



Psychometric Characteristics of Different Versions of Vocal Tract Discomfort (VTD) Scale: A Systematic Review

*Fateme Aghaei¹, *Hassan Khoramshahi^{2,3}, Somayah Biparva⁴*

1. *Musculoskeletal Rehabilitation Research Center, Abvaz Jundishapur University of Medical Sciences, Abvaz, Iran*
2. *Department of Speech Therapy, School of Rehabilitation, Babol University of Medical Sciences, Babol, Iran*
3. *Mobility Impairment Research Center, Babol University of Medical Sciences, Babol, Iran*
4. *Department of General Courses, School of Medicine, Abvaz Jundishapur University of Medical Sciences, Abvaz, Iran*

***Corresponding Author:** Email: hany552ir@yahoo.com

(Received 21 Jan 2021; accepted 18 Mar 2021)

Abstract

Background: This review compares different Vocal Tract Discomfort (VTD) versions. This comparison is based on their validity and reliability parameters in the translation and adaptation process. We aimed to prepare numerical evidence to prove the validity of this easy screening tool. VTD is able to perform an accurate diagnosis of voice discomforts, particularly in primary stages.

Methods: Articles were selected from databases including Google Scholar, PubMed, Science Direct and Scopus. Our relevant papers were gathered by searching the phrase: VTD in titles, abstracts, and keys. Studies not followed an adaptive procedure were excluded. Based on the selection criteria, out of 23 collected articles, eight were studied in this review.

Results: Standard psychometric protocol steps were followed in all selected articles and simultaneously high reliability and validity were reported in their translation procedure. Such analogous results may confirm the efficacy of this research tool.

Conclusion: This review affirms VTD, perceptual patient-based scale, as a valuable evaluation tool to investigate the occurrence of voice disorders. Based on its structure and performance, VTD can work as a quick and precise source for predicting vocal discomforts. Moreover, this capability can help professional therapists to plan more efficient treatment procedures. The other important advantage of VTD is its diagnostic and prognostic capacity to inform patients about their current and future conditions so that they would be motivated to follow treatment procedures more consistently.

Keywords: Vocal tract discomfort (VTD); Translation; Validity; Reliability; Voice disorder; Adaptation; Muscle tension dysphonia (MTD)

Introduction

According to WHO declaration, there is not adequate information to assess before-after therapy

outcomes and to demonstrate the grade of diseases (1, 2). Since 1990s, the world has widely



Copyright © 2022 Aghaei et al. Published by Tehran University of Medical Sciences.
This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International license (<https://creativecommons.org/licenses/by-nc/4.0/>). Non-commercial uses of the work are permitted, provided the original work is properly cited.

taken questionnaires as standard tools to investigate the effects of different issues on an individual's health (3-5). Moreover, questionnaire is considered as a common facilitative method to provide quick and informative data as a supplement to other data collection tools (3, 5-8). Questionnaires have also been applied to clarify main patient-related discomfort and consequently to direct treatment choices (3, 5, 9). In addition, self-evaluation questionnaires potentially lead to more successful multidimensional voice assessment around the world (2, 3, 5, 6). Regularly, questionnaires are adapted by expert translators to determine the exact need for clinical management and to make them appropriate research tools in other languages (5, 10).

Although numerous studies demonstrated that objective measurements are essential in voice problem diagnosis, they are not proved useful to measure the patient's self-perception of his disorder's degree (3, 5). Despite the existence of many objective assessments for speech manners in children and adults, the main role of patient-centered measurements to reveal the details of their disorders has not been proven (3, 5, 11). To demonstrate the importance of these instruments in identifying factors causing voice disorders, researches have recently applied self-assessment questionnaires to quantify the impact of a voice disorder on the subject's self-evaluation (2, 3, 5, 9). Nevertheless, there are few questionnaires, which do this in the current condition (5). A well-structured tool for self-assessment of MTD in different voice disorders is the vocal tract discomfort (VTD) scale (12). However, some documents have proven the VTD application is not limited to MTD and can support other voice disorders (10). In other words, these self-evaluation scales provide the therapist a comprehensive view to manage the intervention program more efficiently (2-5).

