Journal of Modern Rehabilitation
Archive of SID
April 2021, Volume 15, Number 2

Research Paper: Effect of Mathieson Laryngeal Manual Therapy in Patients With Muscle Tension Dysphonia After a Therapeutic Course

Mohammad Fallah[1], Seyyedeh Maryam Khoddami[1*], Shohreh Jalaie[2], Keyvan Aghazadeh[3], Amin Rezaei Rad[1]

1. Department of Speech Therapy, School of Rehabilitation, Tehran University of Medical Sciences, Tehran, Iran.
2. Department of Physiotherapy, School of Rehabilitation, Tehran University of Medical Sciences, Tehran, Iran.
3. Otolaryngology Research Center, Tehran University of Medical Sciences, Tehran, Iran.

Use your device to scan and read the article online

Citation: Fallah M, Khoddami SM, Jalaie S, Aghazadeh K, Rezaei Rad A. Effect of Mathieson Laryngeal Manual Therapy in Patients With Muscle Tension Dysphonia After a Therapeutic Course. Journal of Modern Rehabilitation. 2021; 15(2):73-82.

Article info:
Received: 16 Sep 2020
Accepted: 05 Nov 2020
Available Online: 01 Apr 2021

Publisher
Tehran University of Medical Sciences

ABSTRACT

Introduction: This study aimed to investigate the effect of Mathieson Laryngeal Manual Therapy (MLMT) following a therapeutic course in patients with primary Muscle Tension Dysphonia (MTD).

Materials and Methods: Twelve patients with primary MTD participated in this study. At first, videostroboscopy and perceptual voice assessment was performed, and the Persian version of Vocal Tract Discomfort (VTDp) scale was completed. After two and a half weeks that patients received no treatment, the assessments were repeated to evaluate the effect of spontaneous recovery. For studying the effect of MLMT, it was presented in five sessions. Then, all assessments were repeated. The frequency of supraglottic activity was elicited. For the perceptual evaluation and VTDp, the Wilcoxon nonparametric test was used to study and compare the effect of spontaneous recovery and MLMT.

Results: After spontaneous recovery, a significant difference was observed only in strain ($P<0.05$). After MLMT, the frequency of supraglottic activity decreased, and perceptual voice parameters significantly changed ($P<0.05$), but the VTDp showed no significant difference ($P>0.05$). There was no significant difference between spontanous recovery and MLMT based on the paerceptual voice evaluation and VTDp scale ($P>0.05$).

Conclusion: The MLMT can remarkably improve the supraglottic activity and perceptual characteristics of voice in primary MTD after a therapeutic course. Further studies are recommended to confirm the effectiveness of MLMT on decreasing VTD sensations.

Keywords: Voice, Muscle tension dysphonia, Manual therapy, Perceptual, Self assessment

*** Corresponding Author:**
Seyyedeh Maryam Khoddami, PhD.
Address: *Department of Speech Therapy, School of Rehabilitation, Tehran University of Medical Sciences, Tehran, Iran.*
Tel: *+98 (912) 2007969*
E-mail: *khoddami@tums.ac.ir*

1. Introduction

Muscle Tension Dysphonia (MTD) is a relatively common functional voice disorder. Approximately 10% to 40% of those referring to voice clinics suffer from MTD [1]. The excessive or unbalanced activity of internal and external muscles of the larynx has been recognized as the primary etiology of MTD [2, 3]. Laryngeal muscle tension can impact the size and shape of the vocal tract. To be more exact, changing laryngeal position and horizontal focus, as well as supraglottic activities, are some examples of the vocal tract changes due to laryngeal muscle tension in MTD. It is supposed that patients with MTD do excessive effort during speech production. This condition can cause inefficient vocal function that can be with or without organic damages to the vocal folds [4, 5]. In MTD, the vertical position of the larynx usually changes. This new position of the larynx may disturb the movement of the larynx cartilages. As a result, the degree of tension and free movement of the vocal folds may change and cause a disturbance in the voice [1].

Vocal fatigue is the most typical symptom in patients with MTD [2, 3, 5]. Other common symptoms include hoarseness, tension and struggle, pain during or after phonation, tremor, and feeling of tension and pressure in the larynx [2, 3, 6]. In MTD, the acoustic profile ranges from mild acoustic changes to severe dysphonia and even aphonia. Also, these patients may show severe irregularity in frequency and a decrease in amplitude. These abnormal voice features can be recorded even in the absence of laryngeal structural changes [3, 6].

Several voice therapy approaches have been suggested to reduce hyperactivity and consequently decrease or eliminate voice problems in MTD [2, 7]. Hygienic, symptomatic, psychogenic, physiologic, and eclectic voice therapies are among these approaches. The manual treatment of the larynx is one of the most common physiologic approaches of voice therapy that has gained popularity in recent years [7].

