Vocal Tract Discomfort Scale (VTDS) and Voice Symptom Scale (VoiSS) in the Evaluation of Patients With Voice Disorders

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Summary: Objectives. We aimed to correlate the Vocal Tract Discomfort Scale (VTDS) with the Voice Symptom Scale (VoiSS) for evaluation of patients with dysphonia. In addition, we aimed to compare vocal tract discomfort symptoms in patients with and without self-reported voice problem.

Study design. This is a descriptive, cross-sectional, and retrospective study. We analyzed 143 women and 62 men with voice disorders, as confirmed by endoscopic larynx examination. All patients completed the VTDS and VoiSS at vocal evaluation. Descriptive statistics and the Spearman correlation test were applied to all variables. The degree of covariance of variables was noted. The Mann-Whitney *U* test was used to compare the average number of discomfort symptoms among patients with and without self-reported voice problems.

Results. A weak to moderate positive correlation was observed between the average number, frequency, and intensity of comfort symptom and the total score, physical domain score, and limitation domain score of the VoiSS. The vocal tract discomfort symptoms and the emotional domain score of the VoiSS were weakly correlated. Patients with self-reported voice problems had a higher number, frequency, and intensity of vocal tract discomfort symptoms.

Conclusion. There is correlation between the VTDS and VoiSS scales, with greater references to vocal tract discomfort symptom in patients with self-reported voice problems. Therefore, the discomfort symptoms seem to influence the perception of the impact of a voice problem.

Key Words: Self-assessment–Signals and symptoms–Voice disorders–Voice Symptom Scale (VoiSS)–Vocal Tract Discomfort Scale (VTDS).

INTRODUCTION

Voice disorders can be characterized as processes caused by morphological or functional factors that may interfere with vocal production, laryngeal function, or both.[1] Voice disorders can manifest in different ways, either with the development of sensory symptoms that may or may not be related to vocal production[2] or with deviations in vocal quality.[3] There may also be changes in the structure of the vocal folds, in laryngeal function,[4] or in both, resulting in possible decreases in the individual's quality of life, affecting the physical, emotional, social, and/or economic facets of their lives.[5]

Symptoms reported by patients with voice disorders can be categorized as sensory, physical, or pharyngeal, when they involve unpleasant sensations in the body—specifically in the area of the shoulders and neck—during vocal production. Symptoms are classified as auditory when the patient or their partners aurally recognizes that vocal production has been altered.[6,7] Moreover, these symptoms can vary on a continuum, both in terms of the frequency and the intensity with which these symptoms occur.

In a clinical setting, a patient's complaint about a voice disorder is seldom directly related to a change in vocal quality, but is more often related to the presence of unpleasant physical sensations associated with vocal production. In most cases, this is the physical symptom that motivates the patient to seek a doctor or a speech therapist for an assessment of vocal function.[1,2]

In recent years, self-assessment questionnaires have gained clinical and scientific popularity,[8,9] mainly because they permit the estimation of the magnitude of the problem from the patient's point of view. Thus, they have also been used as a reference standard in screening procedures and for monitoring the effectiveness of treatments offered to dysphonic patients.[8,10–12] Self-assessment questionnaires are important for assessing the impact of the problem on the patient's life, to monitor progress, and to evaluate the effectiveness of the treatment performed. They also play a vital role in making decisions about appropriate voice treatments.[9,12–16]

In addition, some studies[2,12,17] have investigated the discriminatory power of these self-assessment instruments and have found them to perform excellently in discriminating patients with and without voice disorders, when compared to endoscopic larynx examinations as a reference standard. The Voice Symptoms Scale (VoiSS)[18] and the Vocal Tract Discomfort Scale (VTDS)[6] are examples of self-assessment questionnaires. Specifically, these instruments are used to investigate the presence of the symptoms with which patients present.

The VoiSS is a self-assessment questionnaire that investigates the frequency of occurrence of vocal symptoms. The VoiSS

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Ethical approval: This study was approved by the ethics committee of the institution of origin, with the number 52492/12. We obtained consent from all individual participants included in the study.

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addresses questions about vocal function, physical symptoms, and the emotional impact of the vocal problem on the life of the individual.[18] VoiSS was developed in three stages.[18] Initially, based on an open questionnaire, 133 patients with voice disorders reported 467 problems related to their disorders. By analyzing the difficulties reported by these patients, 53 items were identified and used to compile the early version of the VoiSS. This version was administered to 168 patients with dysphonia. Later, a correlation matrix was used to reduce the number of items, resulting in a reduced and final version of the questionnaire, containing 30 items, which was then applied to 180 new patients with dysphonia.

The VoiSS differs from other instruments of vocal self-assessment, such as the Voice-Related Quality of Life and the Voice Handicap Index (VHI), in its ability to investigate, in the same instrument, the presence of vocal symptoms and their impact on the patient's life.[16,19] The VoiSS was considered to be psychometrically robust to vocal self-assessment,[9,19] with a high accuracy (>90%) for discriminating between patients with and without voice disorders.[12]

Thus, considering the discriminatory power of the VoiSS, its psychometric properties, and the relevance of researching the frequency of occurrence of vocal symptoms and their impact on the daily life of the patient, the VoiSS can be considered a robust questionnaire[12,16,19] for use in clinical procedures and research. It could even be used as a reference standard for identifying individuals with and without self-reported voice problems.[20,21]

The VTDS was developed with the objective of evaluating the frequency and intensity of vocal tract discomfort symptoms in patients with dysphonia, using qualitative descriptors.[6,22] The VTDS is the only vocal evaluation instrument to specifically investigate vocal tract discomfort symptoms and has the advantage of presenting a shorter administration time compared to other vocal self-assessment instruments (eg, VoiSS).

