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How Persistent Should We Be in Voice Therapy in Mutational Falsetto Patients?

Elife Barmak[1], Esma Altan[2], Emel Çadallı Tatar[2], Serap Er[3], Mehmet Hakan Korkmaz[4]

[1]Department of Speech and Language Therapy, Ankara Yıldırım Beyazıt University, Ankara, Turkey
[2]Department of Otolaryngology, University of Health Sciences, Dışkapı Yıldırım Beyazıt Training and Research Hospital, Ankara, Turkey
[3]Division of Otolaryngology, Head and Neck Surgery, Department of Hearing-Speech-Balance, University of Health Sciences, Dışkapı Yıldırım Beyazıt Research and Training Hospital, Ankara, Turkey
[4]Department of Otolaryngology, Head and Neck Surgery, Ankara Yıldırım Beyazıt University Faculty of Medicine, Ankara, Turkey

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ABSTRACT

Objective: The purpose of this study is to determine the efficacy of voice therapy in the treatment of patients with mutational falsetto and which parameters should be used as a more specific criterion for assessing the effectiveness of this treatment.

Methods: The objective and subjective voice evaluation data from the files of patients diagnosed with mutational falsetto between 2014 and 2019 were retrospectively evaluated in the study. Fundamental frequency, jitter (%), shimmer (%), noise-to-harmonics ratio, voice turbulence index, soft phonation index, voice handicap index-10, and Grade, Roughness, Breathiness, Asthenia, and Strain scale are all used in the evaluation of voice. The acoustic and perceptual analysis findings of the patients before and after therapy were compared.

Results: A total of 31 participants were enrolled in the study. After therapy, the Grade, Roughness, Breathiness, Asthenia, and Strain scale and voice handicap index-10 scores were statistically substantially lower than before therapy ($P < .05$). The mean fundamental frequency of the patients before therapy was 230.65 ± 69.16 Hz, whereas after therapy, it was 126.32 ± 16.86 Hz. After therapy, there was a statistically significant difference in fundamental frequency, jitter (%), and soft phonation index values when compared to before therapy ($P < .05$). All patients received an average of 4 sessions of voice therapy.

Conclusions: Voice therapy has been identified as a significant treatment approach among the treatment choices for individuals with mutational falsetto. Although fundamental frequency is the most prominent parameter among the acoustic analysis results for determining the efficacy of this therapy, the jitter and soft phonation index parameters were also found to be significant.

Keywords: Acoustic voice analysis, mutational falsetto, voice, voice disorders, voice therapy

Introduction

Mutational falsetto (MF) is a functional voice disorder in which an adult male has a voice that sounds like a female voice but has a higher pitch than usual.[1,2] Mutational falsetto is often seen in men after puberty when the laryngeal mechanism undergoes major changes in size and function because of hormonal changes.[3] High-pitched, weak, thin, hoarse, breathless, pitch breakdowns, difficulties making voices, and obvious laryngeal muscle tension are the most prevalent symptoms of the MF voice.[4,5,6]

Voice therapy (VT), surgical intervention, and botox injection application are some of the treatment options for MF.[3,7,8] In MF, VT appears to be the primary treatment option. The goal of VT is to assist the patient in locating and producing low pitch. After completing therapy, most of these young men achieve normal pitch and voice quality.[3,5] Various VT methods, such as chewing, relaxation exercises, manual circumlaryngeal techniques, coughing, breathing training, auditory and visual feedback, and DoctorVox, can be employed in the therapy of patients with MF as modified.[3,9-13] Manual circumlaryngeal techniques (manual laryngeal reposting, circumlaryngeal massage, and myofascial release) are used for the manipulation, mobilization, and repositioning of the larynx. These techniques are used to treat problems with excessive or irregular muscle activity in the paralaryngeal region.[9,13] For example, in patients with MF, laryngeal reposturing or repositioning techniques