Numerous middle-aged people (10%-40% of voice disorders) suffering from muscle tension dysphonia (MTD), extensively use their voice in stressful situations (10, 13-15). Furthermore, this pathological situation can motivate physical vocal tract discomfort (13, 15, 16). All of these changes

influence mental health and disrupt individual's functions in the social and occupational field (6, 8, 11, 14, 16). MTD is defined as excessive tension in the vocal and laryngeal muscles (8, 13, 14, 16). MTD has primary symptoms such as tickling, irritation, dry mouth, and throat obstruction feeling (called "lump") (4, 8, 13). There are not enough clinical guidelines to provide a standard voice assessment protocol (2, 17, 18). Therefore, establishing clinically practical guidelines, which guarantee the responsiveness of treatments, is strongly recommended (4, 5, 17). This suggestion is based on the need to develop a conceptual framework to produce uniform evidence by a comprehensive set of methods (2, 5, 17). Such insufficiency of evidence to provide a clear diagnosis for voice disorders (such as MTD) leads us to apply more accurate evaluations such as self-assessments (2, 5, 6, 8, 9, 11, 15, 16, 18).

The VTD as a self-administered scale is capable of discriminating between healthy participants and patients with MTD (2, 16, 19). This reliable and valuable perceptual instrument measures the severity and frequency of difficulty that may be experienced in the vocal tract (19). This measurement addresses 8 qualitative descriptors included in the VTD questionnaire, namely burning, tickling, sore, dry, aching, irritable, tight, and lump in the throat (11). Each individual quantifies severity and frequency on a 7-point Likert-type scale, 0 to 6. Each frequency and severity subscale is related to a special state. In frequency, 0 means never, 1-3 means sometimes, 3-5 means often, and 6 means always. In severity, 0 means none while 1-3, 3-5 and 6 mean mild, moderate, and extreme, respectively. Each subscale's total score ranges from 0 to 48 ((max score) 6×8 (all items)) (10).

Furthermore, the declared correlation between the VTD scale and other conventional standardized assessment tools, such as the Voice Handicap Index (VHI) or max phonation time, confirms the clinical value of this self-assessment instrument (3, 5). Moreover, the VTD scale can be used as an optimal tool to monitor progression after voice therapy such as laryngeal manual therapy (3, 17, 19). These findings led to the de-

velopment of voice self-assessment, which helps professionals to provide more precise assessments and effective treatments.

The importance of trans-cultural studies will be more obvious owing to the information gathered about the reliability, validity, and responsiveness of different language versions for VTD (3, 7). Currently, there are many versions of VTD translated and adapted into various languages including German, Arabic, Argentine, Polish, Flemish, Italian, Norsk, and Persian; yet only six studies have been purported to compare patient group with normal individuals (10, 20-25). Commonly validity and reliability are as psychometric factors used to evaluate the quality of questionnaires in research studies (5). Generally, researchers are providing a framework for examining these two concepts in qualitative research (17). Moreover, recent psychometric studies have raised responsiveness as another essential concept in the methodological study of scales (5, 7). Responsiveness indicates the scale's capacity to determine changes in patient condition and reflect intervention efficacy and outcomes (5, 7, 19).

We come up with several reasons to review different versions of VTD. First, it is generally used in clinics for MTD patients (11, 12). Second is the high applicability of VTD as a scale to evaluate the frequency and severity of any discomfort in the vocal tract, which can end in better treatments (10, 26). Third is its adaptive procedure, which seems to be more important for future medical applications and is presently available in nine languages (10, 20, 23, 26).

Based on the high reliability and validity of VTD versions among several languages, the importance of conducting transcultural studies and the number of participants would be more highlighted (5). Thus, regarding the importance of VTD in the evaluation of voice disorders (especially MTD) and its prevalent application in other languages, this review was formed to provide a valid report to contribute to medical instrumental awareness (4). In other word, we intend to address the insufficiency of evidence for self-

evaluation via comparing the reliability and validity of the VTD scale in various languages.

Thus, our research question enquired, "What are the reasons for this global tendency of experts in assessing voice disorders to use VTD? Moreover, is there any coherent statistical evidence in different versions of VTD that demonstrate the higher ability of this tool than the previous ones? We hoped to determine the supplementary position or replacement of VTD in the current world of evaluation and voice therapy in our clinics as an additional aim through answering these questions by reviewing VTD versions.

Methods

For the aim of this review, we collected relevant studies based on the eligibility criteria. These nine articles which are different versions of VTD were published between 1993 [date of original VTD that developed by Mathieson] and 2020.

Our inclusion criteria insisted that all papers needed to be original papers, written in English language on human studies, and contained translation, reliability, and validity reports. Qualitative and case report papers were excluded. Data Collection was carried out by electronic searching in multiple resources including; Web of Science, PubMed, Science Direct, and Scopus, Google Scholar, ProQuest (as gray literature). All these databases were searched by the phrase: "**Vocal Tract Discomfort**" (VTD) in titles, abstracts, and keywords (Table 1). We applied the only Title or Abstract limitation and did not run any filters. All 23 papers were checked for relevance to our research questions by titles and abstracts; next, 14 unrelated ones that did not follow cultural adaptation procedures were excluded. Because of non-English text, one article was also excluded. In Fig. 1, we illustrated the selection process of these 8 articles that we finally included in our review study based on PRISMA guidelines (27, 28).