This instrument is mainly used in cases of muscle tension dysphonia (MTD).[6] Although the quantification of sensory symptoms is subjective and complex, it is believed that the discomfort is a low-intensity pain associated with an unpleasant sensation in patients with dysphonia.[6] The VTDS was designed to be used as part of the evaluation of patients with primary or secondary MTD. However, as MTD is multifactorial and has multiple etiologies involved in its pathogenesis, including both physical and behavioral factors; the vocal tract discomfort symptoms detected by this system can be present in many other types of voice disorders.[23] We found studies from Britain,[6,22] Poland,[24–26] Brazil,[2,7] Persia,[27] and Belgium[28] in which the VTDS was used. In these studies, the patients included teachers with and without voice disorders,[7,24–26] patients with primary and secondary MTD,[6,22,27] patients with different types of voice disorders,[2] and vocally healthy individuals.[28]

In general, the results of the studies with the VTDS have demonstrated that the frequency and intensity of the symptoms of vocal tract discomfort vary according to the etiology of voice disorder[2] and decrease after vocal therapy[6,25]; dysphonic teachers have more symptoms of discomfort than teachers without dysphonia,[7,24,26] and individuals with self-reported voice problems had an average of three symptoms.[28] These findings[2,6,7,22,25–28] seem to indicate that an understanding of the presence and severity of sensory symptoms is important for patients with voice disorders at the time of initial evaluation, during the vocal rehabilitation process and for the discharge of patients.

Thus, considering the relevance of vocal tract discomfort symptoms in dysphonic patients, the main motivation for this research is to understand the influence of these symptoms on the self-assessment of voice problems. In the available literature, only three studies[25–27] investigated the relationship between a self-reported voice problem through VHI and the symptoms of discomfort. Two of these studies[25,26] had subjects who used their voices professionally (teachers). This limits both the possibility of comparison and the generalization of the findings to the wider population of dysphonic patients, because voice professionals tend to report worse scores in vocal self-assessment and have a greater awareness of their vocal difficulties, compared to the general population.[29] Furthermore, although VHI is widely used in clinical and research settings, VoiSS was considered to be more psychometrically robust to vocal self-assessment.[9,19]

To date, there are no studies comparing the symptoms of discomfort in patients with and without self-reported voice problems, as determined using the VoiSS reference standard. Thus, considering that the VoiSS is a reliable and highly accurate self-reporting instrument for discriminating between subjects with and without voice problems,[12] we believe that the investigation of the vocal tract discomfort symptoms in these two groups of individuals, as well as the investigation of the correlation of the scores of these two instruments, can illustrate the impact of the number, frequency, and intensity of symptoms of discomfort on the self-perception of the voice problem.

In this context, the objective of this study was to correlate the VTDS with the VoiSS for the evaluation of patients with dysphonia. In addition, this study aimed to compare vocal tract discomfort symptoms, as identified by the VTDS, in patients with and without self-reported voice problems, as detected by the VoiSS.

We made the following hypotheses. (1) There is a correlation between the VoiSS scores and the number, frequency, and intensity of vocal tract discomfort symptoms (as reported by the VTDS) in dysphonic patients. (2) Patients with voice problems detected by the VoiSS have a higher number, frequency, and intensity of vocal tract discomfort symptoms than those with no voice problems detected by the VoiSS. If our hypothesis is supported by the findings of the present study, it would confirm the impact of vocal tract discomfort symptoms on vocal self-perception, thus reinforcing the importance of using the VTDS as a vocal assessment procedure, particularly for monitoring the effectiveness of treatments offered to dysphonic patients.

METHODS

Study design

This study had a retrospective, descriptive, and cross-sectional design. It was approved by the ethics committee of the institution of origin, with the number 52492/12. All participants were informed about the study and willingly signed informed consent.

Subjects

This study involved patients evaluated in the voice laboratory of a higher education institution during the period May 2012 to July 2015. The eligibility criteria for participation in this study were:

- Subjects aged over 18 years and below 65 years, considering that individuals younger than 18 years may be under the influence of vocal changes and subjects over 65 years tend to take a more negative vocal self-assessment in relation to the population of young adults[29];
- Patients who have undergone laryngological evaluation in the 2 weeks before data collection for confirming the diagnosis of a voice disorder;
- Completion of the two protocols for self-assessment (VoiSS and VTDS);
- Individuals without professional voice use, as voice professionals tend to have worse scores in vocal self-assessment instruments and a greater awareness of their vocal difficulties[29];
- Lack of vocal treatment (therapy or surgery) prior to the time of data collection, because there are differences in the evaluation of frequency and intensity of vocal tract discomfort symptoms in individuals who have undergone voice therapy.[28]

We used the following criteria for allocation of individuals to the two groups: In the voice problem group, subjects had a score ≥16 points on VoiSS[12] and the presence of a functional or structural larynx disorder. In the no voice problem group, subjects had a score <16 points on VoiSS[12] and no functional or structural larynx disorder. Subjects who had scores ≥16 points on VoiSS but no laryngeal disorders were excluded from the study, as were subjects with laryngeal disorders but no self-reported voice problem on VoiSS.

Thus, of the 794 patients evaluated in this laboratory between May 2012 and July 2015, 83 were younger than 18 or older than 65 years old, 83 showed no conclusive result after laryngeal examination, 176 did not complete the VoiSS and the VTDS, 171 were voice professionals, 63 had already undergone previous vocal treatment (therapy or surgery), 11 had no voice problem on VoiSS (score ≥16 points) and a larynx disorder, and two had voice problems on VoiSS (score < 16 points) but no larynx disorder. Thus, 589 subjects who did not fit the eligibility criteria were excluded, with a final sample of 205 individuals included, as shown in Figure 1.

Of these 205 subjects, there were 143 women and 62 men, with an average age of 39.98 ± 16.02 years and the following laryngeal diagnoses: vocal nodules (n = 59; 28.78%); no functional or structural larynx disorder (n = 54; 26.34%); vocal cyst (n = 23; 11.21%); voice disorders secondary to a gastroesophageal reflux disorder (n = 17; 8.29%); vocal polyps (n = 15; 7.31%); incomplete glottal closure without an organic or neurologic cause (n = 14; 6.82%); unilateral vocal fold paralysis (n = 10; 4.87%); *Sulcus vocalis* (n = 8; 3.90%); and Reinke edema (n = 5; 2.43%). Such diagnoses are in line with the most prevalent findings in the general population.[30] All patients were seen for an initial evaluation before undergoing voice therapy.

