Summary: Objective. Muscle tension dysphonia (MTD) is a functional dysphonia, which appears with an excessive tension in the intrinsic and extrinsic laryngeal musculatures. MTD can affect voice quality and quality of life. The purpose of the present study was to assess the effectiveness of vocal function exercises (VFEs) on perceptual and self-assessment ratings in a group of 15 subjects with MTD.

Methods. The study comprised 15 subjects with MTD (8 men and 7 women, mean age 39.8 years, standard deviation 10.6, age range 24–62 years). All participants were native Persian speakers who underwent a 6-week course of VFEs. The Voice Handicap Index (VHI) (the self-assessment scale) and Grade, Roughness, Breathiness, Asthenia, Strain (GRBAS) scale (perceptual rating of voice quality) were used to compare pre- and post-VFEs.

Results. GRBAS data of patients before and after VFEs were compared using Wilcoxon signed-rank test, and VHI data of patients pre- and post-VFEs were compared using Student paired t test. These perceptual parameters showed a statistically significant improvement in subjects with MTD after voice therapy (significant at \( P < 0.05 \) (*) and \( P < 0.004 \) (**)). Also results indicated statistically noticeable reduction in the mean VHI scores across subjects with MTD (significant at \( P < 0.05 \) (*) and \( P < 0.004 \) (**))

Conclusions. Significant improvement after therapy for participants has been observed by the aid of auditory-perceptual ratings of voice quality (with the GRBAS scale) and the patient’s self-assessment ratings measurements (with the VHI). As a result, the data provide evidence regarding the efficacy of VFEs in the treatment of patients with MTD.

Key Words: Muscle tension dysphonia–Vocal function exercises–VHI–GRBAS–Perceptual evaluation.

INTRODUCTION

In 1983, Morrison et al offered the label muscle tension dysphonia (MTD) to clearly delineate traits of patients with functional dysphonia. Although various terms existed in literature, MTD became the preferred term.\(^1\) To be more precise, an excessive tension in the intrinsic and extrinsic (para) laryngeal musculatures is a clinical feature of MTD.\(^2,3\) Furthermore, the tension in the extrinsic musculatures is altered by MTD, which causes the larynx to experience a higher level of vocal strain. As a result, MTD has an impact on the intrinsic muscle of the larynx and vocal folds’ tension, which may lead to voice disturbance as well.\(^5,6\) With respect to the multifactorial etiology of MTD, a couple of its contributing factors, namely, inappropriate vocal behavior, gastroesophageal reflux, psychological and personality factors which enhance the vocal fold tension, could be taken into account when regarding voice disorder as a possible outcome.\(^7,8\)

First and foremost, voice therapy is regarded as the pioneer method of treatment in MTD,\(^9,10\) which involves various therapeutic techniques such as relaxation, yawn-sign, chewing, and laryngeal muscle tension reduction. The purpose of such techniques is to reduce or retrieve inappropriate use of voice so as to rebuild normal phonatory function, in parallel with obliterating excessive tension in the intrinsic and extrinsic (para) laryngeal muscles. Henceforth, diverse methods could be selected by the practitioners to perform maneuver on posture, breathing, phonation, articulation, or on muscle tension.\(^11,12\)

According to one of the voice therapy techniques, vocal function exercises (VFEs)\(^13,14\) which use a holistic approach in focusing on vocal mechanism, are the proposed treatment for MTD.\(^15\)

Vividly, VFEs include a series of voice manipulations, which are designed to increase the laryngeal muscles’ strength as well as coordinate airflow with muscular effort. To put it more simply, laryngeal pathologies may be primarily or secondarily related to “weakness” of the laryngeal muscles. However, for as long as VFEs are practiced properly, laryngeal muscular strength might be enhanced, providing a systematic exercise program to restore balance, strength, and ease of phonation, in addition to breaking the hyperfunctional cycle of functional voice disorders.\(^16,17,18\)

