Voice Handicap Index in Persian Speakers with Various Severities of Hearing Loss

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Abstract
Objectives: The purpose of this study was to assess and compare the total score and subscale scores of the Voice Handicap Index (VHI) in speakers with and without hearing loss. A further aim was to determine if a correlation exists between severities of hearing loss with total scores and VHI subscale scores. Patients and Methods: In this cross-sectional, descriptive analytical study, 100 participants, divided in 2 groups of participants with and without hearing loss, were studied. Background information was gathered by interview, and VHI questionnaires were filled in by all participants. Results: For all variables, including mean total score and VHI subscale scores, there was a considerable difference in speakers with and without hearing loss (p < 0.05). The correlation between severity of hearing loss with total score and VHI subscale scores was significant. Conclusion: Speakers with hearing loss were found to have higher mean VHI scores than speakers with normal hearing. This indicates a high voice handicap related to voice in speakers with hearing loss. In addition, increased severity of hearing loss leads to more severe voice handicap. This finding emphasizes the need for a multilateral assessment and treatment of voice disorders in speakers with hearing loss.

Introduction

Human beings need to communicate with others because they are social beings [1] and the best way to communicate is through speech [2]. Speech conveys concepts and words through voice [3]. Voice, as one of the main aspects of verbal communication, has emotional, social, and economic importance. It has such a complex structure that any voice disorder can cause serious problems in one’s daily life [3, 4]. Moreover, speakers with voice disorders have problems in communication due to inappropriate feedback they get from the environment [5].

On the other hand, normal hearing and normal auditory feedback play an important role in monitoring and controlling aspects of speech such as voice, articulation,
verbal fluency, and rhythm [6]. Hearing is an important sense which plays a vital role in controlling voice because it provides auditory feedback through receiving verbal output. [6]. The moment-to-moment auditory feedback is essential for controlling prosodic speech characteristics such as fundamental frequency, intensity, voice quality, breathing performance, and articulation. Deficits in receiving auditory feedback cause persons with hearing impairment to have problems in motor control for speech and phonation mechanisms including inability to control voice production, subglottal pressure level, and vowel and consonant production which influence acoustic features of voice and its intelligibility [7, 8]. Thus, individuals with hearing impairment have voice difficulties in varying degrees as well. Previous studies demonstrated that children with severe hearing loss phonate hoarsely, roughly, with a higher pitch, and higher loudness level [2], and it has also been reported that the voice quality of subjects with pre- and post-lingual deafness was improved after cochlear implant [3–5].

Due to the fact that voice problems are more likely in individuals with hearing impairment and also because of the important role voice quality plays in communication and the multilateral impacts of voice disorders on quality of life, it seems to be necessary to conduct studies on voice-related quality of life for persons with hearing impairment [14]. The Voice Handicap Index (VHI) questionnaire was created by Jacobson et al. [15] with the purpose of patient self-assessment of the amount of disability caused by voice disorders. VHI is an appropriate tool to study voice disorder from the patient’s perspective and can be used to assess the patient’s judgment about the relative impact of his voice disorder on his quality of life [15]. A patient’s perception of his voice disorder is associated with his voice quality along with other aspects such as social and professional demands and also personal aspects. The VHI consists of 30 questions about emotional, physical, and functional aspects. Each question is rated from 0 to 4 on a 5-degree scale: never = 0, rarely = 1, sometimes = 2, often = 3, and always = 4. The total score is between 0 and 120 and it is assumed that the greater each individual’s score is, the more negative influence voice will have on his quality of life [15–17].

It has been well established that VHI has good reliability and validity, and that is why it has been translated into different languages in recent years. In Iran, Moradi et al. [17] adapted the VHI for Persian speakers and determined the cutoff point of 14.5 to distinguish persons with voice disorders from those with normal voice. Madeira and Tomita [14] evaluated VHI in 38 Brazilian speakers with moderate to profound bilateral sensorineural hearing loss and compared them with 38 individuals without hearing impairment. The results showed that individuals with hearing impairment have higher mean VHI total and subscale scores than normal hearing persons; these differences were statistically significant. Therefore, in Persian speakers with hearing impairment, it is essential to use VHI which determines the impact of voice problems on quality of life related to voice.

The purpose of this study was to evaluate VHI and its subscales in individuals with and without hearing loss who speak Persian as their native language. A secondary purpose was to study the correlation between the severities of hearing loss and VHI scores.