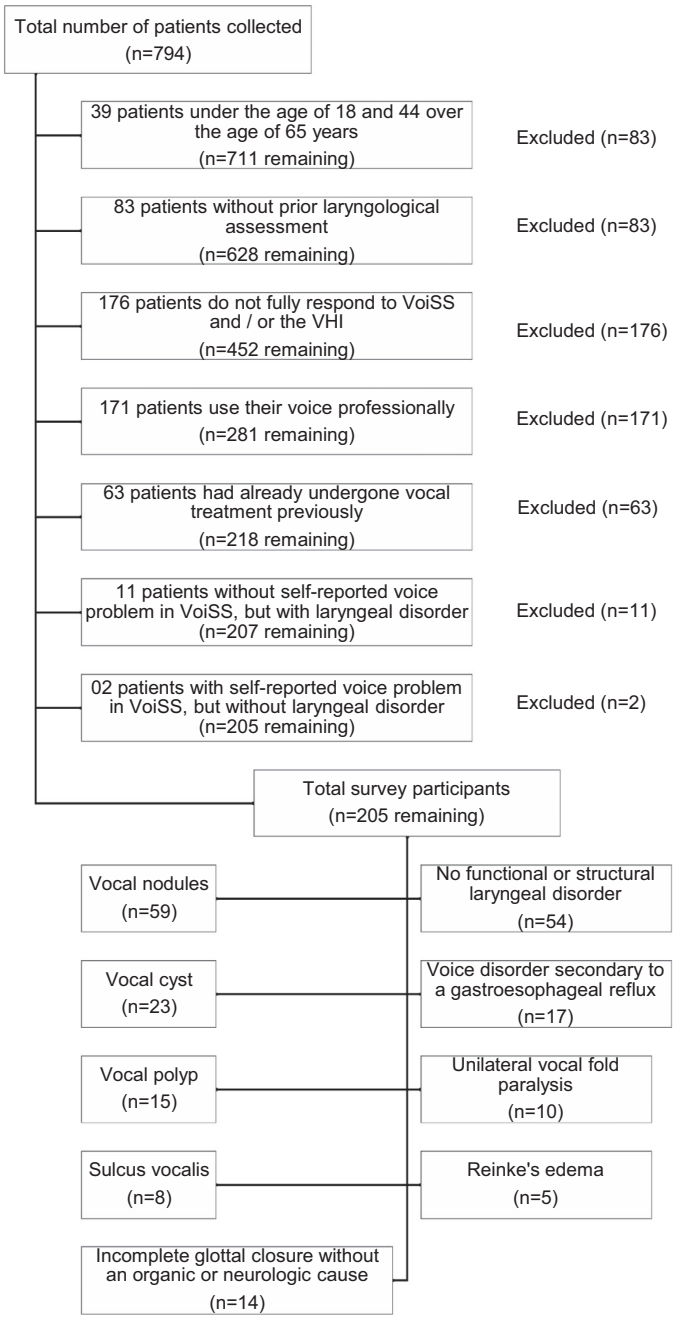

FIGURE 1. Flow chart of the study participants according to the eligibility criteria.

Procedures

Each patient underwent a brief anamnesis for personal and voice data collection, and completed the vocal self-assessment protocols (VoiSS and VTDS) during the same evaluation session, which lasted an average of 60 minutes. The anamnesis determined personal information (gender, age, and profession) and vocal information (a brief history of the vocal problem and previous vocal treatment applied). Thereafter, the VoiSS and the VTDS self-assessment protocols were applied; both were cross-culturally adapted into Brazilian Portuguese.[7,26]

The VoiSS investigated the frequency of occurrence of vocal symptoms. This instrument contains 30 items, including 15 on

the limitation domain (functionality), 8 on the emotional domain (psychological effect), and 7 on the physical domain (organic symptoms). Each item can be rated on a Likert scale of five points, numbered 0–4, where "0" means "never" and 4 means "always." The scores for the items in each domain were summed.[18] The cutoff values used for the domains for this protocol were as follows: total = 16, limitation domain = 11.5, emotional domain = 1.53, and physical domain = 6.5.[12]

In this study, the VoiSS and the results of a visual laryngeal examination were selected as a combined reference standard for determining the outcome (absence or presence of a voice problem). In addition, because we aimed to verify the relationships between the subscales of the two self-assessment instruments (VTDS and VoiSS), individuals were allocated into subgroups according to the cutoff values of the total score and subscripts. In the analysis of the subscales, we included in the group "with a self-reported voice problem" only those individuals who presented values above the cutoff point for the total score and the specific subscale being investigated. Subjects "without a self-reported voice problem" were considered to be those who presented values inferior to the cutoff point in the total score as well as in the investigated subscale. Subjects who did not fit these inclusion criteria were excluded from the study for the analysis of VoiSS subscales, as described below:

- Total score: 151 patients had a self-reported voice problem and 54 patients did not.
- Limitation domain: 135 patients had a self-reported voice problem and 41 patients did not. Sixteen subjects were excluded from the analysis of this subscale because they presented values <16 points in the total VoiSS score and ≥11.5 points in the limitation subscale. Thirteen individuals were excluded because they had values ≥16 points in the VoiSS and <11.5 points in the limitation domain.
- Emotional domain: 140 patients had a self-reported voice problem and 45 patients did not. Eleven subjects were excluded from the analysis of this subscale because they presented values <16 points in the total VoiSS score and ≥1.53 points in the emotional subscale. Nine individuals were excluded because they had values ≥16 points in the VoiSS and <1.53 points in the emotional domain.
- Physical domain: 147 patients had a self-reported voice problem and 51 patients did not. Four subjects were excluded from the analysis of this subscale because they presented values <16 points in the total VoiSS score and ≥6.5 points in the physical subscale. Three individuals were excluded because they had values ≥16 points in the VoiSS and <6.5 points in the physical domain.