There are several published studies on the effectiveness of VFEs that are conducted on healthy subjects and also in patients with voice disorders. According to one study on people without voice disorders, the effectiveness of the VFEs, placebo exercises, or no exercises over a 4-week period between 35 female adults was performed by Stemple et al in 1994. After the 4-week period they found that maximum phonation time and pitch range did improve in the VFE group.\(^19\) In an investigation on singers, Sabol et al provided some evidence in support of Stemple et al’s finding. In the study by Sabol et al, 20 singers were divided into one experimental and one control group. Each group
continued their regular singing practice regimen and the experimental group added the vocal function exercise program. Their results showed changes in flow rate, phonatory volume, maximum phonation time, and pitch range in the experimental subjects, suggesting an increase in glottal efficiency.\textsuperscript{20} Tay et al carried out the VFEs program on a group of 22 choral singers. Auditory-perceptual, aerodynamic, acoustic, and self-evaluation voice measures paved the way for pre- and posttraining comparisons. It was reported that significant improvements in perceived roughness, maximum phonation time, jitter, shimmer, and harmonics-to-noise ratio in the VFE group were clearly observed.\textsuperscript{21} In one study concerned with effectiveness of the VFE on teachers with voice disorder, 58 of that group were under a 6-week period of treatment by Roy et al, which was reported to have a noticeable reduction in mean Voice Handicap Index (VHI) scores before and after the treatment period.\textsuperscript{22} In another study performed by Gillivan-Murphy et al, the effectiveness of the VFEs in 20 teachers with voice disorder was examined. Practically, Gillivan-Murphy et al used two self-assessment scales: the Voice-Related Quality of Life and the Voice Symptom Severity Scale. Consequently, self-reported voice symptoms were improved by the aid of VFEs.\textsuperscript{23} According to one study by Gorman on elderly patients, VFEs were performed in 19 elderly men, twice a day for 12 weeks. The authors reported prominent improvement in maximum phonation time and several aerodynamic measures related to glottal closure.\textsuperscript{24} In another study conducted by Sauder et al, nine patients with presbylaryngis underwent a 6-week course of VFEs. Pre- vs posttherapy comparisons were made of self-ratings of VHI and phonatory effort level, as well as auditory-perceptual voice assessments, acoustic analyses, and visual-perceptual evaluations of laryngeal images. Therefore, results indicated significant decreases in VHI scores, self-ratings of phonatory effort level, and auditory-perceptual measures of breathiness and strain.\textsuperscript{25} In one solitary study about primary school teachers with MTD by Nguyen and Kenny, the treatment effects of VFEs were evaluated. It is worth mentioning that in this study, study patients were randomly allocated into a treatment group, in which acoustic and perceptual data were used as primary outcome measures. Nguyen and Kenny’s observable findings showed positive changes in perturbation, harmonics-to-noise ratio, and perceptual data in the group who had received VFEs.\textsuperscript{26} Teachers with behavioral dysphonia were another target group who had been under treatment procedures. Relevantly, Teixeira and Behlau assessed the improvement in VFEs by using the auditory-perceptual evaluation of voice, self-ratings of the impact of dysphonia, and acoustic analysis in the mentioned group. The VFE group represents the effective changes across treatment outcome measures in that regard.\textsuperscript{27} Last, but not least, Pedrosa et al evaluated the efficiency of the VFEs in another group that underwent VFEs—the functional dysphonia group. The rehabilitation program consisted of six voice treatment sessions and three assessment sessions performed before, immediately after, and 1 month after treatment. The outcome measures were self-assessment protocols Voice-Related Quality of Life and VHI, perceptual evaluation of vocal quality, and a visual examination of the larynx. By and large, their result revealed positive outcome measures.\textsuperscript{28} All in all, the study on Vietnamese speakers is the only study that used VFEs for MTD treatment. Unfortunately, in the Persian context, no firm evidence to support VFE usage in treating voice issues related to MTD exists. Henceforth, the major goal of the current study was to provide scientific reasons to support the merits of VFE efficiency on perceptual and self-assessment ratings to treat Persian speakers with MTD and, consequently, to prove further the positive results of VFEs in clinical practice.