Table 1: Search strategy in different Databases

<i>Databases</i>	<i>Search strategy</i>
Scopus	TITLE-ABS-KEY("vocal tract discomfort")
Web of science	TI="vocal tract discomfort "
Science direct	"vocal tract discomfort"(abs/title/key)
PubMed	"vocal tract discomfort"[Title/Abstract]
Scholar	In the title: "vocal tract discomfort "
ProQuest	TI("vocal tract discomfort ")

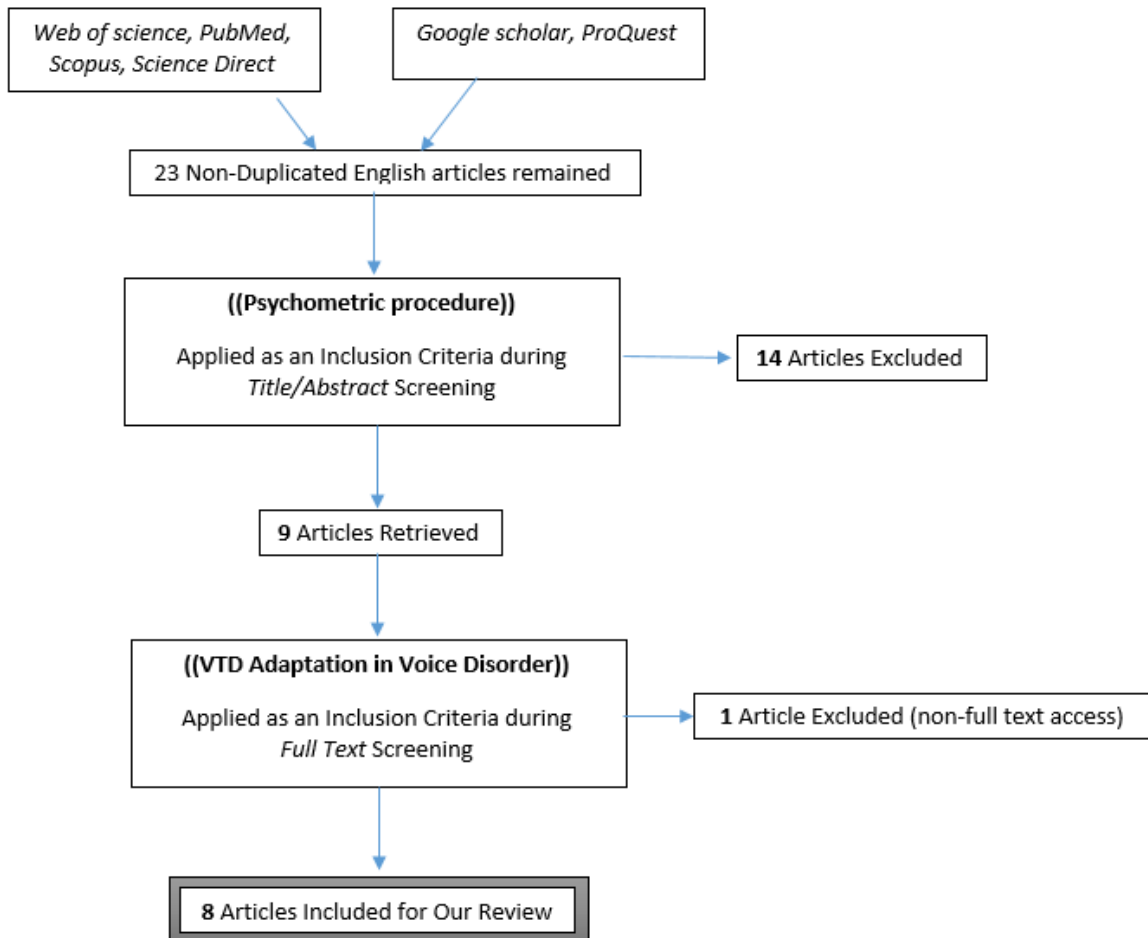


Fig. 1: Study selection chart for finding different versions of VTD (29)

Results

Based on the searches in the mentioned databases, and after filtering the output by title/abstract, mainly 8 articles were obtained. We omitted the North version of VTD because of its

non-English text. Totally, 7 papers were confirmed to be reviewed. The results of these studies written in English but originally belonged to other languages are summarized in Tables 2-4. Some details are presented as follows.

