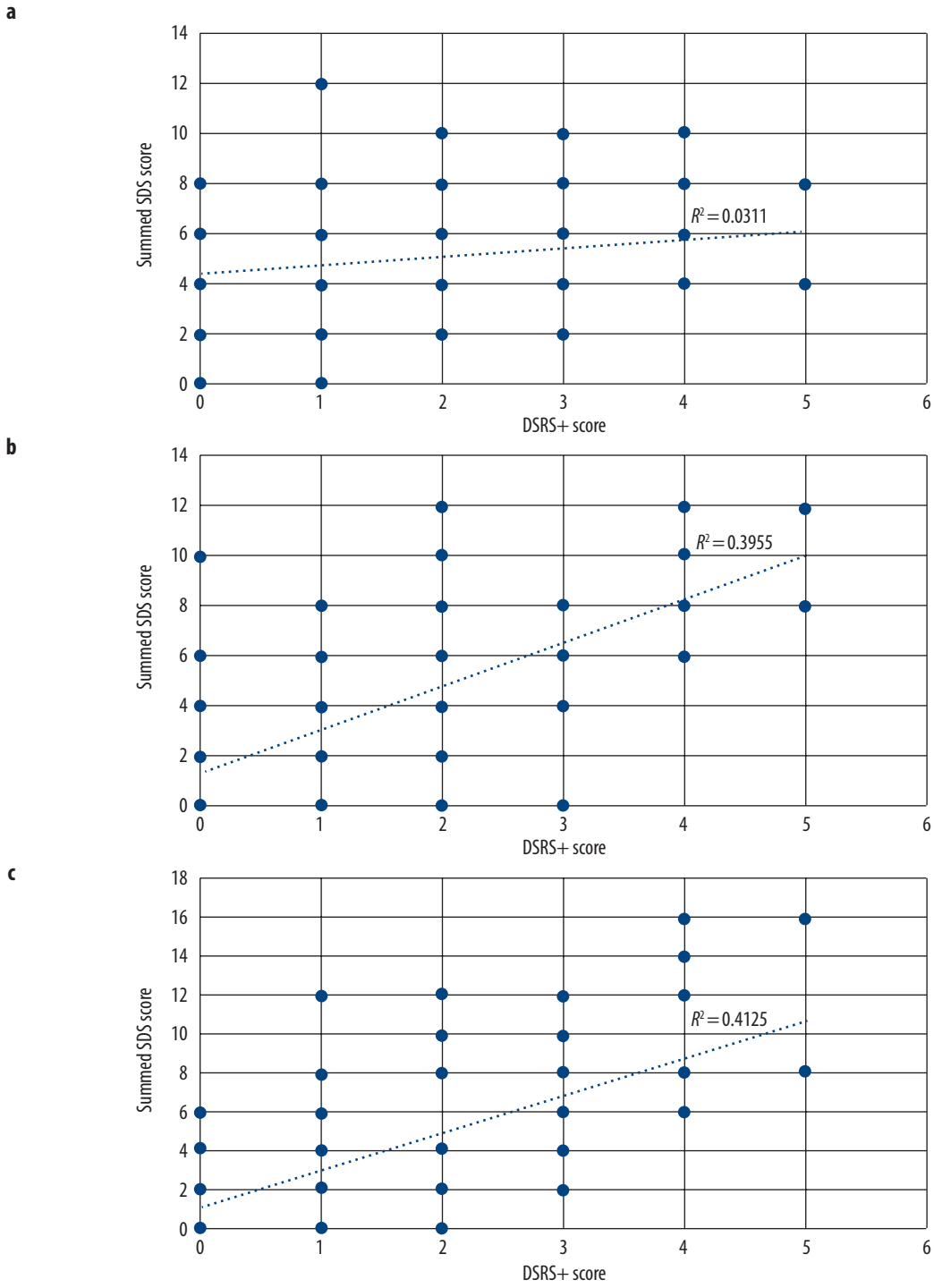

Figure 4. Dependence of the different parts of the SDS questionnaire on the DSRS+ ratings. **a**) SDS 1: sum of scores obtained in questions 1–3 (raising suspicion of a functional swallowing disorder). **b**) SDS 2: sum of questions 4–6 (raising suspicion of oropharyngeal dysphagia). **c**) SDS 3: sum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