Corresponding author: Elife Barmak, e-mail: elifebarmak@gmail.com
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provide a lowering of the high-position larynx and find the F0. The addition of MF to this technique through auditory, kinesthetic, and vibrotactile feedback improves laryngeal positioning (posturing) and muscle balance.[9] Yawn-sign techniques are used both to lower the larynx and to provide relaxation.[14] The patient's vocal folds are seen with a rigid or flexible endoscope for visual feedback, and the link between voice disorders is described. Moreover, using vegetative sounds like coughing, laughing, and light throat clearing, the patient's efforts to make voice at various pitch and intensity levels are encouraged, and the patient's adaptation to the new low-frequency voice is supplied.[13] In the DoctorVox technique, high back pressure levels are effective for finding low frequency in MF patients.[10] Most patients with MF have an excellent therapy result after 1 or 2 VT sessions. Furthermore, having a voice like that of their peers makes them happy. After the successful elimination of the high-pitched voice, the voice therapist should also schedule a follow-up of 3 or 4 weeks for all patients with MF to see how they are doing, both vocally and emotionally.[3] In the literature, it has been reported that patients are admitted to 1 to 10 therapy sessions.[9,10,15] In very rare cases where patients fail to receive VT or psychotherapy, other intervention options may be considered.[3,7]

In patients who do not react to VT and psychotherapy, surgical procedures such as shortening or relaxing (surgical techniques such as thyroplasty III, relaxation thyroplasty, or window relaxation thyroplasty) are used to reduce vocal fold tension.[7,16,17] Through the use of these surgical procedures, the voice pitch is lowered.[7] Since these surgeries affect the entire laryngeal roof, narrowing the pitch intervals, and are non-reversible procedures, patients who use their voice professionally should be informed before the operation.[7,17]

The purpose of our study was to evaluate the efficiency of VT in the treatment of MF patients and determine which parameters should be used as a more specific criterion in determining the success of this treatment. Our research questions are as follows: (i) Is VT efficient in the treatment of MF? (ii) Which outcome measures are appropriate for assessing the effectiveness of VT for MF?

Methods

The study was approved by the Clinical Research Ethics Committee of Health Sciences University Dışkapı Yıldırım Beyazıt Training and Research Hospital (22.07.2019-68/04) and informed consent was obtained from all participants. The files of the patients who applied to the voice polyclinic between 2014 and 2019 due to voice disorder and were diagnosed with an MF because of the evaluation and accepted to receive VT as a treatment approach were retrospectively analyzed. Demographic information, the number of therapy sessions, and objective and subjective evaluation findings of the voice were examined from the files of the patients. Criteria for inclusion of patients in the study were as follows: (i) those diagnosed with MF, (ii) absence of any organic disorder that will cause voice impairment, (iii) persistence of voice disorder for at least 6 months, (iv) not having neck and/or laryngeal surgery, and (v) those who accepted to take VT as a treatment approach.

Patients not meeting these criteria were excluded from the study. Thirty-one patients meeting the study criteria were included in the study.

Main Points

- Voice therapy should be the first choice in the treatment of patients diagnosed with mutational falsetto.
- Demonstrated the effectiveness of voice therapy by ensuring the continuity of therapy sessions for patients diagnosed with mutational falsetto.
- While fundamental frequency is the most prominent parameter in demonstrating the effectiveness of therapy, jitter and soft phonation index parameters were also found to be important.

Evaluations

Demographic Information: The information includes the patient's age, gender, profession, therapy session, and complaints about her/his voice.

Videolaryngostroboscopic Examination: An expert laryngologist with a rigid endoscope examined the stroboscopic evaluation. All the patients were told to make a sustained /i/ vowel with their normal pitch and intensity.[18] The diagnosis of MF was made and videotaped.

Instrumental Evaluation of Voice: The Computerized Speech Lab (CSL)-Kay Elementrics Group CSL Model 4500 device was used to make an objective voice assessment. The recordings were made in a quiet room with a Shure brand microphone (Shure SM48-LC model). The microphone is around 10 cm from the mouth and positioned at a 45° angle. For acoustic voice analysis, the Multi-Dimensional Voice Program (MDVP) was used. The patient was requested to make a long /a/ phonation in a comfortable tone for MDVP measurement. The first and last parts of the recordings were cut and the 3 seconds in the middle of the phonation interval were analyzed.[19] Among the measurement parameters, F0, jitter (%), shimmer (%), noise-to-harmonics ratio (NHR), voice turbulence index, and soft phonation index (SPI) were recorded numerically before and after therapy.