Korean: In this prospective study, 131 healthy ones and 159 voice disordered patients were included. The patient group was classified into 3 different groups based on diagnostic criteria (structural, functional, and neurologic voice disordered). The differences between the VTDS score linked to the diagnostic groups were analyzed with the t-test. All participants completed three Korean self-assessment scales in the voice domain including K-VHI, K-VRQOL, and K-VTDS. A moderate correlation was found between these three scales through Pearson's correlation analysis. Moreover, they reported a high internal consistency of the K-VTDS analyzed by Cronbach's coefficient. The K-VTDS scores for patient groups with voice disorders were significantly higher for both subscales and total scores in comparison with the healthy group ($P < 0.001$). Moreover, K-VTDS was able to differentiate between functional and the structural voice disorders by significant differences in frequency and the total score ($P < 0.05$). A strong positive correlation among the frequency, severity and total scores in the K-VTDS was reported. Finally, the researchers introduced K-VTDS as a reliable and valid scale for voice evaluation in Korean-speaking voice disorders (31).

Argentine: According to the suggested methodology (translation, review, and back-translation), the VTD Scale was linguistically and culturally adapted to Argentinian Spanish. The Argentine version of the VTD scale was performed on 107 patients with muscle tension dysphonia (MTD) (23 men & 84 women) and 30 volunteers without any vocal pathology (9 men & 21 women). All of them completed the Argentine version of VTD before and after Mathieson Laryngeal Manual Therapy (MLMT). Both MTD patients and vocally healthy ones completed the VTD Scale. Then, the results (the two groups' scores) were compared and the state of variance from pre- to post-therapy was checked. The internal consistency (the Cronbach alpha coefficient) was acceptable for both VTD Scale's subscales. On the other hand, the acceptable consistency of the VTD Scale makes it a reliable and valuable in-

strument for voice disorders evaluation among Argentinians (23).

Arabic: All 97 participants (47 males & 50 females) 31 singing students and 66 non-professional voice user students completed the VTD-Arab scale and the VHI-Arab. Also, their vocal sample of /a: / at a comfortable level was recorded (for acoustic assessment). A positive internal consistency confirmed the reliability of the VTD-Arab frequency and severity subscales. The positive correlation established between the VTD-Arab and the VHI-Arab was moderate. The correlations found between the scores of the VTD-Arab and VHI-Arab and all of the acoustic measures were weak. Finally, they reported the VTD-Arab as a valid and reliable tool in predicting voice handicap in singing students that can measure the vocal tract discomfort as well (20).

Italian: In the first phase, the cross-cultural adaptation, translation, and back translation processes were performed. In the second phase, 73 vocally healthy participants and 102 patients with dysphonia answer the I-VTD scale. In phase 3, 57 patients completed the I-VTD scale twice (test-retest reliability analysis). In phase 4, the researchers compared the scores gained by vocally healthy participants and patients with dysphonia (construct validity analysis). For validity analysis, 45 participants with dysphonia completed both the I-VTD scale and the I-VHI. Finally, 30 patients with muscle tension dysphonia were recruited. For responsiveness analysis, they compared the scores of the I-VTD scale before and after voice therapy (phase 5). The internal consistency was acceptable, similar to the test-retest reliability of the I-VTD scale. The obtained scores from vocally healthy participants and patients with dysphonia were significantly different. They found a moderate correlation between the I-VHI and the I-VTD scores. Finally, the I-VTD scale scores in pretreatment conditions were significantly more than the scores gained after successful voice therapy. This procedure proved that the I-VTD scale is a reliable and valuable tool for

the evaluation of vocal tract discomfort in Italian patients (26).

German: First, a cross-cultural adaptation and translation from English to German were completed. The target population included 50 vocally healthy individual and 107 patients with voice disorders who were divided into two different groups (organic & functional). All of them completed the VTD Scale and VHI. The internal consistency of the VTD Scale was excellent. Pearson correlation between the VTD Scale and VHI confirmed by a high correlation. The scores of vocally healthy ones was significantly lower than the voice disorder groups. Moreover, the VTD scores were able to differentiate between two different voice disorder groups. Thus, the German version of the VTD is a useful voice diagnostic tool regarding its excellent internal consistency, reliability, and clinical validity (10).