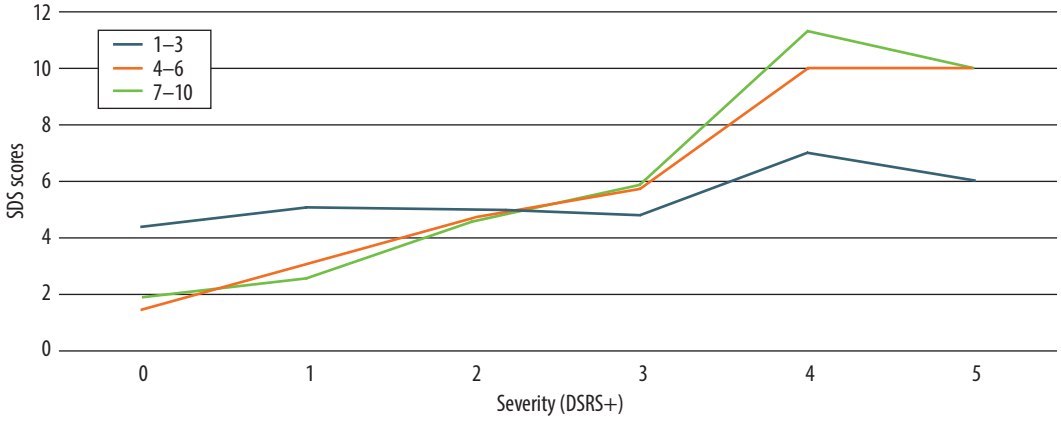

Figure 5. Average SDS scores in questions 1–3, 4–6, and 7–10, plotted against DSRS+ severity

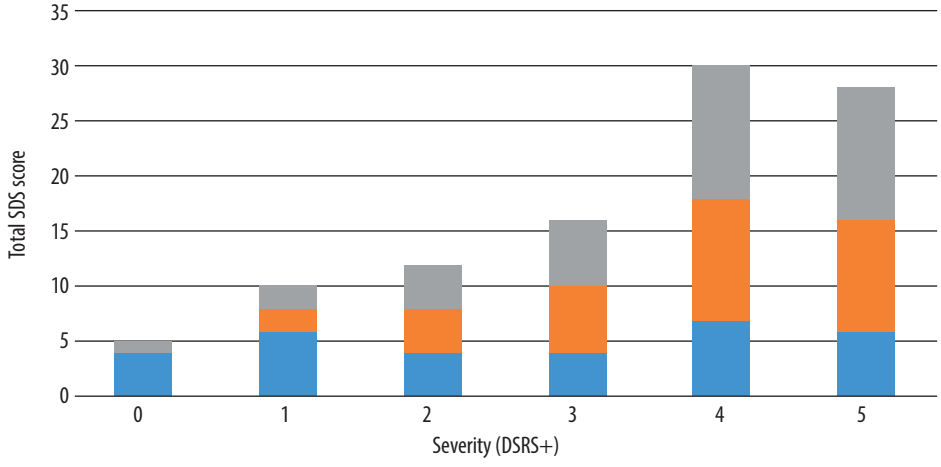

Figure 6. Median scores on questions 1–3, 4–6, and 7–10 of the SDS questionnaire in each DSRS+ group