Subjective Evaluation of Voice: Subjective assessment was made with Grade, Roughness, Breathiness, Asthenia, and Strain (GRBAS) scale and voice handicap index (VHI). In the GRBAS Scale,[20] the same text (Diet Passage) was read to all patients at a comfortable loudness level to evaluate GRBAS. Each parameter is scored on a 4-point scale. Grade, Roughness, Breathiness, Asthenia, and Strain scale was evaluated by the same speech and language therapist who has more than 7 years of experience in the field of voice disorders. The VHI questionnaire consists of 10 questions. With this questionnaire, how much the patient sees his/her voice as adequate in emotional, physical, and social terms is measured subjectively.[21] The patient was asked to fill in every question in the questionnaire as 0 = never 1 = rarely 2 = occasionally 3 = often, and 4 = always.

In our study, objective and subjective voice assessment results were evaluated before and after therapy, and the relationship between therapy sessions was examined.

Statistical Analysis

Statistical evaluation was made using IBM's Statistical Package for the Social Sciences version 20.0 (IBM Corp.; Armonk, NY, USA) package program. Numerical variables were given as mean ± standard deviation and percentages (frequency). Wilcoxon test and paired sample *t*-test were used in 2 dependent samples to test whether there was any difference between the mean values before and after the VT within the group analysis. The relationship between the therapy session and post-therapy analysis results was evaluated with Spearman rho. The significance level was accepted as .05.

Results

Data from 31 patients who met the study criteria out of 50 patients diagnosed with MF and included in the therapy program in our clinic were retrospectively analyzed.

The group diagnosed with MF consisted of 31 patients. The mean age of the patients was 17.52 ± 7.033 (minimum: 13–maximum: 52), and they were all male. The average therapy session of the patients was 3.97 ± 2.04 (minimum: 1–maximum: 8), the rate of those receiving 1-4 sessions of VT was 71% (22 patients), and 29% (9 patients) who received more than 4 sessions (Table 1).

Table 1. Characteristics of Patients with MF

Characteristics	MF Group (n = 31)
Age, years	17.52 ± 7.033 (13-52)
Sex	
Male	31 (100%)
Therapy sessions	3.97 ± 2.04 (1-8)
1-4 therapy sessions	71% (n = 22)
More than 4 therapy sessions	29% (n = 9)

MF, mutational falsetto; SD, standard deviation.
Values are presented as mean ± SD (range) or frequency (%).

The frequency distribution of all patients related to the therapy session is shown in Figure 1.

The findings of GRBAS and voice handicap index-10 (VHI-10) were examined in subjective evaluation. A statistically significant difference was found in terms of GRBAS, and VHI-10 scores performed after VT in all patients compared to pre-therapy ($P < .05$) (Table 2).

Acoustic analysis of the voice was performed in the objective evaluation of the patients. A statistically significant difference was found in the F0, jitter (%), and SPI values of the patients after the therapy compared to the pre-therapy values ($P < 0.05$). It is shown in Table 3.

No significant correlation was found between the therapy session and the GRBAS, VHI-10, and acoustic analysis parameters ($P > .05$) (Table 4).

Discussion

In this study, the effectiveness of VT in the treatment of patients with MF and which parameters should be used as a

Table 2. Comparison of GRBAS and VHI-10 findings Before and After VT

		n	Mean ± SD	Z	*P*
GRBAS	Pre-therapy	31	4.9355 ± 1.91373	−4.881[b]	**.000***
	Post-therapy	31	0.1290 ± 0.71842		
VHI-10	Pre-therapy	31	25.5161 ± 8.02443	−4.862[b]	**.000***
	Post-therapy	31	1.5161 ± 3.21321		

GRBAS, grade, roughness, breathiness, asthenia, and strain; SD, standard deviation; VHI-10, voice handicap index-10; VT, voice therapy. Wilcoxon signed-rank test was used. [b]Based on positive ranks, *$P < .05$.