Persian: Following the standards of forward backward cross-culturally translations, the VTD scale was adapted into the Persian language (labeled VTDp). The VTDp scale was completed by 100 patients with MTD (46 women & 54 men) and 50 healthy participants (26 men & 24 women). For test-retest reliability, 45 patients with MTD completed the VTDp after 7 days. To assess construct validity, participants also completed the VHIp. Discriminant validity proved the capability of VTDp to distinguish MTD patients from healthy volunteers. The internal consistency for VTDp frequency and severity subscales was confirmed. The value of the intra-class correlation coefficient (ICC agreement) and test-retest reliability was excellent. The significant correlations between the VTDp and the VHIp scores demonstrated the acceptable construct validity of the VTDp. The acceptable standard error of measurement found in both VTDp's subscales. To determine the agreement between test-retest measurements, the Bland-Altman analysis was applied which demonstrated no systematic bias. Overall, the VTDp was introduced as a

valid and reliable self-assessment tool to measure patients' vocal tract discomfort in the patient population (24).

Flemish: All of 333 participants completed the VTD scale, the VHI, and the Corporal Pain scale. Moreover, the participants' information about voice-related studies, state of professional voice user, shouting, smoking, voice therapy, and allergy was documented. Accordingly, they reported higher significant value for frequency and severity of VTD in participants, who received voice therapy in the past, played in a team sport, followed voice-related studies, and shouted frequently. In the following, they obtained low correlations between the frequency and severity of the VTD scale and the total VHI score. Furthermore, they reported the same result for the frequency-severity of the VTD scale and frequency-intensity of the Corporal Pain scale. Finally, the VTD scale demonstrates adequate evidence for being a useful scale. VTD is able to reveal clinically essential information in the Flemish patient that cannot be accumulated from any other protocol (21).

Polish: Overall, 218 patients with occupational dysphonia and 140 healthy volunteers were subjected to the Polish VTD scale, VHI assessment, and maximum phonation time (MPT) measurement. Videostroboscopy was also done for all patients. Most of their participant were teachers. They classified their participants into 3 groups: 1) MTD without lesions of the vocal fold mucosa (43% of patients), 2) MTD resulting in benign vocal fold lesions (BVFL) (25% of patients), and 3) glottal incompetence (GI) (32% of patients). A significant difference existed between the study and control groups concerning the severity and frequency subscale of the VTD scale. This result was considered as an evidence for the VTD capability to differentiate the symptoms of dysphonia. Moreover, the high values of Cronbach's alpha indicated that the VTD scale is a valuable instrument in the occupational dysphonia diagnosis (22).

Table 2: Validity and Reliability parameters in translated versions of VTD across languages. Severity subscale

<i>Language</i>	<i>Content validity</i>	<i>Face validity</i>	<i>Construct validity</i>	<i>Internal consistency (Cronbach's alpha coefficient)</i>	<i>Test-retest reliability</i>	<i>Cut off point</i>	<i>Roc curve (R2)</i>
Korean	-	-	-	+	+	-	-
Argentine	-	-	-	0.7-0.9	-	-	-
Arabic	-	-	Done	0.874	-	23	0.804
Italian	-	-	Done	0.94	ICC:0.91-0.97	-	-
German	Done	Done	0.674	0.919	-	25.75	-
Persian	Done	-	$P<0.001$	0.672-0.732	ICC: 0.91	-	-
Flemish	-	-	$P<0.001$	0.05	-	-	-
Polish	-	-	$P<0.000$	0.936	-	-	0.932

Table 3: Validity and Reliability parameters in translated versions of VTD across languages Frequency subscale

<i>Language</i>	<i>Content validity</i>	<i>Face validity</i>	<i>Construct validity</i>	<i>Internal consistency (Cronbach's alpha coefficient)</i>	<i>Test-retest reliability</i>	<i>Cut off point</i>	<i>Roc curve (R2)</i>
Korean	-	-	-	+	+	-	-
Argentine	-	-	-	0.7-0.9	-	-	-
Arabic	-	-	Done	0.884	-	23	0.824
Italian	-	-	Done	0.92	ICC:0.92	-	-
German	Done	Done	0.674	0.919	-	25.75	-
Persian	Done	-	$P<0.001$	0.721-0.769	ICC: 0.93	-	-
Flemish	-	-	$P<0.001$	0.05	-	-	-
Polish	-	-	$P<0.000$	0.930	-	-	0.932

Table 4: Evaluation of different psychometric features among VTD versions in different languages

<i>Languages</i>	<i>Pub-lish date</i>	<i>Patient number</i>	<i>Control group</i>	<i>Pan-el</i>	<i>Trans-lates by voice expert</i>	<i>Back translation</i>	<i>Cultural equa-tion</i>	<i>Validi-ty</i>	<i>Reliabil-ity</i>	<i>Correla-tion with VHI (total score)</i>
Korean	2020	159	+	-	+	-	+	+	+	+
Argentine	2018	107	+	-	-	-	-	+	+	-
Arabic	2017	97	+	-	-	-	-	+	+	+
Italian	2017	102	+	+	+	+	-	+	+	+
German	2016	107	+	+	+	+	+	+	+	+
Persian	2015	100	+	+	+	+	+	+	+	+
Flemish	2015	333	-	-	-	-	-	+	+	+
Polish	2012	218	+	-	-	-	-	+	+	+