Laryngeal manual therapy, which was firstly described by Aronson in 1990, is a direct intervention to relieve tension in the larynx and surrounding areas [7, 8]. There is a great deal of clinical and research evidence to support the efficacy of this technique [4, 7, 9-11]. After Aronson, other speech and language pathologists, as well as physiotherapists and osteopaths, suggested several manual therapy techniques for dysphonic patients. Some are based on the principles introduced by Aronson, but there are some differences between them. The overall goal of all these techniques is to reduce muscle tension in paralaryngeal areas [4, 7, 12-16].

In 2009, Mathieson et al. [4] proposed a different kind of manual laryngeal therapy called Mathieson Laryngeal Manual Therapy (MLMT) for patients with MTD. The anatomical structures considered in this technique include Sternocleidomastoid (SCM) muscle, hyoid bone, the larynx, surrounding areas, and the supralaryngeal area.

According to the hypothesis of this technique, the presence of a tension in the muscular structures of the SCM and submandible can lead to dysphonia. So, it is supposed that releasing tension in these areas can improve voice and other problems in MTD without considering any other target structures, unlike other laryngeal manual therapy techniques. This technique is performed by two-handed and one-handed patterns with soft middle fingers of the clinician. The patient is in a sitting position, and the therapist is placed behind the patient. In this technique, stretching, kneading, and circular massages are used for the target structures during rest [4]. Therefore, MLMT applies more variant massages for the least target structures rather than laryngeal manual therapy techniques suggested by Aronson.

There are few documents regarding the effectiveness of MLMT in patients with MTD. In 2009, the efficacy of MLMT was firstly evaluated on 10 patients with primary MTD after a single 20-min treatment session. The results showed that MLMT had a significant effect on reducing paralaryngeal muscle tension and improving vowel frequency formants, Vocal Tract Discomfort (VTD), laryngeal palpation, and some acoustic measures [4]. Riemann et al. provided a single 20-min session MLMT for 30 patients with functional dysphonia. They found that MLMT could reduce muscle tension and improve the parameters evaluated at the beginning of the study [9]. In 2017, Siqueira et al. assessed the effect of this technique versus the transcutaneous electrical nerve stimulation on diadochokinesis of women with bilateral nodules after 12 sessions. The results showed that MLMT made better coordination in the vocal folds and more stable vowel production than electrical nerve stimulation [11]. The effect of MLMT combined with voice therapy and transcutaneous electrical nerve stimulation was also evaluated by Mansouri et al. in women with MTD [17]. To date, there is no study to investigate the short-term effects of MLMT on voice-related parameters following several treatment sessions in patients with MTD.

Because of no evidence of MLMT effectiveness on voice-related assessments after a therapeutic course in MTD, we aimed to examine the efficacy of this manual laryngeal therapy following a multi-session treatment course in patients with primary MTD. With respect to the multidimensional concept of the voice, the current study tried to evaluate patients with primary MTD from different aspects, including instrumental, self-assessment, and clinician-based evaluations. Consequently, the present study aimed to investigate the effects of MLMT following 5 treatment sessions based on the assessment of supraglottic activity, Vocal Tract Discomfort (VTD), and auditory-perceptual aspects of the voice. Therefore, a multidimensional evaluation of voice was performed at three time points: first, before, and after MLMT. We intended to study the effect of spontaneous recovery and MLMT on different aspects of voice-related assessments after a therapeutic course in patients with primary MTD.

2. Materials and Methods

Study design and participants

This study was designed as a clinical trial study. The participants were 12 patients with primary MTD who attended the Ear, Nose, and Throat (ENT) clinic at Amir-Aalam Hospital, Tehran City, Iran. The patients with primary MTD were diagnosed based on the voice history, voice self-assessment, auditory-perceptual voice assessment, laryngeal palpation, and videostroboscopy examination. The diagnosis of primary MTD was made in collaboration with an otorhinolaryngologist and a Speech and Language Pathologist (SLP) with at least 5 years of clinical experience in voice disorders. The patients were included who 1) were between 18 and 55 years old; 2) had no cardiovascular diseases; 3) had no neurologic and organic voice disorders; 4) had no history of trauma, burns, scars, and surgery in the neck and chest area; 5) lacked therapeutic intervention for voice and laryngeal problems before and during this study, and 6) could read and write. The age group of 18 to 55 years old was selected to decrease the effect of probable vocal and laryngeal changes following puberty and aging. Moreover, the patients who caught a cold or any other diseases that had effects on the results of treatment and who could not complete different stages of the evaluations and treatment were excluded from the study.

Study procedure

After the selection of the patients who met the inclusion criteria, all assessments, including supraglottic activity [18], VTD [19], and auditory-perceptual voice [20], were carried out first, before, and after MLMT. All these assessments were performed by three SLPs who had more than 5 years' experience in assessing patients with voice disorders and did not engage in the MLMT.