### METHODS

#### Subjects

There were 15 subjects with MTD (8 men and 7 women, mean age 39.8 years, standard deviation [SD] 10.6, age range 24–62 years) who participated in the study. The mean duration of MTD in the participants was 5.1 months, SD 1.5. The patients with MTD were recruited at the ENT Department of the Tehran University Hospital in Tehran, Iran. Before recruitment, each subject was diagnosed with MTD by a speech-language pathologist and an otolaryngologist, following a case history, endoscopic, videostroboscopic, and musculoskeletal evaluation, which were routine clinical procedure for collecting diagnostic information about patients and for estimating the study group as a diagnosis measure and not as an outcome measure.

All participants were native Persian speakers with normal speech and language skills. None of them had any hearing defects or any neurologic or velopharyngeal abnormalities. All participants were examined by an ENT physician before their involvement in the study. Furthermore, an audiogram was conducted to exclude any severe hearing defects. Participants were excluded if they had acute or chronic upper respiratory infection at the time of testing and a history of cardiac, pulmonary, or neurologic problems; participants were included if they used Farsi as their primary native language, had not currently received voice therapy services, were aged 18 years old or older, had normal laryngeal framework with no history of laryngeal surgery, and had no current or prior swallowing problems reported.

#### Subject demographics

Demographic data and the characteristics of the subjects, including gender, age, duration of MTD, and initial complaints are provided in Table 1.

#### Ethical aspects

Notably, an informed consent was provided for all participants and, consequently, all subjects were informed about the procedure and were told to inform the examiner whether they intended to discontinue from the study. Meanwhile, treatment procedure was free of charge for all participants. Additionally, all patients were constantly asking for treatment, and none of them was willing to be included in the control group. In addition, the instituting committee did not allow us to deprive the patients of treatment.

#### Treatment approach

In what follows, the diagram of design can be categorized into four major aspects:
Diagnostic procedure
Pre-voice therapy baseline measure
Use of treatment approach: VFEs
Post-voice therapy outcome measure

**Vocal function exercises (VFEs)**

One speech-language pathologist (first author) with expertise in voice provided 45-minute sessions of voice therapy program known as VFEs over the course of 6 weeks, as described by Stemple (1993). The Persian speakers were provided the exercise which modified the usage of Persian vowels; however, the major goal of each maneuver was in parallel with the original exercise. In part 1 the vowel used was the Persian vowel /i/, a front, close (high) vowel. In parts 2, 3, and 4, the vowel used was the Persian vowel /o/, a back, mid (half-close) vowel.

All of the subjects underwent training by the first author in VFE procedure in which they were called for placing the precise pitch on the vowels using the reference tones on the same musical notes recorded from a Challen upright acoustic piano (London 1804). The tones were recorded on voice recorder (Kingston, DVR-902, HK, China) and delivered to participants on CD or flash memory.

The VFEs (typically consisting of four parts) were performed two times each day on a daily basis (morning and evening), 7 days per week, for 6 weeks. In addition, patients had a meeting with the first author once a week to illustrate one complete exercise cycle and to guarantee that the exercises were performed genuinely and consistently. During the four steps of the regimen, subjects were guided to yield as softly as possible with an easy onset (initiation of sound) and without voice break and with a forward placement of the tone but not quite nasal. The four specific exercises are described in Table 2.

### Outcome measures

The auditory-perceptual evaluation (Grade, Roughness, Breathiness, Asthenia, Strain [GRBAS] scale) along with self-assessment ratings (VHI) were applied as treatment outcome measures before and after the treatment completion period (6 weeks) for assessing the VFE efficiency. To be more exact, outcome measures were collected by the clinician who was blind to the study.