Discussion

The purpose of this review was to scrutinize the differences among versions of the VTD scale as a recent easy-to-use diagnostic tool in various clinical settings (2, 3, 19). Although VHI was the most common tool in these communities, there was a great need to get access to a self-assessment tool that would give symptom-based insights and information to clinicians (3-5, 24). On the other hand, validity and reliability of scale are developed in the natural context and standard language of each culture. Hence, the current psychometric procedure tries to represent the national value of languages (2, 10).

The main source of our review study was different versions of VTD adapted to several linguistic and cultural contexts (12). Based on our revision, in all VTD versions which had the expert committee members and the professional translators in their research studies accepted the level of new cross-cultural translated VTD equivalence (conceptual, experimental, and idiomatic) (5, 26). Maybe the single-word structure of items in the English VTD scale was the reason for this acceptance (except "*Lump in the throat*") (21, 26). The main validity and reliability parameters that considered in this review study are internal consistency, test-retest reliability, clinical validity, and responsiveness that were high in all VTD versions (5, 19).

We observed several differences among the VTD adapted versions specifically over their target groups. For example, the Italian version targeted dysphonic patients with various etiologies (neurologic, organic, and functional) (26). In German and Flemish studies, both organic and functional clients with dysphonia were recruited 10. Persian study focused merely on MTD patients (24). Whereas the Polish version concentrated on occupational dysphonia (22). The VTD was applied by unskilled persons; few articles have employed unprofessional translators in the voice field to simplify professional terminology (5). Besides, papers in Persian, Arabic, and Italian context

used speech and language pathologists to translate VTD (only for forward translation) (20, 24, 26). The other considerable point in a few VTD versions such as Persian and German was its separate and independent administration by different translators (10, 24). This method promotes translation reliability (1). On the other hand, it can reduce the prejudice that may arise due to the translators' opinions. Moreover, this technique can prevent the translators' viewpoints to be affected by each other (1, 5).

Due to the complication of voice disorders, accurate diagnoses and comprehensive treatment are required via multiple approaches (2, 3, 6-8, 11, 16, 17). Hence, we need to confront the voice problems by multidisciplinary strategies through breadth services (8, 17). Both the VHI and VTD can add a subjective aspect to the multidimensional voice evaluation for various clinical decision-making procedures (5, 9, 10, 20-22, 24, 26). All VTD versions reported high values of correlation between its frequency and severity subscale and VHI total scores (3). Both tests are reliable instruments (5, 22). Their acceptable correlation allows them to be applied independently or in collaboration with clinicians as a part of their evaluation protocol and voice therapy prognosis (3, 9, 20, 29, 30). Consequently, the high P-value gained from the correlation between these two tools, VHI-30 and VTD, affirms the strong reliability of VTD in precise distinction and clinical self-rating (18, 20, 22, 26). However, some studies like Flemish reported a weak correlation (21). This can be attributed to considering various aspects of a vocal disorder with different question types by these two scales (5, 9, 10, 20, 21, 24, 26). The VHI indirectly evaluates symptoms, assesses the self-perception of vocal problems that could be formed as a vocal handicap's perspective (1, 3-5, 10, 20, 24, 26). Whereas the VTD directly evaluates the degree of vocal tract discomfort sense (by its severity and frequency subscale) (10, 20, 24, 26). Moreover, VTD can be more precise

in discovering additional vocal load by measuring physical sensations (19, 20). This ability is the result of VTD's clear formulation, which addresses symptoms present in disease-related states, especially in a patient with a severe vocal load (4, 9, 13, 14, 26). Moreover, VTD can be used as an easy self-assessment tool to predict the vocal handicap's outcome in 5 min or less (26). Furthermore, this potency to provide a quick independent and supplementary information in the head and neck region made VTD to be highly recommended as an introduction of the daily clinical session and as a part of standard voice evaluation protocols (2, 5, 8, 17, 19, 26). Symptom evaluation, commonly considered as the main goal of consultation, is a confident way to meet the patient's needs (3, 21, 23). In addition, this assessment style enables us to apply an appropriate treatment for each patient based on their discomforts (3, 4, 10, 17). In addition to the robust role of VTD in the evaluation of musculoskeletal and chronic inflammation vocal discomfort, it is proven that VTD can monitor the efficacy of various interventions like voice therapy, surgery, etc. (1, 3, 6, 19, 22, 23, 26).