The first assessments were performed at the study initiation when each patient was referred from the otorhinolaryngologist and SLP to receive MLMT. After that, each patient received no treatment for two and a half weeks to form a control group. So the first assessment will be referred to as pre-spontaneous recovery assessments. All assessments were repeated for the second time about two and a half weeks after the first assessments while the patients did not receive any treatment. The second assessment was performed after the period without treatment and before MLMT will be mentioned as post-spontaneous recovery/pre-treatment assessments. Then, each patient received five sessions of MLMT for two and a half weeks until the patients received no treatment. The MLMT was presented for each patient during five sessions (two sessions in a week) by an SLP who was blinded to the assessments. In the end, the third assessment that will be called post-treatment assessments were repeated immediately after the fifth session of MLMT.

Supraglottic activity assessment

To record laryngeal supraglottic activity, we observed the larynx using a digital EndoSTROBE system (KARL STORZ, Germany) with a 70-degree rigid endoscope (KARL STORZ-ENDOSKOPE pulsar stroboscopy system 20140020) during both rest and /i/ prolongation with habitual pitch and loudness. Then, three SLPs experienced in the laryngeal examination watched the videos and recorded the supraglottic activity pattern based on the voice-vibratory assessment with laryngeal imaging rating form [18]. In this way, we asked them to record two supraglottic activity patterns, including anteroposterior (A-P) and mediolateral (M-L) compression.

Vocal tract discomfort assessment

In this study, we asked the patients to complete the Persian version of the VTD scale (VTDp) to determine the "frequency" and "severity" of VTD sensations [19]. The VTD scale is a self-assessment questionnaire to extract specific sensory symptoms experienced by patients with voice disorders in their vocal tract [4, 21]. The VTDp consists of two subscales, which measures the frequency and severity of the presence of 8 different qualitative sensations: burning, tightness, dryness, aching, tickling, soreness, irritation, and lump in the throat. To measure

the frequency and severity of these sensations, there is a 7-point scale, from 0 to 6. The total score for each subscale ranges from 0 to 48, which higher scores mean the greater frequency and severity of sensations [4, 21].

Auditory-perceptual voice evaluation

For perceptual voice evaluation, we used the Persian version of consensus auditory perceptual evaluation of voice (called ATSHA) [20]. To this effect, the voice samples were recorded by a voice recorder (Zoom H5 Handy Recorder) during /a/ and /i/ vowels sustain, reading sentences, and continuous speech in a quiet room. During voice sampling, the Zoom microphone with a frequency response of 5 Hz to 20 kHz was held at a distance of 10 cm from the front of the mouth with a 45° angle. Then, three SLPs who had at least 5 years of clinical experience in assessing patients with voice disorders were asked to listen to the audio samples by an AKG K240 studio headphone and document the overall severity of dysphonia and strain. Each voice sample would be listened up to two times. The examiners asked to record the score between 0-100 on various tasks in which a higher score shows greater dysphonia and strain in the quality of voice [20]. Although we evaluated perceptual voice parameters, including "overall severity" and "strain" by the ATSHA, we did not grade or classify our patients based on the degree of dysphonia.

The Mathieson Laryngeal Manual Therapy (MLMT)

The MLMT was implemented for all patients based on the method proposed by Mathieson et al. [4]. The order of target structures was sternocleidomastoid muscles, supralaryngeal area, hyoid bone, and larynx. In this way, the massages were performed with pads of the index, middle and third fingers of hands bimanually and unimanually. In MLMT, the therapist performs circular and kneading massages as well as stretching. The therapist starts from areas of least muscle resistance but pays more attention to areas of most muscle resistance [4]. In the present study, the MLMT was presented by an SLP who was blinded to all assessments, including initial, pre-, and post-treatment assessments. The MLMT was performed in 5 individual 25-min sessions twice a week. In each treatment session, the MLMT protocol was performed twice with a short break between them. Each round of MLMT was performed with an approximate time of 10 min, and a 5-min rest interval was inserted between them. Thus, the duration of each treatment session was approximately 25 minutes. Before initiating the study, the SLP and other research team members became familiar with the MLMT by studying the relevant literature. The MLMT protocol was extracted by the research team in detail. Then, the SLP practiced the MLMT according to the suggestion of Dr. Lesley Mathieson under the supervision of Claire Wells, who is one of the organizers of MLMT workshops around the world. The study was initiated when Claire Wells confirmed the SLP is ready to start treatment with the MLMT technique.