Method

The present study was a cross-sectional study carried out at Tehran University of Medical Sciences in 2011. Fifty consecutive adult speaker with hearing loss selected among the patients who had attended either speech therapy clinics or the audiology clinic and showed altered pure-tone and speech audiometry and suffered from bilateral sensorineural hearing loss in frequencies of 500, 1,000, and 2,000 Hz were included. A total of 18 patients were categorized in the mild group (26–30 dB), 17 patients in the moderate group (31–50 dB), and 15 patients in the severe group (51–70 dB). These 50 adults with hearing loss included 25 females and 25 males who were 27.59 ± 6.26 years of age (range, 18–40). Patients with neurologic disorders were excluded from the study.

The control group consisted of 50 participants (25 females and 25 males) who had normal pure-tone and speech audiometry and did not show a history of voice disorder or speech therapy. The mean age of the participants in the control group was 28.22 ± 6.77 years (range, 19–39). The 2 groups were matched in terms of age and gender. Video-stroboscopic findings performed by an otolaryngologist showed no problems in the laryngeal structure and function of any of the participants. The participants were required to sign an informed consent form before carrying out videostroboscopy and VHI. They were asked to fill out the VHI after videostroboscopic assessment.

Descriptive statistical analysis was performed to determine the mean and the standard deviation values of VHI scores among different groups. The Kolmogorov-Smirnov test was used to assess the normality of the distribution of the data.

Comparison of VHI scores in the 3 subgroups with hearing loss and the control group was made using the nonparametric Kruskal-Wallis test. The nonparametric Mann-Whitney test was performed to assess the differences between the control group and 3 subgroups with hearing loss for all subscales and for the total score of VHI. To control the increased risks of type 1 errors due to multiple comparisons, the Bonferroni correction was applied. The correlation between VHI scores and each category of severity (mild, moderate, and severe hearing loss) was assessed using the Spearman rank correlation coefficient.
The Statistical Package for the Social Sciences, version 16.0 (SPSS, Inc., Chicago, IL, USA) was used to perform the statistical analyses. The significance level of the derived data was considered as less than 0.05.

**Results**

The Kolmogorov-Smirnov test indicated that data were not normally distributed among hearing loss and control group. As demonstrated in Table 1, subjects with hearing loss have higher scores in the total and 3 subscales of VHI than the control group. On the other hand, subjects with hearing loss mark higher scores in the emotional subscale than the functional and physical subscales. The mean and standard deviation of VHI scores in the 2 groups with and without hearing loss are presented in Table 1.

The results of the Kruskal-Wallis analysis of variance for the total score and also for the functional, physical, and emotional subscales of VHI demonstrated a significant main effect for group ($p < 0.05$). The results of a comparison made by Mann-Whitney test between the control group and the 3 hearing loss groups showed significant differences between each of the subgroups in the hearing-impaired group and the control group, and between each pairwise comparison among the 3 subgroups in the hearing loss group.

Moreover, the results of the Spearman rank correlation analysis demonstrated a significant positive correlation between VHI scores and the severity of hearing loss. The detailed results are presented in Table 2.

**Discussion**

In this study, the total and subscale scores of the VHI were studied in 50 individuals with hearing loss aged between 18 and 40 years, and the results were compared to 50 individuals with normal hearing.

The results demonstrated that the mean VHI total and functional, emotional, and physical subscores in the hearing loss group were 62.86, 21.72, 22.95, and 18.18, respectively, and these scores were much higher than the mean VHI scores in the control group (Table 1), and their total VHI scores were higher than the cutoff point of VHI for Persian speakers which was calculated as 14.5 by Moradi et al. [17]. These results indicate that patients with hearing loss had significant levels of voice-related disabilities in comparison with the normal group; this is possibly due to vocal changes in these patients as mentioned in a previous study by Madeira and Tomita [14].

The results emphasize the multilateral effects of vocal changes on voice-related quality of life in patients with hearing loss. Wilson et al. [18] reported that "Questionnaires are made to assess a patient’s voice self-assessment of his voice disorder." This shows a significant index of

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<thead>
<tr>
<th>Table 1. Mean and standard deviation of VHI scores in the 2 groups with ($n = 50$) and without hearing loss ($n = 50$)</th>
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<tr>
<th>Groups</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>$p$ value</th>
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<tr>
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<td>5.69</td>
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<td>19</td>
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<tr>
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<td>hearing loss</td>
<td>62.86</td>
<td>17.48</td>
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<tr>
<td>Emotional score</td>
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<td>1.77</td>
<td>0</td>
<td>6</td>
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<tr>
<td></td>
<td>hearing loss</td>
<td>22.95</td>
<td>9.13</td>
<td>12</td>
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<tr>
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<td>2.66</td>
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<tr>
<td></td>
<td>hearing loss</td>
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<td>6.92</td>
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<tr>
<td>Functional score</td>
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<td>2.04</td>
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<tr>
<td></td>
<td>hearing loss</td>
<td>21.72</td>
<td>7.36</td>
<td>10</td>
<td>37</td>
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</tbody>
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<tr>
<th>Table 2. Correlation between different levels of hearing loss (mild, moderate, and severe) with total scores and VHI subscale score in groups with hearing loss ($n = 50$) using the Spearman correlation</th>
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</table>