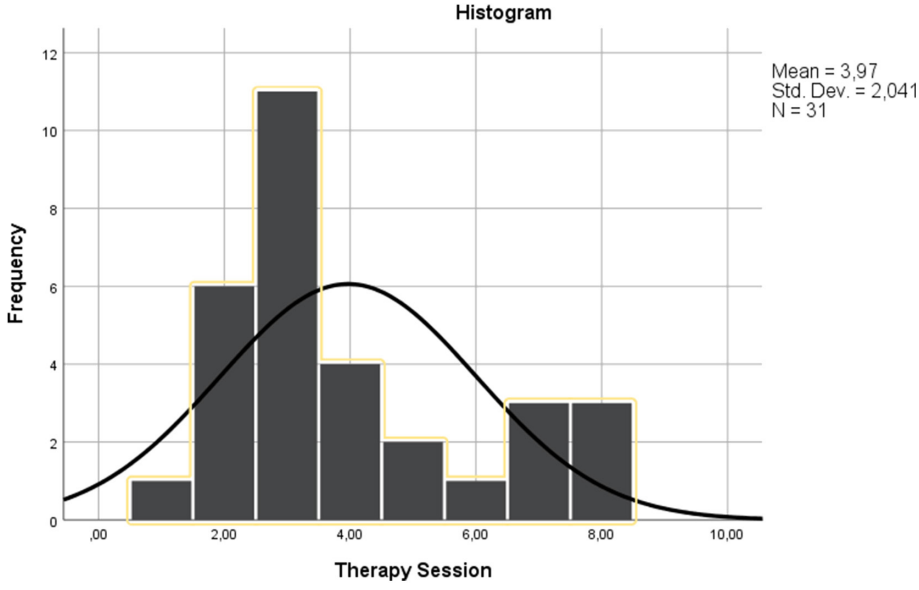

Figure 1. Frequency distribution of all patients related to the therapy session.

Table 3. Comparison of Acoustic Analysis Results Before and After VT

		n	Mean ± SD	t	P
F0	Pre-therapy	31	230.650 ± 69.167	8.739	**.000***
	Post-therapy		126.332 ± 16.863		
Jitter (%)	Pre-therapy	31	1.920 ± 1.524	3.683	**.001***
	Post-therapy		0.817 ± 0.570		
Shimmer (%)	Pre-therapy	31	5.431 ± 2.633	1.843	.075
	Post-therapy		4.156 ± 2.981		
NHR	Pre-therapy	31	0.169 ± 0.081	1.190	.243
	Post-therapy		0.149 ± 0.045		
VTI	Pre-therapy	31	0.052 ± 0.021	–1.014	0.319
	Post-therapy		0.056 ± 0.015		
SPI	Pre-therapy	31	17.732 ± 9.301	4.513	**0.000***
	Post-therapy		10.238 ± 5.109		

F0, fundamental frequency; NHR, noise-to-harmonics ratio; SD, standard deviation; SPI, soft phonation index; VT, voice therapy; VTI, voice turbulence index. Paired sample t testi was used. *$P < .05$.

more specific criterion to evaluate the effectiveness of this treatment were examined.

The MF voice is strikingly high-pitched and can create doubts about the gender and maturity of the speaker.[6] Although the exact incidence of MF in the community is unknown, it is a common condition among children aged 11-15.[22] In a study conducted in Turkey,[23] the incidence of MF was reported as 1.8%, while Hammarberg[24] reported this incidence rate as 2%-3%. Behavioral treatment for MF is short, easy, and highly effective. Untreated MF patients may develop a chronic communication disorder, which can lead to psychological, social, and occupational problems that can last until adulthood.[10,25]

Voice therapy is the first choice of treatment for MF patients.[8,15] Different VT approaches are used in therapy.[9,10,14,26] By providing appropriate auditory feedback with VT, abnormal vocal habits are corrected. The duration of therapy has been reported to last from 1 month to 1 year.[8,15] In our study, different therapy approaches (information, breathing training, yawn-sign, chewing, manual circumlaryngeal techniques, coughing, relaxation, etc.) were used. The average VT session was 4, and some patients received more than 4 sessions of VT. The most important factors for these patients to receive therapy for more than 4 sessions were personality problems (introversion, social communication disorder), mild mental retardation with the language-speech disorder, and their unwillingness to accept their new voice. The VT was continued with the cooperation of a psychologist during the therapy process of our patient with personality problems and with the cooperation of a special education specialist and the family during the therapy process of our patient with language-speech disorder due to mental retardation. Patients diagnosed with MF should find F0 in their VT sessions, and this new vocal skill should be used in daily life.[10] In our study, although the F0 was found in the first and second sessions of the therapy, it was observed that it was difficult to use the F0 (low-frequency voice) found in the first session in daily life due to the different cases. However, by ensuring the continuity of our patient's participation in therapy sessions, they were enabled to use their low-frequency voices in their daily lives. According to the studies conducted, it was reported that 2,[26] 4,[2,5] and 10 sessions[10] were given for voice therapies for MF patients. Our findings seem to be compatible with the literature. For this reason, the individual and psychosocial status of these patients should be taken into account when planning VT, and the number of therapy sessions should be determined according to the patient. The fact that there are different cases in our study also shows us that the duration of therapy will be longer. It was observed that all our patients who were included in the therapy program expressed themselves more easily, and their communication skills increased more after the therapy. This study shows how important therapy is for gaining new vocal skills in patients with MF.