Statistical analyses

The obtained data were analyzed with the statistical software IBM SPSS 17.0 for Windows (SPSS Corp, Chicago, IL). At first, descriptive data were extracted based on the outcome measures at first, before, and after MLMT assessments. In this study, the descriptive data included absolute frequency (number) and relative frequency (percentage) of supraglottic activity patterns and also mean and standard deviation of the VTDp scale scores and auditory-perceptual voice evaluations. To study the effect of spontaneous recovery and MLMT, the Wilcoxon nonparametric statistical test was used for the results of VTDp and auditory-perceptual voice evaluations. Further, the amount of spontaneous recovery and MLMT was extracted to compare the effectiveness of spontaneous recovery and MLMT on the results of outcome measures. The amount of spontaneous recovery effect was calculated by the difference between pre-spontaneous recovery and post-spontaneous recovery/pre-treatment assessments. Also, the difference between post-spontaneous recovery/pre-treatment and post-treatment assessments was obtained to check the MLMT effect. The effectiveness of spontaneous recovery and MLMT on the results of VTDp and perceptual voice evaluations were compared by the Wilcoxon nonparametric statistical test. Moreover, we calculated the inter-rater reliability of auditory-perceptual voice evaluation by the Pearson correlation analysis between three SLPs. This analysis showed excellent agreement between the raters on the perceptual evaluation of overall severity in the initial, pre-, and post-MLMT assessments (rPearson> 0.9). The significant level was set at ≤0.05. In this study, power has also been used to determine the adequacy of sample size.

3. Results

Characteristics of the participants

Our participants included 12 patients with primary MTD (6 men and 6 women) with Mean±SD age of 35.6±8.86 and 41.17±8.42 years in men and women, respectively. The results of individual demographic data are presented in Table 1.

Table 1. Individual demographic data of patients with primary MTD (N=12)

Code	Gender	Age (y)	Job	Duration of MTD (mo)
11	Female	32	Housewife	2
5	Female	33	Housewife	1
1	Female	37	Employee	3
2	Female	45	Housewife	1
3	Female	45	Teacher	1
8	Female	54	Housewife	3
9	Male	22	Student	2
12	Male	28	Officer/Eulogist	1
4	Male	37	Teacher	5
7	Male	40	Seller	5
10	Male	42	Seller/Eulogist	1
6	Male	45	Tailor/Eulogist	1

MTD: Muscle Tension Dysphonia.

JMR

Supraglottic activity assessment

Table 2 reports the absolute and relative frequency of supraglottic activity patterns in pre-spontaneous recovery, post-spontaneous recovery/pre-treatment, and post-treatment assessments. The results were the definitive agreement of three SLPs who observed the images of stroboscopy.

According to Table 2, the most frequent supraglottic activity pattern at first assessment and before MLMT was a combination of mediolateral (M-L) and anteroposterior (A-P) compressions. The frequency of supraglottic activity patterns after spontaneous recovery was similar to the initial evaluation in most patients, which indicates that supraglottic activity did not change after a period without treatment. At the beginning of the study, half of the patients showed both supraglottic activity patterns, and one-sixth of the patients showed no pattern. Before MLMT, the rate of the A-P pattern was higher than M-L, but this status was reversed after MLMT. The number of patients who showed no supraglottic activity pattern increased to one-third of the total after MLMT. Also, half of the patients who initially had both patterns decreased to one-sixth of the total patients after MLMT.

Table 2. Absolute and relative frequency distribution of supraglottic activity pattern before and after spontaneous recovery and MLMT in patients with primary MTD (N=12)

Supraglottic Activity Pattern	Assessments		
	Absolute Frequency (%)		
	Pre-SR	Post-SR/Pre T	Post T
Mediolateral (M-L) compression	1 (8.33%)	1 (8.33%)	4 (33.33%)
Anteroposterior (A-P) compression	3 (25%)	4 (33.33%)	2 (16.66%)
Both M-L & A-P compressions	6 (50%)	5 (41.66%)	2 (16.66%)
None	2 (16.66%)	2 (16.66%)	4 (33.33%)

JMR

MLMT: Mathieson Laryngeal Manual Therapy; MTD: Muscle Tension Dysphonia; SR: Spontaneous Recovery; T: Treatment.

Table 3. The results of the VTDp scale before and after spontaneous recovery and MLMT in patients with primary MTD (N=12)

VTDp Score	Assessments Median (Min/Max)			Effectiveness (P-Value)*		Power
	Pre-SR	Post-SR/ Pre T	Post T	SR (Pre SR & Post SR/Pre T)	MLMT (Post SR/Pre T & Post T)	
Frequency subscale	21 (12.38)	20.50 (12.37)	18 (8.32)	0.253	0.113	0.32
Severity subscale	22.50 (11.33)	18.50 (12.34)	19 (8.34)	0.656	0.722	0.32

JMR

VTDp: The Persian version of the Vocal Tract Discomfort scale; MLMT: The Mathieson Laryngeal Manual Therapy; MTD: Muscle Tension Dysphonia; SR: Spontaneous Recovery; T: Treatment;

*The Wilcoxon nonparametric statistical test; P≤0.05.