The VTDS was then applied to assess the frequency and intensity of symptoms of discomfort of the vocal tract in the patients studied.[2] The VTDS uses a Likert scale of seven points to measure the frequency and intensity of these symptoms, including burning, tightness, dryness, aching, tickling, soreness, irritation, and having a lump in the throat. The scale is enumerated from 0 to 6, with "0" corresponding to "never" and "6" corresponding to "always" in terms of frequency, or "0" corresponding to "no" and "6" corresponding to "extreme" in terms of intensity.

The following cutoff values were used, as defined in the literature,[7] for categorizing the presence or absence of symptoms of discomfort, specifically for the field of "frequency": 0.5 for burning, tightness, aching, tickling, and soreness, and 2.5 for dryness, irritation, and having a lump in the throat. Values equal to or greater than the cutoff indicated the presence of the symptom.

Data analysis

Descriptive statistics, including the mean and standard deviation, were determined for all variables, and inferential statistical analysis was used.

The Spearman correlation test was applied to investigate whether there was a significant correlation between the average number, frequency, and intensity of the symptoms of discomfort and the scores from the VoiSS. The degree to which the variables were jointly modified was also assessed. The correlation coefficient could range from −1 to 1. Although there has been great variation in the classification of correlation coefficients, depending on the health condition and the risk levels of the populations studied,[31] we chose the following classification[32]: 0.1–0.2 represents a very low correlation, 0.2–0.4 indicates a low correlation, 0.4–0.6 indicates a moderate correlation, 0.6–0.8 represents a strong correlation, and >0.8 indicates a very high correlation between variables.

The nonparametric Mann-Whitney *U* test was used to compare the average number, frequency, and intensity of the symptoms of discomfort between individuals with and without self-reported voice problems. The groups were created using the cutoff values of the different domains of the VoiSS (total, limitation domain, emotional domain, and physical domain), as previously described. This test was designed to investigate whether patients with self-reported voice problems, as detected by the VoiSS, would present a higher number, and greater frequency and intensity of vocal tract discomfort symptoms (as detected by the VTDS).

All analyses were performed using the Statistical Package for Social Sciences software (SPSS, Version 20.0, IBM Corp, Armonk, NY). The significance level was set at 5%.

RESULTS

The analysis correlated the number, frequency, and intensity of symptoms of discomfort of the vocal tract with the total, limitation domain, emotional domain, and physical domain scores of the VoiSS (Table 1). A moderately positive correlation was observed between the number of symptoms of discomfort and the total score ($P < 0.001$), the limitation domain score ($P < 0.001$), and the physical domain score ($P < 0.001$) of the VoiSS. A weakly positive correlation was observed with the emotional domain score ($P < 0.001$) of the VoiSS.

There was also a moderately positive correlation between the frequency and intensity of symptoms of discomfort of the vocal tract and the total score and physical score of the VoiSS (Table 1). A weak to moderate positive correlation between the frequency and intensity of symptoms of discomfort of the vocal tract

TABLE 1.
Correlation Between the Mean, Number, Frequency, and Intensity of Vocal Tract Discomfort Symptoms and the Voice Symptom Scale Scores

	VoiSS-T		VoiSS-L		VoiSS-E		VoiSS-P	
Variables	Corr	*P* Value	Corr	*P* Value	Corr	*P* Value	Corr	*P* Value
Number of VTDS	0.5	<0.001*	0.4	<0.001*	0.3	<0.001*	0.7	<0.001*
Fr. burning	0.4	<0.001*	0.4	<0.001*	0.3	<0.001*	0.5	<0.001*
Fr. tightness	0.5	<0.001*	0.4	<0.001*	0.4	<0.001*	0.5	<0.001*
Fr. dryness	0.4	<0.001*	0.4	<0.001*	0.3	<0.001*	0.5	<0.001*
Fr. aching	0.4	<0.001*	0.3	<0.001*	0.2	<0.001*	0.5	<0.001*
Fr. tickling	0.3	<0.001*	0.2	0.001*	0.2	0.003*	0.4	<0.001*
Fr. soreness	0.4	<0.001*	0.3	<0.001*	0.3	<0.001*	0.4	<0.001*
Fr. irritability	0.4	<0.001*	0.3	<0.001*	0.3	<0.001*	0.5	<0.001*
Fr. lump in the throat	0.4	<0.001*	0.3	<0.001*	0.2	<0.001*	0.6	<0.001*
Int. burning	0.4	<0.001*	0.4	<0.001*	0.3	<0.001*	0.5	<0.001*
Int. tightness	0.4	<0.001*	0.3	<0.001*	0.3	<0.001*	0.4	<0.001*
Int. dryness	0.4	<0.001*	0.4	<0.001*	0.3	<0.001*	0.4	<0.001*
Int. aching	0.4	<0.001*	0.3	<0.001*	0.3	<0.001*	0.4	<0.001*
Int. tickling	0.3	<0.001*	0.2	0.001*	0.2	0.005*	0.4	<0.001*
Int. soreness	0.4	<0.001*	0.3	<0.001*	0.2	<0.001*	0.4	<0.001*
Int. irritability	0.4	<0.001*	0.3	<0.001*	0.2	<0.001*	0.5	<0.001*
Int. lump in the throat	0.4	<0.001*	0.3	<0.001*	0.2	<0.001*	0.5	<0.001*

* Significant values ($P < 0.05$)—Spearman correlation.
Abbreviations: Corr., correlation; E, emotional; Fr., frequency; Int., intensity; L, limitation; P, physical; T, total; VoiSS, Voice Symptom Scale; VTDS, Vocal Tract Discomfort Scale.

and the limitation score of the VoiSS (Table 1) was observed. Similarly, a weak correlation was found between the frequency and intensity of symptoms of discomfort of the vocal tract and the emotional score of the VoiSS (Table 1).

