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Correlation Between the Voice Handicap Index and the Multidimensional Voice Program

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ABSTRACT

Objective: Voice disorders have an adverse effect on the psychological, social, and physical lives of patients, and they diminish their quality of life. A subjective self-assessment tool, the voice handicap index (VHI-10) and an objective diagnostic tool, the multi-dimensional voice program (MDVP), are frequently used in the evaluation of voice disorders. The aim of this study is to determine how these tools correlate with each other and whether they can be used independently.

Methods: A total of 27 patients were enrolled in this study. VHI-10 and MDVP were prepared to perform voice analysis. The strength of the linear relationship was measured using Pearson's and Spearman's correlation.

Results: The study included 14 (51.8%) males and 13 (49.2%) females with a mean age of 46.07±14.78 years. The total score of the VHI-10 was 23.4±9.9. According to the MDVP scores, the mean fundamental frequency (mF0) was 188.064±53.6 Hz (88.946-260.153), jitter (percentage jitter) was 1.85 (1.115-7.27), shimmer (absolute shimmer) was 0.475 (0.394-0.829), and noise harmonic ratio (NHR) was 1.715±4.7. There was no correlation between VHI scores and MDVP parameters, including mean fundamental frequency, jitter, shimmer, and NHR (r=0.086; -0.018; 0.002; and 0.083) ($p>0.05$).

Conclusion: VHI-10 scores and parameters of the MDVP were not significantly related to each other, and these tools cannot be used interchangeably.

Keywords: Voice analysis, voice handicap index, multi-dimensional voice program

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INTRODUCTION

Voice, the basic tool of human communication, plays a crucial role in personal and social life. Approximately 25% of working people need an ideal voice quality (1). Voice disorders have an adverse effect on the psychological, social, and physical life of patients and diminish their quality of life (1,2). Voice disorders are commonly seen in the general population (0.65-15%). 30% of people experience voice problems at least once in their lifetime (3). Subjective and objective diagnostic tools are used in the evaluation of these disorders.

Self-assessment tools were developed to subjectively demonstrate how voice disorders affect the quality of a patient's life. These tools play a critical role in determining the degree of voice disorder, treatment planning, and post-treatment follow-up and evaluation of patients. The voice handicap index (VHI-10), developed by Jacobson et al. (4) in 1998 and simplified by Rosen et al. (5), is the most widely used and accepted tool in the subjective evaluation of patients with voice disorders. In addition, Kiliç et al. (6) evaluated the reliability and validity of VHI in Turkish and demonstrated that it can easily be used in the Turkish population. The preferred objective methods for evaluating voice quality are acoustic analysis devices, which perform multi-dimensional analysis of the voice. The multi-dimensional voice program (MDVP) (Kay Pentax, Lincoln Park, USA), is a commercial software developed for this purpose, which is considered the gold standard, especially for the evaluation of voice (7). With the MDVP program, the mean fundamental frequency, amplitude, and frequency perturbations of the voice, ratios, and harmonic and subharmonic values can be evaluated (8).

The aim of this study was to determine how one of the most commonly used subjective self-assessment tools, VHI-10, and the objective diagnostic tool, MDVP, correlate with each other in the evaluation of patients with voice disorders and whether they can be used independently of each other.

METHODS

The study was conducted according to the tenets of the Declaration of Helsinki. The Clinical Research Local Kütahya Health Sciences University Non-invasive Clinical Research Ethics Committee with the registration number E-41997688-050.99-17208 approved our study (decision no: 2021/12-12, date: 08.07.2021). An informed consent form was obtained from each subject. The data of 27 patients who applied to our clinic with a complaint of dysphonia between 2015 and 2016 were retrospectively evaluated. The laryngeal examination of each patient was performed by an otolaryngologist experienced in laryngology with the help of flexible fiberoptic laryngoscopy and videolaryngostroboscopy.

Subjective Voice Analysis

VHI-10 was prepared to perform subjective voice analysis. The self-reported VHI-10 consists of 10 items in three sub-groups of functional, emotional, and physical sections (5). Items 4, 5 and 7 refer to functional aspects, items 3, 8, and 9 to physical aspects, and items 1, 2, 6, and 10 to emotional aspects. Each item is scored with a Likert-type response between 0 and 4, with higher scores indicating a greater voice problem (4).

Objective Voice Analysis

Computerized voice analysis was performed using the MDVP to perform objective voice analysis. According to the MDVP (Model 5105, Version 2.3 Kay Elemetrics Corporation), the patient was sitting in a comfortable position in a quiet environment, with the microphone at approximately 10 cm away from the mouth and a mouth-microphone angle of approximately 45°, and a sampling rate of 44,100 Hz was performed during the phonation of approximately 5 s. The mean fundamental frequency (mF0), jitter (%), shimmer (%), harmonic noise ratio, frequency perturbation rate [period perturbation quotient (PPQ)], amplitude perturbation rate [amplitude perturbation quotient (APQ)], and soft phonation index (SPI) values were recorded and analyzed during phonation. These parameters show the mean fundamental frequency, amplitude, and frequency perturbations of the voice, their proportions, and harmonic and subharmonic values (8).