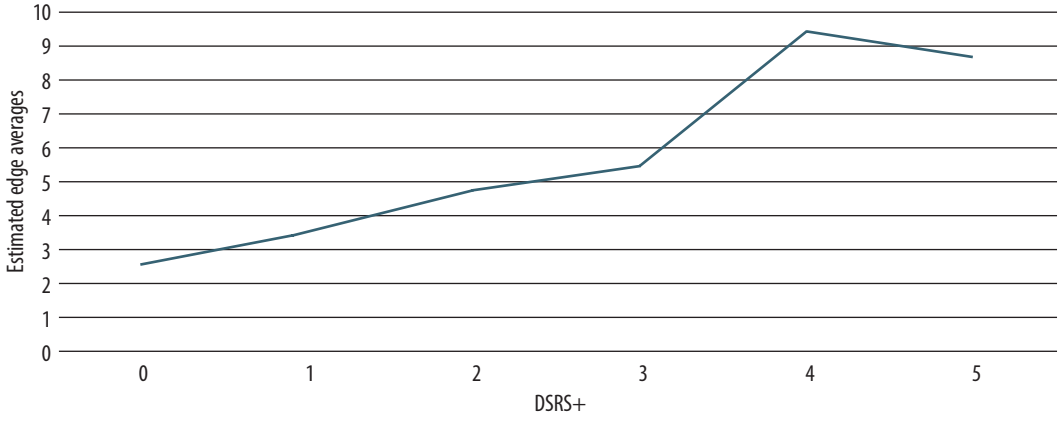

Figure 7. Estimated edge averages of the SDS questionnaire

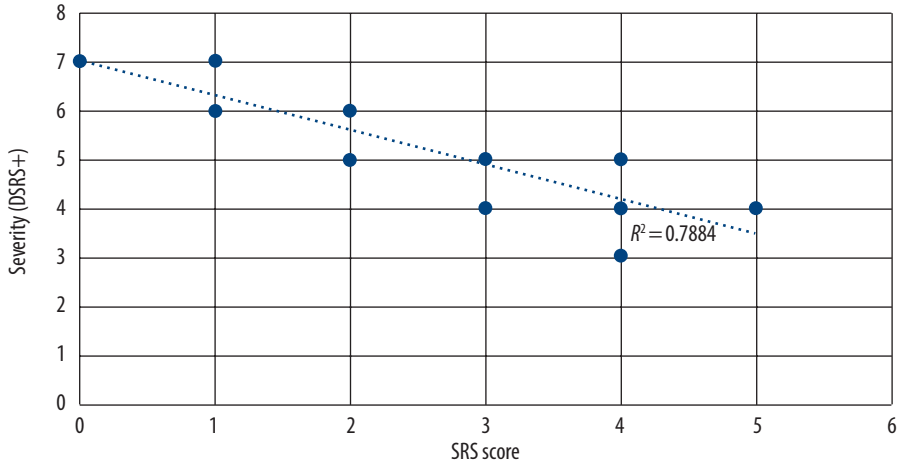

Figure 8. Distribution of SRS scores according to the DSRS+ ratings

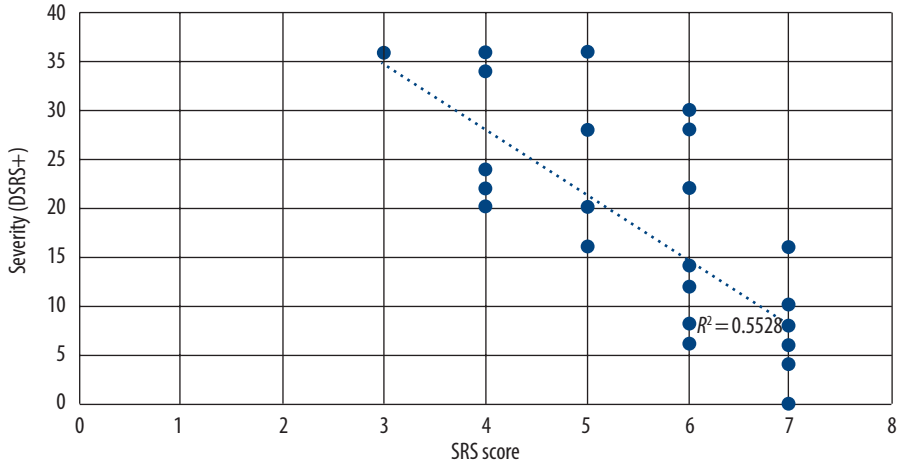

Figure 9. Distribution of SDS scores according to the SRS ratings

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