<table>
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<tr>
<th>Patients with hearing loss</th>
<th>correlation</th>
<th>$p$ value</th>
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</thead>
<tbody>
<tr>
<td>Total VHI score</td>
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<td>&lt;0.05</td>
</tr>
<tr>
<td>Emotional score</td>
<td>+0.65</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Physical score</td>
<td>+0.66</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Functional score</td>
<td>+0.58</td>
<td>&lt;0.05</td>
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the impact of the disorder on individuals, as not only do these methods assess one aspect of the disorder, but they also examine various aspects of voice disorders, including physical, functional, and emotional problems [18]. It seems that vocal changes have multilateral effects on social and personal aspects of patients with hearing loss. Thus, symptomatic voice therapy may not be sufficient enough to treat vocal disabilities in speakers with hearing loss. In addition, different aspects of disability caused by vocal changes need to be considered in evaluating and improving quality of life in this group. Also, Cohen and Turley [19] reported that elderly individuals with hearing loss were more likely to have voice disorders in different aspects of voice production than those without hearing loss.

The results of the present study were in agreement with that of Madeira and Tomita [14] who studied VHI in Portuguese individuals and concluded that speakers with hearing loss gained higher total and subscale scores compared to speakers with normal hearing and the 3 subscales (emotional, physical, and functional). The differences between the mean scores were statistically significant. In this study, the total VHI score in subjects with normal hearing was 5.59 which agrees with the results of studies conducted by Moradi et al. [17], and Madeira and Tomita [14] where the mean VHI scores in normal subjects were, respectively, 5.50 (Persian) and 4.00 (Portuguese). However, in the present study, the mean VHI in subjects with hearing loss was 62.86, while in Madeira and Tomita’s study, it was 23.5. These differences may be due to the fact that there are differences among the ethnic context and cultures of different nations, and quality of life is closely related to culture and context and because VHI measures voice-related quality of life, the differences in the abovementioned studies seem to be justifiable.

Based on these results, the mean of VHI total and its subscales were significantly different among the subgroups with hearing loss and the VHI scores of the severe group were significantly higher than that of the other subgroups with hearing loss. In addition, the results of the statistical analysis showed a significant positive correlation between severity of hearing loss and the VHI total and its subscales. This correlation may be due to deficiencies in auditory feedback process. It means that, voice handicap in total and subscales of VHI grow as the degree of auditory feedback deficiency or hearing loss increases.

As we know, while talking, a person controls his speech output via listening to it. Moreover, hearing, as an exteroceptive sense and also the main sense which mediates speech, has an important role in controlling sounds. While speaking, speech output is received again – through auditory feedback – as an input to control speech production. Thus, auditory feedback plays a notable role in producing speech. It controls the moment-to-moment speech output and plays an important role in controlling delayed speech control. Individuals suffering from hearing loss have problems in phonation mechanisms, since they do not receive proper stimulus and also because they have difficulties in auditory feedback. As a result, they experience disorders in phonation and voice mechanisms. More severe hearing loss leads to more damaged auditory feedback cycles resulting in increased complaints regarding one’s voice-related problems. Therefore, considering that healthy voice characteristics highly depend on hearing system operation, so hearing loss (damage) is accompanied by severe voice disorders, and it seems that the voice disorders in people with hearing loss are comprehensible by ordinary people [22, 23]. This is in line with the findings of the present study.

Similar to what was observed in previous studies, the group with hearing loss gained the highest average scores on physical, functional, and emotional subtests. Apparently, the physical subtest contained items easier to understand by the respondents, and as some other researchers [5, 19] have noted, they might be more concerned with the physical aspects of their disorder than the other ones.

**Conclusion**

The results of this study showed that in subjects with hearing loss, the total and subscale scores of VHI are significantly higher than those without hearing loss are. This indicates that the effects of voice disabilities on voice-related quality of life are multilateral in subjects with hearing loss and voice handicap influences different aspects of individuals’ life suffering from hearing loss. Moreover, in subjects with hearing loss, there is a significant correlation between varying degrees of hearing impairment and total and subscales of VHI, suggesting that the increase in severity of hearing loss would lead to a rise in perceived voice handicap by the individuals.

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Disclosure Statement

The authors have no conflicts of interest to disclose.

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