Inclusion/Exclusion Criteria

Only adult patients with complaints of dysphonia were recruited in this study. The exclusion criteria were being below the of age 18 years, the presence of a malignant tumor, trauma, previous laryngeal surgery, inflammatory or infectious diseases that may alter the anatomy of the larynx, a history of head and neck radiotherapy pregnancy, and illiteracy.

Statistical Analysis

Data obtained in the study were statistically analyzed using the Statistical Package for Social Sciences software (SPSS 17.0 for Windows; IBM, Armonk, NY, USA). The results are stated as mean ± standard deviation values or number (n) and percentage (%). Kolmogorov-Smirnov test was used for assessing normality. The strength of the linear relationship between the results of the subjective self-assessment tools (VHI-10) and objective (MDVP) diagnostic tools was measured using Pearson and Spearman correlation coefficients, and a value of $p<0.05$ was considered statistically significant. Pearson's correlation coefficient was used for normally distributed variables and Spearman's correlation for non-normally distributed variables.

RESULTS

Evaluation was made of 14 (51.8%) males and 13 (49.2%) females with a mean age of 46.07±14.78 years (range, 20-70 years). In the evaluation of laryngeal pathologies, 8 (29.6%) patients had unilateral vocal cord nodules, 5 (18.5%) had unilateral vocal cord polyps, 4 (14.8%) had unilateral vocal cord paralysis, 2 (7.4%) had bilateral vocal cord paralysis, 2 (7.4%) had bilateral sulcus vocalis, 2 (7.4%) had unilateral intracordal cyst, 1 (3.7%) had mutational falsetto, 1 (3.7%) had bilateral Reinke's edema, 1 (3.7%) had unilateral keratosis, and 1 (3.7%) had unilateral pseudocyst (Table 1).

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In the evaluation of the VHI-10 scores, the physical part was 8±2.61, the functional part was 6.7±3.62, the emotional part was 8.7±4.62, and the total score was 23.4±9.9. According to the MDVP scores, maximum phonation time (MFT) was 12.4 s (10.9-13.2); mean fundamental frequency (mF0) was 188.064±53.6 Hz, jitter (percentage jitter) was 1.85 (1.115-7.27); shimmer (absolute shimmer) was 0.475 (0.394-0.829); noise harmonic ratio (NHR) was 1.715±4.7, APQ was 3.848 (3.354-6.674); PPQ was 0.857 (0.672-2.301), and SPI was 5.107±1.963 (Table 2).

According to the Kolmogorov-Smirnov test, VHI-10 scores and MDVP parameters, including mF0, NHR, and SPI, were normally distributed, but MFT, jitter, shimmer, APQ, and PPQ scores were not.

In the evaluation of the VHI-10 scores and MDVP parameters using the Pearson correlation test, a strong correlation was found between the total VHI scores and functional, physical, and emotional subgroups (r=0.916; 0.843; and 0.947) ($p<0.05$). There was no correlation between VHI scores, parameters of mean fundamental frequency, and NHR (r=0.086; 0.083) ($p>0.05$) (Table 3). According to Spearman's correlation test, there was no correlation between VHI scores and parameters of jitter and shimmer (r_s:-0.018; 0.002;) ($p>0.05$) (Table 3).

DISCUSSION

Voice disorders adversely affect the psychological, social, and physical lives of patients and diminish their quality of life. Subjective self-assessment tools and objective diagnostic tools are available for the assessment of voice disorders and help in the evaluation of disease severity, treatment planning, and post-treatment follow-up. According to the results of this study, a poor correlation between VHI-10 and MDVP parameters was observed. However, there was a strong or strong correlation between the VHI subgroups in the assessment of the severity of voice disorder.