Seven studies reviewed report similar restrictions. All the articles emphasize that their study should be carried out in larger sample sizes, which may affect the obtained results (3, 5-7). In fact, each article enrolled more participants than the original VTD version developed by only 36 participants (12). Based upon the fact that the original population is in a mixture of various dysphonia (3), it is strongly suggested to apply VTD in different classified-types of voice disorders (20-22). VTD is applicable in determining the effectiveness of treatments (4, 7, 10, 24, 26). Thus, it is highly recommended to perform VTD in longitudinal studies before and after specific treatment to record the results by including subjects' symptomatic specifications like length and degree of voice disorders (2-4, 6, 20, 22, 24, 26). Accordingly, VTD can present specific cut-off points for each type of therapy (6). However, in the VTD adaptation procedure, the appropriate classification among various patient groups has not yet been established (19, 20, 26). Moreover, future

research studies should clearly differentiate between patient groups and healthy groups by the VTD cutoff point (5). Consequently, defined cutoff points make them to be employed as the best screening tools for large populations (3, 18). This review validates that the VTD scale is a reliable and valuable perceptual indicator for sensory changes in the vocal tract tissues among voice disorders (7, 10, 19, 20, 22-24, 26). The VTD can clinically provide beneficial data that is not obtained by other patient-based scales (3, 10, 19-24, 26). Thus, in a time-limited situation, the VTD can work as a quick and low-cost source for predicting vocal discomfort according to the individual's perception of handicap (3-5, 8). VTD's immediate and accurate diagnosis gives a chance to voice therapies to present a cost-effective and on-time treatment (2, 3, 8, 9, 17, 20, 26). On the other hand, VTD's outcome informs the patient about his/her voice disorder (4, 8, 13, 26). Furthermore, VTD can bring a strong motivation for patients to follow treatment procedures more insistently (2, 8).

Conclusion

Application of VTD, in combination with other objective clinical evaluation methods, leads us to clarify the complicated nature of voice disorders more than ever. Actually, this combination provides a comprehensive and precise method for assessment. Further, VTD can indicate many complex aspects of throat symptoms that are related to voice disorders while other voice assessment scales cannot demonstrate them. VTD's measurement reveals some symptoms that are not among the main purpose of voice therapy but have been affected significantly after interval treatment. Consequently, this diagnostic tool can be an evidence for speech and language pathologist to signify treatment responsiveness by VTD. Moreover, VTD can help clinicians to perform voice therapy based on frequency and severity of some specific symptoms of disordered voice that are indicated by the patient.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

Present study received no specific grant from any funding research centers.

Conflict of interest

The authors declare that there is no conflict of interest.

References

1. Seifpanahi S, Jalaie S, Nikoo MR, et al (2015). Translated versions of Voice Handicap Index (VHI)-30 across languages: a systematic review. *Iran J Public Health*, 44(4):458-69.
2. Ma EP, Yiu EM (2001). Voice activity and participation profile: assessing the impact of voice disorders on daily activities. *J Speech Lang Hear Res*, 44(3), 511-24.
3. Behlau M, Zambon F, Moreti F, et al (2017). Voice self-assessment protocols: different trends among organic and behavioral dysphonias. *J Voice*, 31(1), 112-e13.
4. Roy N, Weinrich B, Gray SD, et al (2002). Voice amplification versus vocal hygiene instruction for teachers with voice disorders: a treatment outcomes study. *J Speech Lang Hear Res*, 45(4), 625-38.
5. Francis DO, Daniero JJ, Hovis KL, et al (2017). Voice-related patient-reported outcome measures: a systematic review of instrument development and validation. *J Speech Lang Hear Res*, 60(1), 62-88.
6. Khatoonabadi AR, Khoramshahi H, Khoddami SM, et al (2018). Patient-based assessment of effectiveness of voice therapy in vocal mass lesions with secondary muscle tension dysphonia. *Iran J Otorhinolaryngol*, 30(98):131-137.
7. Khoramshahi H, Khatoonabadi AR, Khoddami SM, et al (2018). Responsiveness of Persian version of consensus auditory perceptual evaluation of voice (CAPE-V), Persian version of voice handicap index (VHI), and Praat in vocal mass lesions with muscle tension dysphonia. *J Voice*, 32(6):770.e21-770.e30.
8. Tanner K, Milstein CF, Smith ME (2018). Assessment and Management of Muscle Tension Dysphonia: A Multidisciplinary Approach. *Perspect ASHA Spec Interest Groups*, 3(3):77-81.
9. Cox RM, Gilmore C, Alexander GC (1991). Comparison of two questionnaires for patient-assessed hearing aid benefit. *J Am Acad Audiol*, 2(3):134-45.
10. Lukaschyk J, Brockmann-Bausser M, Beushausen U (2017). Transcultural adaptation and validation of the German version of the Vocal Tract Discomfort Scale. *J Voice*, 31(2):261.e1-261.e8.
11. Oates J (2009). Auditory-perceptual evaluation of disordered voice quality. *Folia Phoniatr Logop*, 61(1):49-56.
12. Mathieson L (1993). Vocal tract discomfort in hyperfunctional dysphonia. *J Voice*, 2:40-48.
13. de Oliveira Lemos I, da Cunha Pereira G, et al (2017). Effects of a voice therapy program for patients with muscle tension dysphonia. *Folia Phoniatr Logop*, 69(5-6):239-245.
14. Khoddami SM, Nakhostin Ansari N, Izadi F, et al (2013). The assessment methods of laryngeal muscle activity in muscle tension dysphonia: a review. *ScientificWorldJournal*, 2013:507397.
15. Kunduk M, Fink DS, McWhorter AJ (2016). Primary muscle tension dysphonia. *Current Otorhinolaryngology Reports*, 4(3), 175-182.
16. Roy N, Gouse M, Mauszycki SC, et al (2005). Task specificity in adductor spasmodic dysphonia versus muscle tension dysphonia. *Laryngoscope*, 115(2):311-6.
17. Roy N, Barkmeier-Kraemer J, Eadie T, et al (2013). Evidence-based clinical voice assessment: a systematic review. *Am J Speech Lang Pathol*, 22(2): 212-26.
18. Sobol M, Sielska-Badurek EM, Rzepakowska A, et al (2020). Normative Value of SVHI-10. Systematic Review and Meta-Analysis. *J Voice*, 34(5):808.e25-808.e28.