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**TABLE 1.**

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Gender</th>
<th>Age (Y)</th>
<th>Duration of MTD (Mo)</th>
<th>Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>35</td>
<td>5</td>
<td>Hoarseness, pain, vocal fatigue</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>42</td>
<td>6</td>
<td>Strained voice, globus pharyngeus</td>
</tr>
<tr>
<td>3</td>
<td>Male</td>
<td>24</td>
<td>2</td>
<td>Pain on or after phonation, “tightness” in throat</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>29</td>
<td>4</td>
<td>Unable to project voice, vocal fatigue</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>38</td>
<td>7</td>
<td>Loss of pitch range, voice loss, hoarseness</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>52</td>
<td>6</td>
<td>Vocal strain, pain, tension</td>
</tr>
<tr>
<td>7</td>
<td>Female</td>
<td>62</td>
<td>8</td>
<td>Hoarseness, pain</td>
</tr>
<tr>
<td>8</td>
<td>Female</td>
<td>45</td>
<td>7</td>
<td>Hoarseness, tension</td>
</tr>
<tr>
<td>9</td>
<td>Female</td>
<td>33</td>
<td>4</td>
<td>Aphonie in higher intensity, voice loss</td>
</tr>
<tr>
<td>10</td>
<td>Male</td>
<td>39</td>
<td>5</td>
<td>Globus pharyngeus, pain</td>
</tr>
<tr>
<td>11</td>
<td>Male</td>
<td>27</td>
<td>3</td>
<td>Vocal fatigue</td>
</tr>
<tr>
<td>12</td>
<td>Female</td>
<td>30</td>
<td>6</td>
<td>Hoarseness</td>
</tr>
<tr>
<td>13</td>
<td>Male</td>
<td>43</td>
<td>5</td>
<td>Voice loss, pain</td>
</tr>
<tr>
<td>14</td>
<td>Female</td>
<td>51</td>
<td>4</td>
<td>Laryngeal tension</td>
</tr>
<tr>
<td>15</td>
<td>Male</td>
<td>47</td>
<td>5</td>
<td>Increased tension, hoarseness</td>
</tr>
</tbody>
</table>

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**TABLE 2.**

<table>
<thead>
<tr>
<th>Exercises</th>
<th>Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise 1: Warm-up</td>
<td>Participants were asked to sustain the vowel sound /i/ on the musical note F4 (349.23 Hz) above middle C4 (261.63 Hz) for women, on the musical note F3 (174.61 Hz) below middle C3 (130.81 Hz) for men as long as possible.</td>
</tr>
<tr>
<td>Exercise 2: Stretching</td>
<td>Participants were asked to ascend glide from the lowest to the highest note on the vowel /o/.</td>
</tr>
<tr>
<td>Exercise 3: Contracting</td>
<td>Participants were asked to descend glide from the highest note to the lowest note on the vowel /o/.</td>
</tr>
<tr>
<td>Exercise 4: Low-impact adductory power</td>
<td>Finally, subjects were asked to sustain five musical notes C4 (261.63 Hz), D4 (293.66 Hz), E4 (329.00 Hz), F4 (349.23 Hz), and G4 (392.00 Hz) (females) or the same notes one octave lower C3 (130.81 Hz), D3 (146.83 Hz), E3 (164.81 Hz), F3 (174.61 Hz), and G3 (196 Hz) (males) as long as possible on the vowel /o/. In this procedure participants were guided to round their lips to produce the /o/ sound while feeling vibration on the lips.</td>
</tr>
</tbody>
</table>
**Perceptual and self-assessment**  
**VHI (the self-assessment scale)**

To evaluate the effectiveness of therapy, each patient completed the VHI before and after the 6-week treatment period. The VHI consists of 30 questions and generates a total score (ranging from 0 to 120) and three subscale scores: functional (F), physical (P), and emotional (E). These questions are related to the physical, functional, and emotional aspects of voice and rated on a 5-point equal-appearing interval scale, with the following value: 0 = never, 1 = almost never, 2 = sometimes, 3 = almost always, and 4 = always.

Voice disorders negatively affect an individual’s ability so as to communicate, work, and maintain social relationships. Participants have to rate each statement, indicating how much experience they have had in each question. Self-report measures such as the VHI are ecologically valid and firm, projecting the influence of a voice disturbance on an individual’s life.30,31

The VHI can be used as a measure of the effectiveness of specific treatment techniques32 and it VHI has been shown to have the best psychometric properties.32 The decision to use the VHI was based on the nature of MTD: it is a disorder for which the primary outcome of interest is improvement from the patient’s perspective rather than an objectively measured endpoint; the VHI has been previously validated for the purpose of assessing current or prior swallowing problems that have been reported in the literature.33