Patients with self-reported voice problems experience more symptoms of discomfort than patients without self-reported voice problems, when patients were grouped based on the total score of the VoiSS ($P < 0.001$; [F(8. 966) = 24.98]).

The VTDS differed significantly between patients with and without self-reported voice problems, with a greater frequency and intensity of symptoms in patients with self-reported voice problems (Table 2).

Patients with self-reported voice problem as detected in the VoiSS limitation domain score showed more vocal tract discomfort symptoms than did those without self-reported voice problems (Table 3; $P \leq 0.001$; [F(0. 301) = 63.70]). Patients with self-reported voice problems also had a greater frequency and intensity in nearly all VTDS (Table 3).

Patients with self-reported voice problems as detected by the VoiSS emotional domain score showed more symptoms of vocal tract discomfort than patients without such problems (Table 4; $P < 0.001$; [F(0. 373) = 98.17]). The frequency and intensity of symptoms of discomfort also presented with larger values for almost all symptoms of discomfort in patients with self-reported voice problems.

Patients with self-reported voice problems as detected by the physical domain score of the VoiSS had increased symptoms of discomfort of the vocal tract (Table 5; $P \leq 0.001$; [F(7. 047) = 124.21]). Patients with self-reported voice problems presented with higher values for the frequency and intensity of symptoms of discomfort of the vocal tract for all vocal symptoms ($P \leq 0.001$).

DISCUSSION

Voice disorders, as identified by a speech therapist or physician, are not always perceived in the same manner as by the patient; therefore, qualitative and quantitative investigations of the vocal symptoms of the patient allow a wider and more adequate consideration of their needs.[2,18] Treatment often focuses on eliminating or reducing the symptoms presented by the patient.[17]

In this context, the present study aimed to investigate the correlation between the scores of the VoiSS[18]—which is a more extensive protocol and maps symptoms related to the limitations of communication, and physical and emotional symptoms—and the VTDS,[6] which identifies only sensory/physical symptoms related to discomfort in the vocal tract.

We raised the following hypotheses for this study: (1) there is a correlation between the VoiSS scores and the number, frequency, and intensity of vocal tract discomfort symptoms in dysphonic patients; (2) patients with self-reported voice problems as detected by the VoiSS have a higher number, and a greater frequency and intensity of vocal tract discomfort symptoms. We discuss our findings in the light of these two hypotheses below. As no other studies have assessed the relationship between the VoiSS and the VTDS scores, our discussion will be based on the findings of previous studies using other self-assessment instruments, such as the VHI, and the inferences made from the findings of this study.

TABLE 2.
Comparison of the Mean, Number, Frequency, and Intensity of Vocal Tract Discomfort Symptoms in Patients With and Without Self-reported Voice Problem in the Total Score of Voice Symptom Scale

	VoiSS-T				
	Patients Without Self-reported Voice Problem		Patients With Self-reported Voice Problem		
Variables	Mean	SD	Mean	SD	*P* Value
Number of VTDS	1.71	1.61	4.39	2.39	<0.001*
Fr. burning	0.65	0.96	1.98	2.02	0.008*
Fr. tightness	0.18	0.52	1.85	2.01	<0.001*
Fr. dryness	1.00	1.06	3.34	2.10	<0.001*
Fr. aching	1.06	0.90	2.27	2.08	0.017*
Fr. tickling	0.41	0.79	1.73	1.93	0.003*
Fr. soreness	0.65	1.41	1.98	2.07	0.004*
Fr. irritation	0.88	1.05	2.60	2.13	0.001*
Fr. lump in the throat	0.24	0.66	2.40	2.24	<0.001*
Int. burning	0.65	0.93	2.09	2.07	0.005*
Int. tightness	0.18	0.72	1.95	1.97	0.001*
Int. dryness	1.06	1.08	3.26	1.94	<0.001*
Int. aching	1.24	1.20	2.37	2.06	0.038*
Int. tickling	0.41	0.93	1.86	2.00	0.001*
Int. soreness	0.35	0.70	2.00	2.01	0.001*
Int. irritation	1.00	1.73	2.77	2.15	0.001*
Int. lump in the throat	0.24	0.66	2.43	2.23	<0.001*

* Significant values ($P < 0.05$)—Mann-Whitney *U* test.
Abbreviations: Fr., frequency; Int., intensity; SD, standard deviation; T, total; VoiSS, Voice Symptom Scale; VTDS, Vocal Tract Discomfort Scale.

TABLE 3.
Comparison of the Mean, Number, Frequency, and Intensity of Vocal Tract Discomfort Symptoms in Patients With and Without Self-reported Voice Problem in the Limitational Score of Voice Symptom Scale

	VoiSS-L				
	Patients Without Self-reported Voice Problem		Patients With Self-reported Voice Problem		
Variables	Mean	SD	Mean	SD	*P* Value
Number of VTDS	1.69	1.58	4.41	2.43	<0.001*
Fr. Burning	0.69	1.01	1.99	2.02	0.011*
Fr. Tightness	0.31	0.70	1.93	2.03	0.001*
Fr. Dryness	0.94	1.06	3.36	2.12	<0.001*
Fr. Aching	1.00	0.89	2.27	2.07	0.021*
Fr. Tickling	0.31	0.70	1.73	1.89	0.001*
Fr. Soreness	0.69	1.44	1.98	2.05	0.006*
Fr. irritation	0.75	0.93	2.56	2.05	<0.001*
Fr. lump in the throat	0.25	0.68	2.30	2.20	<0.001*
Int. burning	0.69	0.94	2.10	2.08	0.008*
Int. tightness	0.44	1.20	1.99	2.01	0.001*
Int. dryness	1.00	1.09	3.25	1.96	<0.001*
Int. aching	1.19	1.22	2.33	2.04	0.039*
Int. tickling	0.31	0.87	1.82	1.95	0.001*
Int. soreness	0.37	0.71	2.02	2.02	0.001*
Int. irritation	0.94	1.18	2.72	2.09	0.001*
Int. lump in the throat	0.25	0.68	2.32	2.21	<0.001*

* Significant values ($P < 0.05$)—Mann-Whitney *U* test.
Abbreviations: Fr., frequency; Int., intensity L, limitation; SD, standard deviation; VoiSS, Voice Symptom Scale; VTDS, Vocal Tract Discomfort Scale.