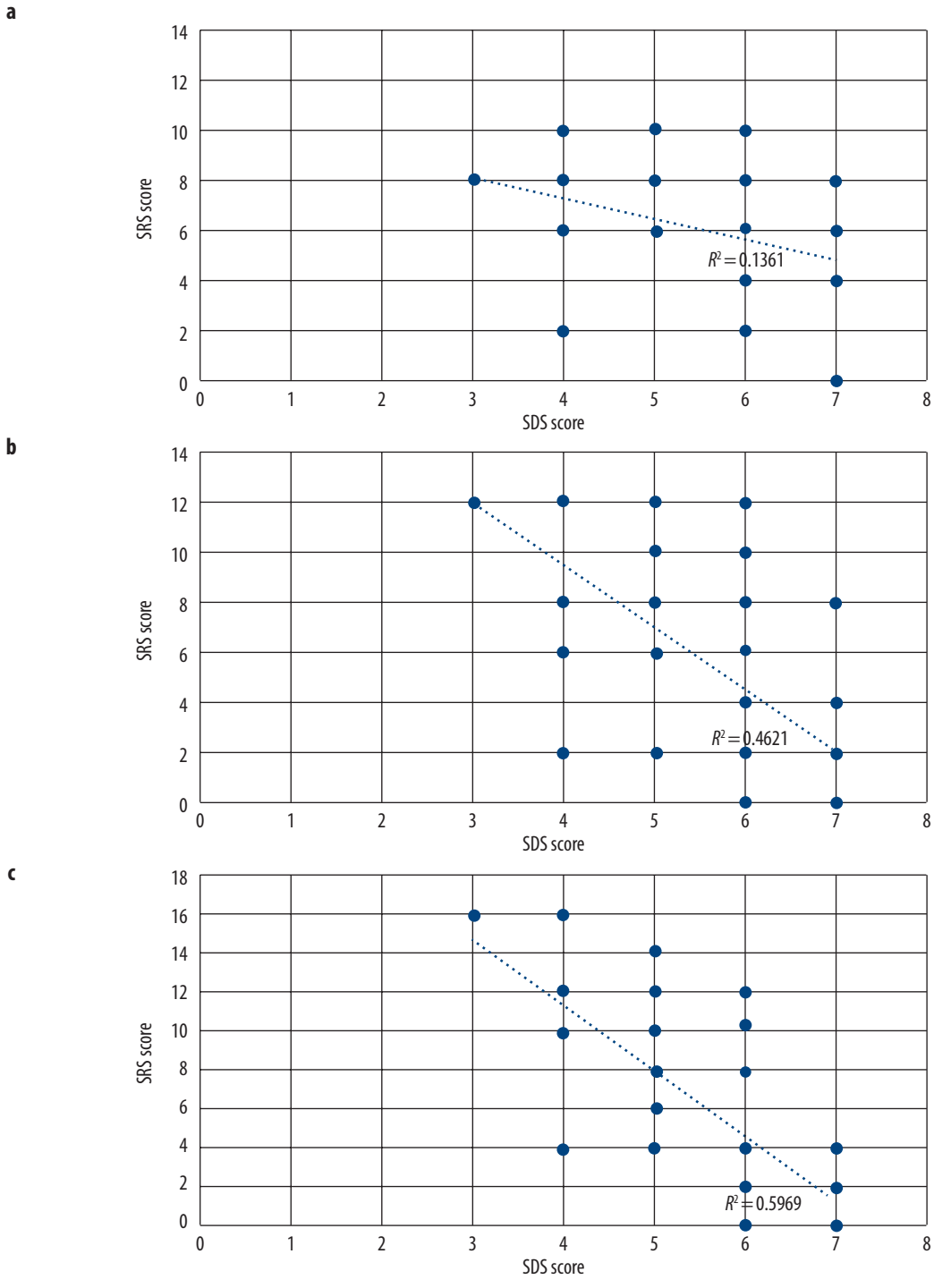

Figure 10. Dependence of individual parts of the SDS questionnaire on SRS ratings. **a**) SDS 1: sum of scores obtained in questions 1–3 (raising suspicion of functional swallowing disorder); **b**) SDS 2: sum of questions 4–6 (raising suspicion of oropharyngeal dysphagia); **c**) SDS 3: sum of questions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