**GRBAS (perceptual rating of voice quality)**

The GRBAS scale was used for the perceptual voice analysis. The GRBAS scale is the most widely used scale for perceptual evaluation proposed by the Japan Society of Logopaedics and Phoniatrics. An experienced speech pathologist therapist (not involved in the voice therapy) rated each patient on running speech. He was not informed about the purpose of the study. Pretreatment and posttreatment voice samples for each patient were presented to the listener. The listener rated voice samples in a quiet laboratory. The perceptual judgments scale (GRBAS) rates were grade, roughness, breathiness, asthenia, and strain on a scale of 0–3 (0, normal or absence of deviance; 1, slight deviance; 2, moderate deviance; 3, severe deviation).34

**Instrumentation and recording procedure**

The recordings were carried out in a quiet room in Tehran, at the hospital of “Tehran” affiliated to Tehran University of Medical Sciences. Room noise level was measured by a sound level meter (model CEL-450; UK Office, Keison Products, P.O. Box 2124, Chelmsford, Essex, CM1 3UP, England); samples (running speech) were recorded using a microphone (frequency response 50 Hz–20 kHz; AKG C410, Harman International Company, Vienna, Austria) placed at a distance of 30 cm in front of the subject’s mouth and collected by using a voice recorder (Kingston).

**Statistical analysis**

The results were given as arithmetic mean±SD. GRBAS data of patients before and after VFEs were compared using Wilcoxon signed-rank test, and VHI data of patients pre- and post-VFEs were compared using Student paired t test. We noted the effects at P < 0.05, but according to the Bonferroni correction, those at P < 0.004 level could show more confidence in statistical improvement. SPSS for Windows (version 16.0, SPSS Inc., Chicago, IL) was used for statistical analysis.

**RESULTS**

**GRBAS (perceptual rating of voice quality)**

The results for all five of the GRBAS (perceptual rating of voice quality) parameter values pre- and post-VFEs are shown in Table 3. The P value was calculated using the Wilcoxon signed-rank test. These perceptual parameters show a statistically significant improvement in subjects with MTD after voice therapy (significant at P < 0.05 (*) and P < 0.004 (**)).

It should be noted that the severity of dysphonia (before VFEs) in this study was moderate to severe. In the current study, the voices were judged as more rough (auditory-acoustic impression of irregularity of vibration) than breathy (auditory-acoustic impression of degree of air leakage) with a moderate to severe degree of dysphonia before therapy. On average, the mean values of the S parameter (auditory-acoustic impression of hyperfunction) were higher than the A values (auditory-acoustic impression of weakness or lack of power) in the pretherapy assessment.

**VHI (the self-assessment scale)**

VHI values pre- and post-VFEs are shown in Table 4. Results showed statistically significant reduction in the mean VHI scores across subject with MTD (significant at P < 0.05 (*) and P < 0.004 (**)). For the total values as well as for the physical, functional, and emotional subscales, Student paired t test was conducted to reveal their differences; consequently, the improvement was observed accordingly.

Based on the findings, participants had a significant improvement from an average pretreatment VHI of 43.4 (for the total values) to posttreatment VHI of 24.4 (P < 0.004), which is a score reduction of 19. The physical score (P-scale) was on average reduced from 19.4 to 11.5 (P < 0.05), which is a score reduction of 7.9; the functional (F-scale) score from 17.8 to 8.6 (P < 0.004), which is a score reduction of 9.2; and the

| TABLE 3. Mean, SD, and P Values of GRBAS Data Pre- and Post-VFEs in MTD Patients |
|-----------------|----------------|------------|---|
| **Grade**       | Before VFEs    | After VFEs | P  |
| Roughness       | 2.1 ± 0.8      | 0.5 ± 0.6  | 0.006**|
| Breathiness     | 1.8 ± 0.6      | 0.7 ± 0.5  | 0.01*  |
| Asthenicity     | 1.2 ± 0.3      | 0.4 ± 0.2  | 0.02*  |
| Strained        | 1.1 ± 0.5      | 0.3 ± 0.4  | 0.04*  |

P values on Wilcoxon signed-rank test mean±SD of pretherapy and posttherapy measures are reported. Effects significant at P < 0.05 (*) and P < 0.004 (**) are noted.

Abbreviations: GRBAS, Grade, Roughness, Breathiness, Asthenia, Strain scale; MTD, muscle tension dysphonia; SD, standard deviation; VFEs, vocal function exercises.
emotional (E-scale) score from 6.2 to 4.3 ($P < 0.05$), which is a score reduction of 1.9 (Table 4).