Vocal tract discomfort assessment

The results of the VTDp scale in pre-spontaneous recovery, post-spontaneous recovery/pre-treatment, and post-treatment assessments are presented in Table 3. Although the scores of both frequency and severity subscales of the VTDp decreased after the period of without treatment and also after MLMT, no significant difference was observed between the results of the VTDp scale before and after the period of without treatment and also MLMT. To be more exact, the Wilcoxon nonparametric statistical analysis showed that the effect of spontaneous recovery and also MLMT on the frequency and severity of VTDp were not significant (P>0.05). Moreover, the comparison of the effectiveness of spontaneous recovery with MLMT by the Wilcoxon nonparametric statistical analysis demonstrated no significant difference between them (P=0.766 and P=0.195 for the frequency and severity subscales, respectively).

Auditory-perceptual voice evaluation

In Table 4, the descriptive data of scores for overall severity of dysphonia and strain in pre-spontaneous recovery, post-spontaneous recovery/pre-treatment, and post-treatment assessments are provided. Based on the results of the ATSHA, our patients had moderate dysphonia (55.41±19.47) at the initial assessment. The mean scores of both overall severities of dysphonia and strain decreased after the period of without treatment and MLMT. According to the Wilcoxon nonparametric statistical test, the effect of spontaneous recovery was significant only for the strain; however, the effect of MLMT was significant for both overall severity of dysphonia and strain (P<0.05). Also, the Wilcoxon nonparametric statistical analysis showed no significant difference between the effectiveness of spontaneous recovery and MLMT (P=0.120 and P=0.195 for the overall severity of dysphonia and strain, respectively).

4. Discussion

The current study aimed to evaluate the effectiveness of MLMT compared to spontaneous recovery over a multi-session period in patients with primary MTD based on the assessment of supraglottic activity, VTD, and auditory-perceptual aspects of the voice. The positive effect of MLMT was evident in reducing the combining pattern of supraglottic activity (A-P and M-L), increas-

Table 4. The results of auditory-perceptual voice evaluation before and after spontaneous recovery and MLMT in patients with MTD (N=12)

Auditory-perceptual voice evaluation Score	Assessments (Mean±SD)			Effectiveness (P-Value)		Power
	Pre-SR	Post-SR/Pre T	Post T	SR (Pre SR & Post SR/ Pre T)	MLMT (Post SR/ Pre & Post T)	
Overall severity of dysphonia	55.41±19.47	50.41±18.52	35.41±10.75	0.103	0.007*	0.32
Strain	55.83±20.20	45.41±22.60	30.83±13.11	0.012*	0.004*	0.32

JMR

MTD: Muscle Tension Dysphonia; MLMT: the Mathieson Laryngeal Manual Therapy; MTD: Muscle Tension Dysphonia; SR: Spontaneous Recovery; T: Treatment.

*The Wilcoxon nonparametric statistical test; P≤0.05.

ing no supraglottic activity, and also increasing in M-L supraglottic activity, while these patterns had no change after spontaneous recovery. Although the frequency and severity of VTD sensations decreased after the spontaneous recovery and MLMT, the effect of spontaneous recovery and MLMT was not remarkable on the results of VTD. A notable effect was obtained for both overall severities of dysphonia and strain after MLMT. However, the effect of spontaneous recovery was remarkable only for the strain perceived in the voice. Besides, comparing the effectiveness of spontaneous recovery and MLMT demonstrated no notable difference based on the outcome measures of VTD and perceptual voice evaluation.

Supraglottic activity patterns, including A-P and M-L compressions, are two crucial video stroboscopic findings that are probably related to laryngeal muscle tension patterns in MTD [18]. We expected to observe a remarkable decrease in the frequency of supraglottic activity patterns after MLMT. We found that the spontaneous recovery period did not cause a positive change in reducing supraglottic activity in most patients. Lack of effect of spontaneous recovery on supraglottic activity after a short period without direct massage is expected. But more than half of the patients showed positive changes in supraglottic activity after treatment.

Interestingly, positive changes were obtained both in the frequency and type of supraglottic activity. To be more exact, we found that the supraglottic activity patterns observed at the initial evaluation and before MLMT were eliminated after receiving MLMT in more than one-third of the patients. Half of the patients who had both supraglottic patterns of activity in the initial assessment decreased to 20% after receiving MLMT. Also, the number of patients who showed an M-L pattern increased to one-third of the whole after treatment. The present study showed that MLMT has a positive effect on reducing laryngeal tension by lowering the interfering factor of the supraglottic activities and also improving types of these patterns.

