

Assessment of the Need for Voice Therapy after Type 3 Thyroplasty: Experience of 31 Patients

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ABSTRACT

Objective: The aim of the study is to determine the need for voice therapy after type 3 thyroplasty surgery by using the voice self-assessment method.

Methods: A total of 31 male patients who underwent type 3 thyroplasty and 31 male control subjects without voice or pitch complaints were included. Each group's Turkish Voice Handicap Index-10 and Turkish Self-evaluation of Voice Quality Survey were administered online.

Results: There are statistically significant differences between surgery and control groups in both total and subgroup scores of the Turkish Voice Handicap Index-10 Scale and the Turkish Self-evaluation of Voice Quality Survey.

Conclusion: Individuals who have undergone a voice-deepening procedure experience emotional, physical, and functional problems related to their voice. In these patients, voice therapy in support of surgery is necessary to prevent potential hypofunction, improve voice quality, and preserve vocal health.

Keywords: Laryngeal surgery, pitch perception, thyroplasty, voice disorders, voice training, voice quality

INTRODUCTION

Voice plays a role not only in conveying verbal language to the listener but also in conveying emotions and thoughts. Voice should correspond to a person's age and gender, as it significantly reflects personality, behavior, and mood, and is an important secondary sexual characteristic (1). The relationship between voice and gender involves pitch, intonation, resonance, timbre, articulation, breathiness, intensity, and non-verbal communication. Having a tone of voice perceived as unsuitable for one's gender or appearance can adversely affect social and professional life as well as one's quality of life (2). Lowering the pitch of the voice is the primary treatment goal for individuals who have resisted at least three months of voice therapy, those with puberphonia, sulcus vocalis, vocal fold atrophy, vocal fold scar, various constitutional voice disorders, trans males who desire a masculine voice but do not want hormone therapy or who have insufficient pitch drop despite androgen therapy, and men who, for personal reasons, want to lower their pitch without a pathological condition (3,4).

Type 3 thyroplasty is performed to lower voice pitch (5). It reduces the tension of the vocal folds, leading to a lower fundamental frequency and a deeper voice quality. The effectiveness of type 3 thyroplasty has been well demonstrated in the literature (4,6-10). To our knowledge, the need for postoperative voice therapy has not been studied. To determine treatment approaches for lowering voice pitch in individuals with high-pitched voices, Kizilay and Firat (11) used a voice assessment form and found that voice-related emotional problems were high before treatment, whereas physical scores were high after treatment, indicating that patients had difficulty using their new voices. The aim of this study is to investigate whether individuals require voice therapy after type 3 thyroplasty. For this purpose, the Turkish Voice Handicap Index-10 (TVHI-10) and the Turkish Self-evaluation of Voice Quality Survey (T-SVQS) (Appendix 1) will be used to investigate individuals' emotional, physical, and functional problems related to their voice in their daily lives after type 3 thyroplasty.

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METHODS

Study Design and Participants

The study was conducted between 2018 and 2023, and included 31 male native Turkish-speaking patients who sought medical attention for a complaint of a high-pitched voice and underwent surgical intervention. Their ages ranged from 20-53 years (mean age 33.39 ± 8.1 years). Postoperative duration was classified into three categories: 19 patients underwent voice-deepening surgery more than 12 months previously, 6 patients underwent voice-deepening surgery between 6 and 12 months previously, and the remaining 6 patients underwent voice-deepening surgery less than 6 months previously. The second author carried out all the surgeries. Among these patients, one had puberphonia, 14 had sulcus vocalis, and 16 received a diagnosis of constitutional high-pitched voice.

Surgical Procedure and Voice Assessment Instruments

All the subjects were examined by means of laryngostroboscopy, and a diagnosis of sulcus vocalis was made when there was a channel or stria that ran parallel to the free edge of the vocal folds, causing unilateral or bilateral glottal incompetence, with decreased or even absent glottal wave amplitude over the lesion. All patients in the surgical group underwent type 3 thyroplasty performed by the same experienced laryngologist to ensure standardization. The procedure was conducted under local anesthesia with sedation. After a horizontal cervical incision at the level of the thyroid cartilage, a small rectangular window was created in the thyroid lamina. The anterior portion of the thyroid cartilage was then approximated to shorten and relax the vocal folds, thereby lowering the pitch. No intraoperative or postoperative complications were observed. The control group consists of 31 individuals matched for age and gender. Control participants did not undergo laryngoscopy; however, all denied vocal symptoms or pitch-related complaints. The exclusion criteria for both the surgery and control groups include being a professional voice user, having extralaryngeal pathology, being female, having previously received voice therapy, and having systemic and/or pulmonary diseases. In this experimental study, voluntary participants were directed, via an online survey, to complete the TVHI-10 scale and the T-SVQS, which were prepared in accordance with the subject and purpose of the study.

Statistical Analysis

All data analyses were conducted using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). The normality of quantitative variables was assessed using the Shapiro-Wilk test. For non-normally distributed data ($p < 0.05$), non-parametric statistical tests were used. Descriptive statistics were reported as median \pm interquartile range [(IQR), Q1-Q3] for non-normally distributed data and as mean \pm standard deviation (SD) for normally distributed data. The IQR value is equal to the difference between Q3 and Q1. The Mann-Whitney U test was used for comparisons

between two independent groups, and the Kruskal-Wallis test was used for comparisons among more than two groups. For categorical variables, chi-square tests were performed. The internal consistency of the scales was evaluated using Cronbach's alpha coefficient. Construct validity was assessed with exploratory factor analysis (EFA) using Varimax rotation. The Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity were used to assess sampling adequacy and the suitability of the correlation matrix for factor analysis, respectively. A p-value of < 0.05 was considered statistically significant. The number of participants in each subgroup (n) was clearly stated in all comparison tables.