Correlation between the VoiSS and VTDS

The findings of the present study support the hypothesis that there is a correlation between the VoiSS scores and the number, frequency, and intensity of vocal tract discomfort symptoms in dysphonic patients. We observed a moderately positive correlation between the average number, frequency, and intensity of symptoms of vocal tract discomfort on the VTDS, and the total score, limitation scores, and physical scores of the VoiSS.

A previous study[26] has analyzed vocal tract discomfort symptoms among teachers with primary and secondary MTD (vocal nodules, polyps, or edema). A strong positive correlation was found between the scores of the VTDS and the total scores and the physical domain of the VHI, and a moderately positive correlation was found between the scores of VTDS and scores on the functional and emotional domains of the VHI.

Another study on pre- and postintervention in teachers noted that the decrease in vocal tract discomfort symptoms after intervention was accompanied by a decrease in VHI scores.[25] This may indicate that the frequency and intensity of symptoms of discomfort influence the perception of the impact of dysphonia on the individual's life.

There are some differences between the present study and the previous studies,[25,26] particularly in terms of the instruments used to assess the impact of voice disorders (VoiSS and VHI, respectively). Although both instruments incorporate the psychosocial impact of a voice problem into their theoretical construct,[19] only the VoiSS includes physical symptoms, corresponding to five of the seven items included in the physical domain score of the VoiSS. Particularly, during the validation of the VoiSS,[18] the physical symptom item "Do you cough or clear your throat?" had the most significant influence on the development of the scale used for evaluating patients with dysphonia.[19]

In this regard, although we have not investigated the psychometric properties of the VTDS, it should be noted that the validity of an instrument is an important consideration for evaluation, as it concerns the extent to which this instrument actually measures that which it purports to measure.[20,33]

One way to analyze the validity of an instrument is by studying the relationship between the scores of the investigated instrument and the scores of another instrument used as reference standard or measure related to the targeted concept. There should be a high specificity between the measurements of the two instruments.[33]

Thus, although there are other studies relating the scores of the VTDS and the VHI,[25–28] only the VoiSS shares specificity with the VTDS in examining the frequency of voice symptoms,

TABLE 4.
Comparison of the Mean, Number, Frequency, and Intensity of Vocal Tract Discomfort Symptoms in Patients With and Without Self-reported Voice Problem in the Emotional Score of Voice Symptom Scale

	VoiSS-E				
	Patients Without Self-reported Voice Problem		Patients With Self-reported Voice Problem		
Variables	Mean	SD	Mean	SD	*P* Value
Number of VTDS	1.60	1.68	4.46	2.40	<0.001*
Fr. burning	0.60	0.98	2.01	2.02	0.007*
Fr. tightness	0.33	0.72	2.02	2.06	0.001*
Fr. dryness	0.93	1.10	3.34	2.09	<0.001*
Fr. aching	0.93	0.88	2.31	2.04	0.001*
Fr. tickling	0.33	0.72	1.73	1.93	0.003*
Fr. soreness	0.53	1.35	2.06	2.06	0.002*
Fr. irritation	0.80	0.94	2.57	2.10	0.001*
Fr. lump in the throat	0.27	0.70	2.36	2.24	<0.001*
Int. burning	0.60	0.91	2.17	2.12	0.005*
Int. tightness	0.47	1.24	2.01	2.00	0.001*
Int. dryness	0.93	1.10	3.30	1.95	<0.001*
Int. aching	1.20	1.26	2.41	2.04	0.032*
Int. tickling	0.33	0.90	1.81	1.98	0.002*
Int. soreness	0.33	0.72	2.04	2.01	0.001*
Int. irritation	1.00	1.19	2.74	2.15	0.003*
Int. lump in the throat	0.27	0.70	2.37	2.26	<0.001*

* Significant values ($P < 0.05$)—Mann-Whitney *U* test.
Abbreviations: E, emotional; Fr., frequency; Int., intensity; SD, standard deviation; VoiSS, Voice Symptom Scale; VTDS, Vocal Tract Discomfort Scale.

TABLE 5.
Comparison of the Mean, Number, Frequency, and Intensity of Vocal Tract Discomfort Symptoms in Patients With and Without Self-reported Voice Problem in the Physical Score of Voice Symptom Scale

	VoiSS-P				
	Patients Without Self-reported Voice Problem		Patients With Self-reported Voice Problem		
Variables	Mean	SD	Mean	SD	*P* Value
Number of VTDS	1.38	1.20	4.94	2.16	<0.001*
Fr. burning	0.37	0.71	2.22	1.99	<0.001*
Fr. tightness	0.25	0.68	2.10	2.05	<0.001*
Fr. dryness	0.75	0.93	3.55	2.05	<0.001*
Fr. aching	0.94	0.92	2.60	1.98	<0.001*
Fr. tickling	0.31	0.70	2.01	2.02	<0.001*
Fr. soreness	0.37	0.88	2.26	2.08	<0.001*
Fr. irritation	0.88	1.08	2.80	2.09	<0.001*
Fr. lump in the throat	0.25	0.68	2.76	2.19	<0.001*
Int. burning	0.44	0.81	2.38	2.06	<0.001*
Int. tightness	0.44	1.20	2.07	1.97	<0.001*
Int. dryness	0.87	1.08	3.48	1.88	<0.001*
Int. aching	1.06	1.23	2.69	1.96	<0.001*
Int. tickling	0.44	0.96	2.05	2.06	<0.001*
Int. soreness	0.25	0.57	2.26	2.03	<0.001*
Int. irritation	0.87	1.08	2.99	2.12	<0.001*
Int. lump in the throat	0.25	0.68	2.74	2.18	<0.001*

* Significant values ($P < 0.05$)—Mann-Whitney *U* test.
Abbreviations: Fr., frequency; Int., intensity; P, physical; SD, standard deviation; VoiSS, Voice Symptom Scale; VTDS, Vocal Tract Discomfort Scale.

considering, of course, the particular characteristics of each instrument. In this study, the correlation between these two instruments reinforced the validity of the content of the VTDS and the possibility of using this scale to assess and monitor the symptoms of discomfort in patients with dysphonia. Moreover, the moderately positive correlation between the total score of the VoiSS and the VTDS may indicate that the prevalence of these symptoms may affect self-perception of the impact of the voice disorder in different aspects of the patient's life.