### DISCUSSION

The purpose of the present study was to assess the effectiveness of VFEs on perceptual and self-assessment ratings in a group of 15 subjects with MTD. As to the fact that there would be such a dire need to reach an evidence-based approach, evaluating the efficiency of intervention could be taken as a vital aspect in today’s health care. Conducting a research on critical effects of intervention on voice disorders is significant as well. Additionally, several measurements such as voice quality and voice handicap need to be used because of a variety of voice disorders.  

It seems that evaluation of a patient’s perception of voice handicap is a critical issue in the assessment of voice disorders and in therapeutic decision making. Rosen et al reported that VHI enables the detection of posttreatment changes for all of the voice disorders studied, regardless of the type of treatment, including surgery, medical therapy, and voice therapy.

Furthermore, GRBAS is a perceptual or auditory-acoustic assessment tool that addresses voice quality. In other words, GRBAS scale is the tool used in auditory-perceptual evaluation, which paves the way for speech pathologists to subjectively assess the degree and quality of hoarseness. The GRBAS parameters could be obtained relatively more easily by speech pathologists.

In the present study, auditory-perceptual ratings of voice quality (with the GRBAS scale) and the patient’s self-assessment ratings measurements (with the VHI) both showed significant improvement after voice therapy (VFEs) for the subjects.

Contrary to the current study which focused primarily on the use of VFEs on one sample group of MTD, Roy et al used VFEs as a treatment method for voice-disordered teachers. In the study by Roy et al, voice-disordered teachers were randomly assigned to one of three groups: vocal hygiene, VFEs, and a nontreatment control group, with the purpose of assessing the functional effects of two voice therapy approaches. Likewise, in the current study, the subjects completed the VHI before and following a 6-week treatment phase. Afterward, they reported a significant reduction in mean VHI scores before and after VFEs. Consequently, the results of our study are in agreement with the positive findings reported by Roy et al.

Similarly, Gillivan-Murphy et al found that VFEs improved self-reported voice symptoms in voice-disordered teachers. To be more exact, in the study by Gillivan-Murphy et al, subjects were randomly assigned to a no-treatment control and a treatment group. They applied two different self-assessment scales, including the Voice-Related Quality of Life and the Voice Symptom Severity Scale to examine the effectiveness of VFEs. Their self-assessment scales for the outcome measure were different compared with the present study. Additionally, the amount of therapy was similar between these two mentioned reviews and the present study. In other words, the subjects in the study of Gillivan-Murphy et al and Roy et al underwent 6 weeks of therapy, similar to the 6 weeks in our study. Ultimately, despite all mentioned differences about the studied population and the tools for outcome measures, the observed measures in Gillivan-Murphy et al were in parallel with the reported results in the current study.

Also in another study by Sauder et al, the effectiveness of pre- vs posttherapy VFEs was reported in elderly patients with presbylaryngis; therefore, the population under the current study differs from that studied by Sauder et al. In the study by Sauder et al, comparisons were made of self-ratings of voice handicap and auditory-perceptual voice assessments. After treatment, patients reported significant reductions on VHI scores, and blinded listeners rated the posttreatment voices as significantly less breathy and strained, which are findings supported by the present study.

Teixeira and Behlau assessed the improvement in VFEs after a 6-week therapy by using the consensus auditory-perceptual evaluation of voice and self-ratings of the impact of dysphonia in teachers diagnosed with behavioral dysphonia. Our findings provided some evidence in support of Teixeira and Behlau’s study, which reported that the VFE group showed effective changes across treatment outcome measures.

As mentioned earlier, there is some evidence to support the use of VFEs in treating voice problems related to hyperfunction. However, there is only one study that applied this method to treat MTD. In a study by Nguyen and Kenny, acoustic and perceptual data were used as outcome measures. Their findings showed significant changes in perceptual data in the VFE group, which are in agreement with the present study.