19. Dabirmoghaddam P, Hassan Khoramshahi H, Dehqan A, et al (2020). Construct and discriminant validity of the Persian version of the consensus auditory perceptual evaluation of voice (CAPE-V). *J Voice*, S0892-1997(20)30367-2.
20. Darawshah WB, Natour YS, Sada EG (2018). Applicability of the Arabic version of Vocal Tract Discomfort Scale (VTDS) with student singers as professional voice users. *Logoped Phoniatr Vocol*, 43(2): 80-91.
21. Luyten A, Bruneel I, Meerschman I, et al (2016). Prevalence of vocal tract discomfort in the Flemish population without self-perceived voice disorders. *J Voice*, 30(3):308-14.
22. Niebudek-Bogusz E, Woźnicka E, Wiktorowicz J, et al (2012). Applicability of the Polish Vocal Tract Discomfort (VTD) scale in the diagnostics of occupational dysphonia. *Logoped Phoniatr Vocol*, 37(4):151-7.
23. Santi MA, Romano A, Dajer ME, et al (2020). Vocal tract discomfort scale: validation of the argentine version. *J Voice*, 34(1):158.e1-158.e7.
24. Torabi H, Khoddami SM, Ansari NN, et al (2016). The Vocal Tract Discomfort Scale: validity and reliability of the Persian version in the assessment of patients with muscle tension dysphonia. *J Voice*, 30(6): 711-716.
25. Gaasland CR, Birkeland IK (2018). Norwegian translation and validation of the Audio Tract Disorder Self-Assessment Scale (VTDS-N) [Master Thesis]. School of Psychology, the University of Bergen, Norway.
26. Robotti C, Mozzanica F, Pozzali I, et al (2019). Cross-cultural adaptation and validation of the Italian Version of the vocal tract Discomfort Scale (I-VTD). *J Voice*, 33(1), 115-123.
27. Asar S, Jalalpour S, Ayoubi F, et al (2016). PRISMA; Preferred Reporting Items for Systematic Reviews and Meta-Analyses. *JRUMS*, 15 (1):68-80.
28. Sohrabi MR (2013). Principles of writing a review article. *Pajoohandeh J*, 18(2), 52-6.
29. Khoramshahi H, Dehqan A, Scherer RC, et al (2021). Comparison of vocal fatigue and vocal tract discomfort between teachers of normal pupils and teachers of mentally disabled pupils. *Eur Arch Otorhinolaryngol*, 278(7):2429-2436.
30. McDonald JD (2008). Measuring personality constructs: The advantages and disadvantages of self-reports, informant reports and behavioral assessments. *Enquire*, 1(1):1-19.
31. Lee HN, Yoo JY, Han JH, et al (2020). Transcultural Adaptation and Validation of the Korean Version of the Vocal Tract Discomfort Scale. *J Voice*, S0892-1997(20)30158-2.