Among the studies that assessed the relationship between VHI and VTDS, only those studies[25,26] in which the population was composed exclusively of professional voice users showed moderate to strong correlations between these two instruments. In contrast to the weak correlation found in the study by Torabi et al,[27] which recruited patients with MTD, individuals with professional voice use tended to have higher scores on the VHI in general. This indicated that this group pays special attention to their vocal production,[29] which may explain the strong correlation between the VHI and VTDS in professional voice users with dysphonia.

It can be highlighted that most of the studies that analyzed the correlation between the VTDS and VHI scores used professional voice users in their samples, which limits comparisons with the findings of the present study. The only study[27] that recruited subjects with voice disorders and no professional voice use found a weak correlation between the VTDS and VHI scores, whereas in this study, a weak to moderate correlation was observed between the VTDS and VoiSS scores. This higher correlation between VTDS and VoiSS compared to results with VTDS and VHI[27] may justify the use of VoiSS as a benchmark new psychometric study for the construct validity of the VTDS.

In turn, a correlation with the limitation score may indicate that the presence of vocal tract discomfort symptoms limits the functionality of voice use in daily communication. The relationship between the scores of the VoiSS limitation domain and the VTDS scores can be explained in that the symptoms of vocal tract discomfort are associated with vocal hyperfunction, the presence of musculoskeletal strain in the neck, with a higher larynx position, increasing the longitudinal tension in the vocal folds and reducing the hypopharyngeal space.[34,35] Such findings may impair vocal efficiency, requiring more effort for vocal production, and, consequently, can cause limitations in the use of the voice, which can explain the relationship found between vocal tract discomfort symptoms and the self-reported impact in the limitation domain of the VoiSS. In general, the limitation domain

items are related to the reduction of vocal resistance and difficulties in vocal production in different communication contexts. Patients with MTD (primary or secondary) and with symptoms of vocal tract discomfort tend to have decreased vocal resistance, increased effort in producing speech, and difficulty in using the voice at high intensity.[36]

A previous study[7] sought to determine the correlation between vocal signs and symptoms (by means of a questionnaire)[37] and VTDS scores in a population of teachers. Symptoms of "vocal fatigue," "difficulty projecting," and "increased effort associated with speaking" were weakly to moderately correlated with the VTDS scores. These findings support the findings of our study on the correlation between the limitation domain of the VoiSS and VTDS scores.

A weakly positive correlation between the emotional domain score of the VoiSS and the VTDS can be explained by the fact that the emotional impact of a voice disorder is particularly influenced by cultural and psychosocial variables,[29,38–40] such as personal and environmental characteristics, and does not necessarily correlate with the presence of physical symptoms. The emotional domain score of the VoiSS investigates the presence of negative feelings associated with vocal production—such as depression, stress, embarrassment, and incompetence—that are experienced by the patient in relation to their voice problem.[18] Some authors[41–43] have suggested that the relationship between emotional aspects and physical symptoms of a voice disorder is bidirectional because emotional features may cause secondary dysphonia. Thus, from the previously published findings and those of our study, it is clear that vocal tract discomfort symptoms can impact emotions, although there is not a strong linear relationship between these variables according to correlation testing.

Thus, the correlation between the VoiSS scores and VTDS scores may support the theoretical construct of the VTDS and can enhance its relevance in clinical practice, providing information that is complementary to other vocal assessment data.

Comparison of vocal tract discomfort symptoms in patients with and without self-reported voice problems

The findings of the present study support the hypothesis that patients with self-reported voice problems are reported to have a higher number and greater frequency and intensity of vocal tract discomfort symptoms. Patients with self-reported voice problems in all domains of the VoiSS had scores for symptoms of discomfort ranging between 4.33 ± 2.42 and 4.94 ± 2.16 (Tables 2–5).

In the literature,[2,7,25,26] most studies use an endoscopic larynx examination for allocating and comparing patients in terms of VTDS scores. However, many patients consult a specialist (doctor or speech pathologist) when their symptoms have a physical, social, emotional, or professional impact.[1] In particular, the complaint related to the presence of sensory symptoms appears to be decisive in the patient's decision to seek treatment for a voice disorder. These symptoms are present in patients with different types of voice disorders[2] and, in general, they decrease in terms of frequency and intensity after completion of vocal therapy[25] or surgical intervention.[44] Moreover, pharyngeal symptoms are present in different voice disorders, whether due to organic or functional causes.[2,9,22] As such, the VTDS, although it has been proposed to be used for evaluating patients with MTD,[6] can be used in a wide range of voice disorders.

The confirmation of the hypothesis that patients with self-reported voice problems, as detected by the VoiSS, have a higher number, and greater frequency and intensity of vocal tract discomfort symptoms, shows that the physical symptoms reflect not only physiological changes associated with MTD, but can influence how patients perceive the impact of their voice problems.

A previous study[44] that compared the data of the VoiSS and the VHI pre- and postintervention involving the removal of benign vocal fold lesions, observed that there was a reduction in the scores of the two instruments postintervention. The authors noted that the physical domain scores of the VoiSS decreased markedly after the intervention. In the same study,[44] it was observed that data from self-assessment instruments are not strongly correlated with the auditory perception measures and the findings of strobe evaluation of the larynx. This supports the findings of the present study, particularly that physical symptoms are among the main factors that determine the impact of a voice problem and that information about these symptoms is important for monitoring the effectiveness of treatment offered to patients with a voice disorder.