As far as we know, there is no study on the effect of laryngeal manual therapy on supraglottic activity. There is only one study by Khorramshahi et al. in which the responsiveness of some objective and subjective voice assessments was studied after the combination of laryngeal manual therapy proposed by Aronson and voice therapy [22]. The authors investigated the responsiveness of videostroboscopy findings, such as the shape and size of the lesion, supraglottic structures, and mucosal waves in reaction to treatment. Although Khorramshahi et al. found remarkable improvement on videostroboscopy findings after voice therapy, there was a low correlation between the videostroboscopy and the other target scales, which had shown internal responsiveness to treatment [22]. So, the present study is the first to evaluate the effect of MLMT on supraglottic activity in patients with primary MTD. Overall, more than half of the patients showed positive changes in the frequency of supraglottic activity at post-treatment assessment, indicating a positive effect of MLMT, which can be considered as a sign of elimination of laryngeal muscle tension after 5 sessions of treatment. Observation of supraglottic patterns of activity after 5 sessions of MLMT proves that this treatment course was insufficient to remove these activities completely, and may be additional treatment sessions are needed.

VTD is a self-assessment scale that extracts the frequency and severity of 8 frequent discomfort sensations experienced by MTD patients in the vocal tract [4, 21]. This scale has been used to investigate the effectiveness of treatment in some studies in patients with MTD [4, 17]. The present study showed no remarkable effect of spontaneous recovery on the frequency and severity of discomfort sensations in the vocal tract; this finding was not surprising. Also, a comparison of the results of the VTDp scale before and after 5 sessions of treatment showed that the effect of MLMT on the frequency and severity of discomfort sensations experienced by the patients was not notable. The comparative results of spontaneous recovery and MLMT demonstrated no considerable difference between them. All findings related to VTD showed that 5 sessions of MLMT could not provide a remarkable improvement on the frequency and severity of discomfort sensations experienced in the vocal tract by patients with primary MTD.

It should be noted that the score of power (0.32) showed that if this study were done on larger sample size, all the differences in the results of the VTD scale would be significant. The effect of MLMT on the results of VTD was studied in primary MTD after one treatment session [4]. The authors found the frequency and severity of some symptoms such as tickling, "soreness, tightnss, and dryness" decreased significantly after treatment [4]. We did not extract the results of the VTD scale based on the individual sensations, so the comparison with the findings of the study by Mathieson et al. is not possible. In a study on MTD patients, Mansouri et al. observed significant improvement in both frequency and severity subscales of VTD after MLMT, which was combined with voice therapy and electrical stimulation [17].

The difference in the results can be attributed to the difference in treatment techniques provided by these two

studies. In the study of Mansouri et al., the MLMT was used along with voice therapy and voice hygiene in one group, and the second group received these techniques associated with electrical stimulation [17]. However, in the present study, the patients received only MLMT. Another probable factor can be related to the number of treatment sessions, which was 10 sessions in the Mansouri et al. study, but our patients received only 5 treatment sessions. Further studies with larger sample size or longer treatment course are needed to investigate the effect of MLMT on the results of VTD in primary MTD.

In the current study, the Persian CAPE-V scale (called ATSHA) [20] was applied to examine the effect of MLMT in primary MTD. Auditory-perceptual voice evaluation showed a remarkable decrease in both overall severities of dysphonia and strain perceived by the raters after MLMT, while only the amount of strain decreased significantly after the period that the patients received no treatment. Anyway, no remarkable difference was observed between the effectiveness of spontaneous recovery and MLMT on the results of perceptual voice evaluation in this study.

There is only one study in which the effect of MLMT was investigated on perceptual voice assessment in functional dysphonia [9]. Riemann et al. used another perceptual scale in which the /a/ vowel prolongation and spontaneous speech were examined [9]. After receiving one session of MLMT, overall voice quality, loudness, breathiness, tension, and instability in the production of vowels and the components of intensification and speech production in speech showed significant improvement. These findings indicated that MLMT could be considered as a useful treatment technique to improve the quality of the voice as a whole by decreasing tension in the target anatomical structures [9] that were consistent with the present study. The effect of MLMT associated with other voice therapy techniques and electrical stimulation after 10 sessions also proves that a combination of these techniques can significantly improve the overall severity of dysphonia, roughness, and breathiness in MTD [17].

Regarding study design, it cannot be assumed that improvement of perceptual voice parameters is only due to MLMT [17], while we applied only the MLMT technique during 5 treatment sessions. So, there are many differences in the treatment techniques and treatment doses that make the comparison between the two studies difficult. In the present study, a significant improvement in the strain after no treatment period may be due to decreased psychological tension and stress that the patients experienced after receiving enough information about their voice problems and were sure that they would receive treatment in the future.