According to the study by Jacobson et al (1997), a VHI total of 0–30 is considered a low score (a mean VHI total of 33.7), and the handicap associated with the voice disorder is minimal. A score from 31 to 60 (mean VHI total of 44.8) projects a moderate handicap, whereas post-treatment VHI of 43.4 (for the total values) to the posttreatment VHI of 24.4. The handicap associated with the pretreatment VHI of 43.4 (for the total values) to the posttreatment VHI of 24.4. The handicap associated with the pretreatment VHI of 43.4 (for the total values) to the posttreatment VHI of 24.4. The handicap associated with the pretreatment VHI of 43.4 (for the total values) to the posttreatment VHI of 24.4.

<table>
<thead>
<tr>
<th>Physical</th>
<th>Before VFEs</th>
<th>After VFEs</th>
<th>$P$ Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td>19.4 ± 9.2</td>
<td>11.5 ± 8.1</td>
<td>0.02*</td>
</tr>
<tr>
<td>Emotional</td>
<td>17.8 ± 8.4</td>
<td>8.6 ± 6.3</td>
<td>0.006**</td>
</tr>
<tr>
<td>Total</td>
<td>43.4 ± 19.2</td>
<td>24.4 ± 18.9</td>
<td>0.004**</td>
</tr>
</tbody>
</table>

$P$ values on Student paired t test, mean ± SD of pretherapy and posttherapy measures are reported. Effects significant at $P < 0.05$ (*) and $P < 0.004$ (**) are noted.  

**Abbreviations**: MTD, muscle tension dysphonia; SD, standard deviation; VFEs, vocal function exercises; VHI, Voice Handicap Index.
the VHI had the least amount of change, and the lifestyle limitations (functional aspects) scale of the VHI had the most amount of change among the subscales. Furthermore, the current study results reveal that, on average, a significant improvement of voice quality can be achieved through voice therapy (VFEs) and a general reduction of severity was found for all the parameters.

Auditory-acoustic evidence in this study indicated that VFEs resulted in some changes in vocal mechanisms in MTD participants. With regard to our findings, it seems that a more stable vocal fold vibration can be judged as a reduction of roughness. Furthermore, authors of the current study speculated the decrease in size of glottal gap based on reduction in breathiness. However, this is merely a speculation and was not tested with visual perceptual analysis pre- and post-voice therapy. This assumption is in agreement with Gorman’s findings that VFEs resulted in better glottal closure. Moreover, it seems that VFEs resulted in a decrease in the perceptual impression of hyperfunction that was judged as reduction of strain. Stemple’s suggestion seems to be addressed by the findings of the current study, with regard to the point that VFEs apparently cause a break in the cycle of hyperfunctioning process in patients with functional dysphonia.

Exercises for the laryngeal muscles could be performed with the aid of specific tasks in the VFE program, which may also be applied for the vast majority of voice disorders containing hyperfunctional-like MTD without any known organic basis. However, the purpose of VFEs is to both address laryngeal muscles and increase the bulk, strength, and coordinated interaction of laryngeal muscles by means of a systematic exercise program containing maximum vowel prolongation and pitch glides. According to the current evidence, VFEs paved the way for quality of life as a result. In addition, auditory-acoustic impression of GRBAS parameters reached a more satisfactory level after voice therapy, suggesting the efficacy of VFEs in treating voice-related problems that limit participation and activity, and that also affect perception of voice quality.

CONCLUSIONS

It is worth mentioning that the current study delineated that VFEs are effective in addressing patients’ MTD based on the positive results of VFEs on MTD. Meanwhile, the parameters used are sensitive and practical in detecting voice changes after treatment.

Notably, each of the various voice facets is measured through the VHI and GRBAS, whose results on measurements are not necessarily related. The VHI is regarded as a subjective self-administered list of questions dealing with the patient’s perceived disability, whereas the GRBAS scale is a comprehensively applied approach for voice quality perceptual evaluation.

However, because of the positive changes in outcome measures reached after participants underwent treatment through the VFE program, it seems that such restricted exercise had a couple of treatment effects on participants’ voice.

Despite an eye-catching improvement that was observed with the current study’s data, this study is not without limitations, namely, having a small sample size and lacking a control group condition. It is highly recommended that further studies be conducted using a larger Persian sample in comparison to a control group in a Persian context.

Acknowledgments

The authors highly appreciate the participation of patients with MTD in this study.

REFERENCES