In a survey conducted with the objective of developing an instrument for screening for voice disorders in the elderly,[45] 6 of the final 10 items in the protocol were related to physical symptoms in the pharynx. These items showed good internal consistency and reproducibility for identification of vocal disorders in this population, and included a dry throat, itching, burning/stinging, pain, and phlegm in the throat. This again shows that pharyngeal symptoms are important for determining the presence of a voice disorder or the identification of a population that is at a risk of developing such a disorder. This reinforces the importance of studies such as this that investigates the relationship between symptoms of discomfort and the perceived impact of a voice problem.

The average of the vocal tract discomfort symptoms found in patients with a self-reported voice problem is in line with the average score of 4.1 symptoms observed in patients with voice disorders of different etiologies.[2] It is important to define the evaluation criteria used in different screening procedures with different standards of reference, such as the definition of the average score of symptoms of discomfort in patients with and without voice problems.

Another study compared patients with MTD and individuals without vocal complaints. It was noted that the VTDS showed excellent discrimination between these groups.[27] Patients with MTD had a higher frequency and intensity of vocal tract discomfort symptoms.

A study[26] which investigated the applicability of the VTDS in the diagnosis of occupational dysphonia showed a difference in the number, frequency, and intensity of vocal symptoms between healthy individuals and individuals with functional dysphonia, with greater VTDS scores in patients with occupational dysphonia.

Only one study[28] has reported the investigation of vocal tract discomfort symptoms using a self-assessment questionnaire (VHI) to categorize patients according to the presence or absence of a voice problem. However, this same study only included individuals without self-reported voice problems, noting that they had fewer than three symptoms of discomfort.

There have been no other studies comparing the vocal tract discomfort symptoms in patients with and without self-reported voice problems. Such studies can facilitate an understanding of the influence of physical symptoms on the perception of the impact of dysphonia on the patient's quality of life. The findings of this study confirmed that there is indeed such an influence, as we observed a moderately positive correlation between the VoiSS and the VTDS scores, and that patients with self-reported voice problems had higher scores in the VTDS. Specifically, the correlation between the VoiSS and VTDS, which are questionnaires that share principles for investigating the frequency of occurrence of symptoms, draws attention to the relevance of the content of VTDS and encourages studies that examine the psychometric properties of this scale in the Brazilian context.

In general, the pharyngeal symptoms are important for dysphonia patients, but are not detected directly by the procedures performed by the clinician (auditory-perceptual evaluation, acoustic analysis, aerodynamics evaluation, and endoscopic larynx examination) or specifically investigated by other instruments used for the self-assessment of voice problems. Thus, the VTDS appears to provide important information that complements other instruments in the context of vocal evaluations.

Thus, considering the data of our state and the inferences made from the surveyed literature, we argue for the use of VTDS in the clinical context for the following reasons. (1) The VoiSS is a robust instrument and there is a moderately positive correlation between the scores of the VoiSS and the VTDS. (2) Pharyngeal symptoms are strong indicators of a voice disorder. (3) Pharyngeal symptoms influence the perception of the impact of a voice problem. (4) The VTDS is the only specific questionnaire to investigate the frequency and intensity of pharyngeal symptoms associated with vocal production. (5) The VTDS can be administered in a short period of time.

Further longitudinal studies should be performed to examine the correlation between self-assessment questionnaires (such as the VHI, VoiSS, and Voice-Related Quality of Life) and the VTDS pre- and postintervention, in patients with different voice disorders. The observation of the existence and strength of the correlation between these instruments can provide additional evidence for the influence of pharyngeal symptoms on the perceived impact of the voice problem. Furthermore, longitudinal studies using different vocal assessment measures (auditory-perceptual analysis, acoustic analysis, aerodynamics evaluation, and endoscopic larynx examination), and using the VTDS pre- and postintervention, may elucidate the sensitivity of this scale in monitoring the effectiveness of the applied treatment, and allow comparison of its performance with that of other self-assessment questionnaires.

Additionally, we suggest that diagnostic accuracy studies should be conducted to investigate the discriminatory power of the VTDS in classifying patients with and without voice disorders, using different reference standards. Studies using logistic regression models can help to identify the relative weight of VTDS scores in determining the outcome (presence of a voice disorder) and thereby elucidate the role of pharyngeal symptoms in the assessment and diagnosis of voice disorders.

We would like to point out that no study or group of participants presented a broad spectrum of vocal diseases. The symptoms of discomfort vary in number, frequency, and intensity depending on the type of voice disease.[2] For example, patients with lesions on the membranous portion of the vocal folds and patients with laryngeal disorders due to symptoms of gastroesophageal reflux had a greater number of symptoms than the average of individuals with neurologic voice disorders.

Thus, analyzing a group of patients across a wide range of voice disease spectrum provides an overview of the relationship between discomfort symptoms and the impact of a voice problem. However, other studies can be performed to verify if there are differences in the correlation between the scores of two instruments depending on the type of voice disorder studied.

The VTDS seems to be a promising instrument for use in the vocal clinic, correlating with other instruments of vocal self-assessment and providing further information on voice disorders. The number of publications on the VTDS is still small, and further research in different contexts, such as those suggested above, are required.

The main contribution of this study is the evidence showing that the VTDS correlates moderately with an instrument (VoiSS) that is robust psychometrically, and that VTDS scores are higher in patients with self-reported voice problems, supporting the effect of pharyngeal symptoms on the perceived impact of dysphonia in the daily life of the patient.

CONCLUSIONS

There is a weak to moderate positive correlation between the VTDS and the VoiSS results. Patients with self-reported voice problems detected by the cutoff values of the VoiSS have scores indicating a higher number, and greater frequency and intensity of vocal tract discomfort symptoms than patients without self-reported voice problems.

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