In summary, this study suggests that the MLMT is a useful technique for voice rehabilitation in patients with primary MTD in a therapeutic course. On the other hand, releasing muscle tension and resistance in the submental area and SCMs after 5 sessions by MLMT can provide remarkable improvement in primary MTD based on the assessments undertaken by a clinician. To be more exact, the MLMT resulted in a positive change to decrease supraglottic activities based on the laryngoscopic findings. Also, the overall severity of dysphonia and strain significantly reduced after 5 sessions of MLMT. However, the patients reported no significant positive changes in the vocal tract. Statistical analysis indicated that remarkable improvement could be obtained with larger sample size. Also, perhaps 5 treatment sessions of MLMT were not enough to decrease discomfort sensations experienced in the vocal tract by the patients. These findings demonstrated that additional treatment sessions by MLMT technique in a larger sample size might need for gaining notable improvement based on the patients' sensations.

Study recommendations

Some caveats are worth considering. First, a small sample can be regarded as a limitation. It is recommended to design future studies with a larger sample size. Second, further studies with more than 5 treatment sessions are suggested. Third, assessment and treatment were administered by a voice clinician who was educated in MLMT, and the results are confined to the clinician's level of experience, confidence, and expectations. Regardless of these factors, the outcome of treatment was satisfactory because of positive changes. However, more research is needed to measure the efficacy and adequacy of treatment. Also, it is recommended to study the effect of MLMT after a treatment course based on the other outcome measures related to MTD. Given that this article was a clinical trial, there was no real control group and no random allocation because of ethical and technical issues. So further studies are required to resolve these limitations.

5. Conclusions

The results of the current study showed that a therapeutic course of MLMT could lead to positive changes in the treatment of different aspects of voice disorders due to a decrease in paralaryngeal muscle tension in primary MTD. These findings provide an essential basis for

clinical practice by using MLMT in the management of primary MTD.

Ethical Considerations

Compliance with ethical guidelines

Ethical approval was granted by the Institutional Review Board, School of Rehabilitation, and the Ethics Committee of Tehran University of Medical Sciences, Tehran, Iran. The Ethics Committee Code was 9511360005. Before initiation of the study, written informed consent was obtained from all patients.

Funding

The authors received no specific funding for this study.

Authors' contributions

Conceptualization, writing the article, and interpreting the results: Mohammad Fallah; Methodology, Writing – original draft, and Writing – review & editing: Seyyedeh Maryam Khoddami and Amin Rezaee Rad; Data collection and Data analysis: Shohreh Jalaie; Diagnosis of MTD: Keyvan Aghazadeh; Supervision: Amin Rezaee Rad.

Conflict of interest

The authors declared no conflicts of interest.

Acknowledgements

We are thankful to all participants for their cooperation. This paper is a part of a MSc. thesis in Speech Therapy at Tehran University of Medical Sciences (No. 9511360005). We extend our special thanks to Professor Lesley Mathieson and Claire Wells for their kindly help and support in the training of MLMT.

References

[1] Khoddami SM, Ansari NN, Izadi F, Talebian Moghadam S. The assessment methods of laryngeal muscles activity in muscle tension Dysphonia: A review. The Scienthfhc World Journal. 2013; 2013:507379. [DOI: 10.1155/2013/507397]

[2] Boon DR, Mcfarlane SC, Von Berg SL. The voice and voice thrapy. 7th ed. Boston, MA: Pearson/Allyn & Bacon; 2005. https://www.worldcat.org/title/voice-and-voice-therapy/oclc/607382196

[3] Colton RH, Casper JK, Leonard R. Understanding voice problems: A phisiyological perspective for diagnosis and treatment. 3th ed. Baltimore, MD: Lippincott Williams and wilkins; 2006. https://books.google.com/books/about/Understanding_Voice_Problems.html?id=1RwVcsw0KLAC

[4] Mathieson L, Hirani SP, Epstein R, Baken RJ, Wood G, Rubin JS. Laryngeal manual therapy: A preliminary study to examine its treatment effects in the management of muscle tension dysphonia. Journal of Voice. 2009; 23(3):353-66. [DOI:10.1016/j.jvoice.2007.10.002] [PMID]

[5] Mathieson L, Greene MCL, Baken RJ. Greene and Mathieson's the voice and its disorders. 6th ed. United States: Wiley; 2001. https://books.google.com/books/about/Greene_and_Mathieson_s_the_Voice_and_Its.html?id=1KZsAAAAMAAJ

[6] Amiri-Shoki Y, Jenabi MS, Ghelichi L, Khodaverdipor M. [Voice hygiene for teachers (Persian)]. Andishmand. 2007; 1. https://www.migna.ir/news/28731