These results can be explained in several ways. First, the high correlation between the VHI-10 subgroups reveals that the functional, physical, and emotional contents of this method are highly compatible with each other; therefore, VHI-10 can be used easily and reliably for the subjective evaluation of laryngeal disorders. However, the weak correlation between the two diagnostic tools can be explained by the disadvantages of both the VHI-10 and MDVP methods. The VHI-10 test, which is a subjective self-assessment tool, may vary according to the age, personality, social status, educational level, occupational status,

Table 1. Demographic features and laryngeal pathologies of the patients

	n (%)
Number of patients	27 (100%)
Age (range), years (mean ± SD)	46.07±14.78 years (18-60)
Gender	
Male	14 (51.8%)
Female	13 (49.2%)
Laryngeal pathologies	
Unilateral vocal cord nodules	8 (29.6%)
Unilateral vocal cord polyps	5 (18.5%)
Unilateral vocal cord paralysis	4 (14.8%)
Bilateral vocal cord paralysis	2 (7.4%)
Bilateral sulcus vocalis	2 (7.4%)
Unilateral intracordal cyst	2 (7.4%)
Mutational falsetto	1 (3.7%)
Bilateral Reinke edema	1 (3.7%)
Unilateral keratosis	1 (3.7%)
Unilateral pseudocyst	1 (3.7%)

SD: standard deviation

Table 2. Voice handicap index scores and multi-dimensional voice program parameters of the patients

	Scores and parameters (mean ± SD) [median (25p-75p)]
VHI-10	
Physical part	8±2.61
Functional part	6.7±3.62
Emotional part	8.7±4.62
MDVP	
Maximum phonation time	12.4 (10.9-13.2)
Mean fundamental frequency (mF0)	188.064±53.6 Hz
Jitter (percentage jitter)	1.85 (1.115-7.27)
Shimmer (absolute VHImmer)	0.475 (0.394-0.829)
Noise harmonic ratio	1.715±4.7
Amplitude perturbation quotient	3.848 (3.354-6.674)
Period perturbation quotient	0.857 (0.672-2.301)
Soft phonation index	5.107±1.963

SD: standard deviation, p: percentage, VHI-10: voice handicap index, MDVP: multi-dimensional voice program

Table 3. The Pearson and Spearman correlation scores between VHI-10 scores and MDVP parameters

		r	p-value
VHI-10	**VHI-10**		
	Functional	0.916	p<0.05
	Physical	0.843	
	Emotional	0.947	
	MDVP		
	Mean fundamental frequency (mF0)	0.086	p>0.05
	Jitter	-0.018	
	VHImmer	0.002	
	Noise harmonic ratio	0.083	

VHI-10: voice handicap index, MDVP: multi-dimensional voice program family status, test compliance, and vital characteristics of the patients (9,10). In addition, although VHI has been successfully adapted for Turkish society (6), differences between the language features of nations in describing the severity of the disease may explain the discrepancy between the two methods. Ziwei et al. (11) evaluated the VHI and objective voice parameters in a similar study in 50 patients and reported that there may be no correlation between the VHI subgroups and the objective parameters and therefore concluded that subjective parameters may show different results in different countries. Hunter and Kebede (12) and Hall (13) stated that different phonetic structures in languages of various nationalities may lead to different voice characteristics, which may affect subjective measurement results. Acoustic analysis can also be affected by microphone type, ambient noise levels, data evaluation system features, and program features used for sampling and analysis, which can be considered responsible for the discrepancy between the two methods (14). Although MDVP is accepted as an objective diagnostic tool, patient intolerance can be an important handicap for this diagnostic tool because it could occur in all other computer-assisted analysis devices. The variability of subglottic pressure and glottic closure in patients with compliance problems during the evaluation may have a negative effect on the measurement of voice parameters and may explain the weak correlation between the two methods. Psychosocial changes in patients and gender, in particular, may lead to changes in the assessment of voice with objective diagnostic tools (2,8,9,15). In the studies of Baken and Orlikoff (16), it is stated that the relationship between VHI and MDVP and shimmer measurements and gender was uncertain.

Similar to the present study, some previous studies in the literature have indicated that acoustic measurements were poorly correlated with VHI, that they might not be related to each other, and that they should be evaluated independently (9,17-19). In those studies, the assessment of different voice disorders, non-homogeneity of patient groups, insufficient time in objective diagnostic tests, longer time for subjective tests compared with objective tests, and the effects of patient emotions and perceptions were thought to be responsible for the discrepancy between them. In the present study, no correlation was found between the two methods. In addition to the handicaps of the diagnostic tests, non-homogenous study groups could be held responsible for this phenomenon just like in other studies.

Voice is a multidimensional and complex phenomenon (11). At the same time, pathological changes affecting voice quality can be caused by different factors (11). Interchanging frequently used diagnostic tools for any reason may produce false or incomplete diagnostic results. Therefore, to achieve the most accurate diagnosis in the evaluation of voice disorders, multiple parameters should be independently evaluated using different diagnostic tools (20).

Study Limitations

Further studies involving a greater number of homogeneous patients, evaluating gender differences and evaluating pre-/post-treatment results, excluding social phonetic differences, and using different objective and subjective diagnostic tools will contribute to the literature.

CONCLUSION

The results of this study demonstrated that the scores of the VHI-10 and the parameters of the MDVP were not significantly related to each other and that these tools cannot be used interchangeably. In the future, there is a need for diagnostic tools that can successfully evaluate voice disorders both objectively and subjectively and that are at the same time correlated with each other.