The F0 range in males has been reported as 100-150 Hz.[27] In the research by Dağlı et al[22] with MF patients, the mean F0 was reduced by 141 ± 13.6 Hz after therapy, but in another study, the mean F0 decreased from 268.6 ± 16.9 to 120.4 ± 32.7 Hz after therapy.[15] In our study, the mean F0 frequency of all patients was observed to return to the normal frequency range after therapy. Even though the fundamental issue with MF is the F0,[10] quality characteristics are also impacted.[8] Parameters such as frequency [jitter, jitta, relative average perturbation

Table 4. The Relationship Between the Therapy Session and Subjective and Acoustic Analysis

		GRBAS	VHI-10	F0	Jitter (%)	Shimmer (%)	NHR	VTI	SPI
Therapysession	Correlation coefficient	0.231	0.068	0.087	0.045	–0.318	–0.265	–0.330	0.167
	P	.211	.715	.643	.812	.081	.150	.070	0.370
	n	31							

F0, fundamental frequency; GRBAS, grade, roughness, breathiness, asthenia, and strain; NHR, noise-to-harmonics ratio; SD, standard deviation; SPI, soft phonation index; VHI-10, voice handicap index-10; VTI, voice turbulence index. Spearman's rho test was used. *$P < .05$.

(RAP), pitch perturbation quotient (PPQ), smoothed pitch perturbation quotient (sPPQ), and fundamental frequency variation (vFo) and amplitude (shimmer (%), shimmer (dB)] perturbation measures and NHR give crucial information for quality characteristics.[28,29] After therapy, MF patients showed improvements in jitter, shimmer, NHR, and CQ, according to the studies.[10,22] On the other hand, some studies have shown no change in NHR after therapy.[8] Patients' jitter (%) and SPI values were shown to be better after therapy in our study. Frequency perturbation parameters reflect periodicity, pitch control, and frequency variation. These parameters increase in diplophony, roughness, and pitch breaks.[28,30] Our study shows that the improvement in the F0 positively affects the jitter. In addition, the significant decrease in SPI value after therapy in our study also shows that vocal abduction is good and vocal tension is reduced.

It has been reported that the vocal cord contact surface of the patients increased, and the breathing pattern and voice quality improved after VT.[10] The achievement of a voice range suitable for the age and gender of all patients after therapy, as well as improvements in the jitter and SPI parameters, resulted in a significant decrease in the GRBAS and VHI-10 results of all patients in our study. The improvement in the voices of all patients shows us that there is a significant improvement in their perception of voice. While Liang et al[2] reported significant findings in the VHI and F0 results of MF patients after 4 weeks of VT, Saltürk et al[26] reported that GRBAS, F0, and VHI findings were important after 1 and 2 sessions. Our patients' GRBAS and VHI-10 scores decreased significantly after the conclusion of their different therapy sessions. However, no link between therapy sessions and GRBAS, VHI-10, or acoustic analysis parameters was detected.

Our study had several limitations. One is that it is a retrospective study, and the other is that the patients did not come to their controls at the third and sixth months after they started using the adult voice after therapy.

Conclusion

The effectiveness of VT has been demonstrated by providing continuity in therapy sessions for the finding and generalization of new vocal behaviors in patients diagnosed with MF. Although F0 is the most prominent parameter among the acoustic analysis results for determining the efficacy of this therapy, the jitter and SPI parameters were also found to be significant.

Ethics Committee Approval: Ethical committee approval was received from the Clinical Research Ethics Committee of Health Sciences University Dışkapı Yıldırım Beyazıt Training and Research Hospital (Approval No: 68/04).

Informed Consent: Informed consent was obtained from all participant.

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