[7] Roy N, Ford CN, Bless DM. Muscle Tension dysphonia and spasmodic dysphonia: The role of manual laryngeal tension reduction in diagnosis and management. The Annals of Otology, Rhinology, and Laryngology. 1996; 105(11):851-6. [DOI:10.1177/000348949610501102] [PMID]

[8] Stemple JC, Roy N, Klaben B. Clinical voice pathology: Theory and management. 5th ed. San diego: Plural Publishing, Inc; 2014. https://www.amazon.com/Clinical-Voice-Pathology-Theory-Management/dp/1597565563

[9] Riemann AP, Siqueira LTD, Rondon AV, Brasolotto AG, Silverio KCA. Immediate effect of laryngeal manual therapy in dysphonic individuals. CoDAS. 2016; 28(1):59-65. [DOI:10.1590/2317-1782/20162015089] [PMID]

[10] Salehi A, Barkmeier-Kraemer J. laryngeal manual therapy as a treatment for impaired production of tahrir vibrato in traditional Iranian singers. Folia Phoniatrica et Logopaedica. 2014; 66(6):265-72. [DOI:10.1159/000369063] [PMID]

[11] Siqueira LTD, Silverio KCA, Brasolloto AG, de Jesus Guirro RR, Carneiro CG, Behlau M. [Effects of laryngeal manual therapy (LMT) and transcutaneous electrical nerve stimulation (TENS) in vocal folds diadochokinesis of dysphonic women: A randomized clinical trial (Portuguese)]. CoDAS. 2017; 29(3):e20160191. [DOI:10.1590/2317-1782/20172016191]

[12] Roy N, Leeper HA. Effects of the manual laryngeal musculoskeletal tension reduction technique as a treatment for functional voice disorders: Perceptual and acoustic measures. Journal of Voice. 1993; 7(3):242-9. [DOI:10.1016/S0892-1997(05)80333-9]

[13] Roy N, Bless DM, Heisy D, Ford CN. Manual circumlaryngeal therapy for functional dysphonia: An evalution of short and longterm treatment outcome. Journal of Voice. 1997; 11(3):321-31. [DOI:10.1016/S0892-1997(97)80011-2]

[14] Ternstorm S, Andersson M, Bergman U. An effect of body massage on voice loudness and phonation frequency in reading. Logopedics, Phoniatrics, Vocology. 2000; 25(4):146-50. [DOI:10.1080/140154300750067520] [PMID]

[15] Van Lierde KM, De Ley S, Clement G, De Bodt M, Van Cauwanberge P. Outcome of manual laryngeal therapy in four dutch adult with persistent moderate to severe vocal hyperfunction: A pilot study. Journal of Voice. 2004; 18(4):467-74. [DOI:10.1016/j.jvoice.2004.02.003] [PMID]

[16] Rubin JS, Liberman J, Harris TM. Laryngeal manipulation. Otolaryngologic Clinics of North America. 2000; 33(5):1017-34. [DOI:10.1016/S0030-6665(05)70261-9]

[17] Mansuri B, Torabinejad F, Jamshidi AA, Dabirmoghaddam P, Vasaghi-gharamaleki B, Ghelichi L. Transcutaneous electrical nerve stimulation combined with voice therapy in women with muscle tension dysphonia. Journal of Vocie. 2020; 34(3):490.e11-e21. [DOI:10.1016/j.jvoice.2018.11.003] [PMID]

[18] Poburka BJ, Patel RR, Bless DM. Voice-Vibratory Assessment With Laryngeal Imaging (VALI) form: Reliability of rating stroboscopy and high-speed videoendoscopy. Journal of Voice. 2017; 31(4):513.e1-14. [DOI:10.1016/j.jvoice.2016.12.003] [PMID]

[19] Torabi H, Khoddami SM, Ansari NN, Dabirmoghaddam P. The vocal tract discomfort scale: Validity and reliability of the Persian version in the assessment of patients with muscle tension dysphonia. Journal of Voice. 2016; 30(6):711-6. [DOI:10.1016/j.jvoice.2015.08.002] [PMID]

[20] SalaryMajd N, Khoddami SM, Drinnan M, Kamali M, Amiri-Shavaki Y, Fallahian N. Validity and rater reliability of Persian version of the consensus auditory perceptual evaluation of voice. Bimonthly Audiology. 2014; 23(3):65-74. https://aud.tums.ac.ir/browse.php?a_id=5029&sid=1&slc_lang=en

[21] Mathieson L. Vocal tract discomfort in hyperfunctional dysphonia. Journal of Voice. 1993; 2:40-8. https://ci.nii.ac.jp/naid/10026964586/

[22] Khoramshahi H, Khatoonabadi AR, Khoddami SM, Dabirmoghaddam P, Ansari NN. 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. Journal of Voice. 2018; 32(6):770.e21-30. [DOI:10.1016/j.jvoice.2017.08.008] [PMID]