Ethics Committee Approval: The Clinical Research Kütahya Health Sciences University Non-invasive Clinical Research Ethics Committee with the registration number E-41997688-050.99-17208 approved our study (decision no: 2021/12-12, date: 08.07.2021).

Informed Consent: Informed consent was obtained from all individual participants included in the study.

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REFERENCES

1. Verdolini K, Ramig LO. Review: occupational risks for voice problems. Logoped Phoniatr Vocol 2001; 26: 37-6.
2. Hanschmann H, Lohmann A, Berger R. Comparison of subjective assessment of voice disorders and objective voice measurement. Folia Phoniatr Logop 2011; 63: 83-7.
3. Stuut M, Tjon Pian Gi RE, Dikkers FG. Change of Voice Handicap Index after treatment of benign laryngeal disorders. Eur Arch Otorhinolaryngol 2014; 271: 1157-62.
4. Jacobson B, Johnson A, Grywalski C, Silbergleit A, Jacobson G. The voice handicap index (VHI): development and validation. Am J Speech Lang Pathol 1997; 6: 66-70.
5. Rosen CA, Lee AS, Osborne J, Zullo T, Murry T. Development and validation of the voice handicap index-10. Laryngoscope 2004; 114: 1549-56.
6. Kiliç MA, Okur E, Yildirim I, Öğüt F, Denizoğlu İİ, Kızılay A, et al. Ses Handikap Endeksi (Voice Handicap Index) Türkçe versiyonunun güvenilirliği ve geçerliliği [Reliability and validity of the Turkish version of the Voice Handicap Index]. Kulak Burun Bogaz Ihtis Derg 2008; 18: 139-47.
7. González J. Correlations between speakers' body size and acoustic parameters of voice. Percept Mot Skills 2007; 105: 215-20.
8. Lovato A, De Colle W, Giacomelli L, Piacente A, Righetto L, Marioni G, et al. Multi-Dimensional Voice Program (MDVP) vs Praat for Assessing Euphonic Subjects: A Preliminary Study on the Gender-discriminating Power of Acoustic Analysis Software. J Voice 2016; 30: 765.e1-5.
9. Wheeler KM, Collins SP, Sapienza CM. The relationship between VHI scores and specific acoustic measures of mildly disordered voice production. J Voice 2006; 20: 308-17.
10. Renk E, Sulica L, Grossman C, Georges J, Murry T. VHI-10 and SVHI-10 Differences in Singers' Self-perception of Dysphonia Severity. J Voice 2017; 31: 383.e1-4.
11. Ziwei Y, Zheng P, Pin D. Multiparameter voice assessment for voice disorder patients: a correlation analysis between objective and subjective parameters. J Voice 2014; 28: 770-4.
12. Hunter G, Kebede H. Formant frequencies of British English vowels produced by native speakers of Farsi. Proceedings of the Acoustics Nantes Conference, Nantes, France, 2012.Available at: http://hal.archives-ouvertes.fr/docs/00/81/05/80/PDF/hal-00810580.pdf. Accessed November 2, 2015.

13. Hall M. Phonological characteristics of Farsi Speakers of English and L1 Australian English speakers' perceptions of proficiency. Master of Arts Thesis. Curtin University 2007.
14. Deliyski DD, Shaw HS, Evans MK, Vesselinov R. Regression tree approach to studying factors influencing acoustic voice analysis. Folia Phoniatr Logop 2006; 58: 274-88.
15. Smits R, Marres H, de Jong F. The relation of vocal fold lesions and voice quality to voice handicap and psychosomatic well-being. J Voice 2012; 26: 466-70.
16. Baken RJ, Orlikoff RF. Clinical Measurement of Speech and Voice. 2nd ed. San Diego, CA: Singular Publishing Group 2000.
17. Hsiung MW, Pai L, Wang HW. Correlation between voice handicap index and voice laboratory measurements in dysphonic patients. Eur Arch Otorhinolaryngol 2002; 259: 97-9.
18. Woisard V, Bodin S, Yardeni E, Puech M. The voice handicap index: correlation between subjective patient response and quantitative assessment of voice. J Voice 2007; 21: 623-31.
19. Schindler A, Mozzanica F, Vedrody M, Maruzzi P, Ottaviani F. Correlation between the Voice Handicap Index and voice measurements in four groups of patients with dysphonia. Otolaryngol Head Neck Surg 2009; 141: 762-9.
20. Wuyts FL, De Bodt MS, Molenberghs G, Remacle M, Heylen L, Millet B, et al. The dysphonia severity index: an objective measure of vocal quality based on a multiparameter approach. J Speech Lang Hear Res 2000; 43: 796-809.