Participant Information Sheet and Informed Consent Form

This study, titled "Investigation of the Need for Voice Therapy Following Voice Deepening Surgery Using the Self-Assessment Method of Voice," aims to evaluate the self-perceptions of patients who underwent type 3 thyroplasty for voice-deepening and did not receive postoperative voice therapy. The study seeks to assess whether there is a need for voice therapy after surgery based on these self-assessments.

Voluntary participants will be asked to evaluate the quality of their voice and the impact of their voice on quality of life. Voice assessments are typically categorized as objective or subjective. Self-assessment, a form of subjective evaluation, is important because it helps identify the individual's perception of their condition and of the significance of the problem in their life. The purpose of self-assessment is to understand the extent of deviation in voice quality, the impact on professional and social life, and the possible emotional reactions related to voice disorders.

Self-assessment tools are also useful in determining the effectiveness of treatment by measuring how much the difficulties caused by a voice disorder have been alleviated. Among the available self-assessment tools, the most widely used is the VHI. The VHI-10, a shortened version, is a 10-item instrument with a 5-point Likert scale (0=never, 4=always). A higher total score or item score indicates a greater impact of the voice problem on the individual's quality of life.

Another important dimension in voice evaluation is how voice quality is perceived by both the individual and others in their environment. To address this, a 10-question SVQS, developed specifically for this study, will be used. Participants will assess their current voice pitch, quality, loudness, and strength by choosing among the options: "always," "never," or "sometimes."

While the VHI-10 will evaluate the impact of voice on quality of life, the SVQS will assess participants' perception of their voice.

The purpose of this study is to emphasize the need for voice therapy following voice-deepening surgery to stabilize the achieved fundamental frequency, improve voice quality and quality of life, prevent potential hypofunction, increase vocal loudness, and reduce air leakage and vocal fatigue. This study also aims to contribute to the limited literature on this topic.

Participants in the experimental group were adult Turkish-speaking male patients (n=31) who underwent type 3 thyroplasty for pitch lowering between 2018-2023. An age- and gender-matched control group (n=31) was also recruited.

Participants will receive an informed consent form, a personal information form, the VHI-10, and the SVQS via email, using the online platform Google Forms. It is estimated that completing the forms will take approximately 5-10 minutes.

There are no known risks or undesirable effects associated with participation in this retrospective, descriptive study. This study aims to investigate whether voice-deepening surgery through self-assessment of voice.

Your participation in this study is completely voluntary, and you have the right to refuse to participate. You may withdraw from the study at any time by notifying the researcher. The researcher also reserves the right to exclude you from the study if necessary. Refusing to participate in or withdrawing from the study will not affect your medical care or your relationship with your physician.

You will not incur any financial costs as part of this study, nor will you receive payment for your participation.

Any data collected from you will be used solely for the purposes of this study. Your identity and confidentiality will be protected throughout all stages of the research.

Participant Declaration

I have been informed about a scientific research study to be conducted by the responsible research team. I have received detailed information regarding the purpose, methods, and procedures of the study. I have been invited to participate as a volunteer.

I understand that any personal or medical information shared during this study will be treated with strict confidentiality and used solely for educational and scientific purposes, ensuring full respect for my privacy.

I am aware that I may withdraw from the study at any time without providing a reason. I also acknowledge that the research team may withdraw me from the study if medically necessary, and that this will not cause any harm to my health.

I will not be held financially responsible for any part of the study, and I understand that I will not receive payment for my participation. In the event of any health issues arising directly or indirectly from the study, I have been assured that all necessary medical interventions will be provided at no cost to me.

I understand that I may contact the research team at any time if I have questions or experience any health concerns during the study.

I confirm that I have not been pressured or coerced into participating, and that my refusal to participate will not affect my medical treatment or relationship with healthcare providers.

Having understood all the information provided and after allowing myself sufficient time to consider it, I voluntarily agree to participate in this study.

Ethics Approval

This study was reviewed and approved by the Non-Interventional Scientific Research Ethics Committee of İstanbul Atlas University (approval no: E-22686390-050.99-28121, date: 15.06.2023). The research titled "Investigating the Need for Voice Therapy After Voice Deepening Surgery Through the Method of Self-Assessment of Voice" was found to be ethically appropriate. All procedures were carried out in accordance with relevant guidelines and regulations. Informed consent was obtained from all individual participants included in the study.

RESULTS

The Shapiro-Wilk test indicated that the quantitative data were not normally distributed ($p < 0.05$); therefore, non-parametric statistical tests were applied for all analyses. The surgery group (n=31) and the control group (n=31) differed significantly in both total and subgroup scores on the TVHI-10 and the T-SVQS (Mann-Whitney U test, $p < 0.001$). A cut-off value of ≥ 11 points was considered indicative of a voice handicap, based on the Turkish validation study by Kiyak et al. (12). The mean \pm SD of the total TVHI-10 score was 14.26 ± 11.00 (median=14, range 0-36) in the surgery group and 1.94 ± 2.98 (median=1, range 0-12) in the control group. The difference between groups was statistically significant (Mann-Whitney U test, $p < 0.001$). According to the Turkish validation study, a cut-off value of ≥ 11 on the TVHI-10 indicates the presence of a clinically significant voice handicap. Based on this threshold, 17 of 31 patients (54.8%) in the surgery group exceeded the cut-off, whereas only 2 of 31 (6.5%) in the control group did so. This finding demonstrates that, despite having undergone type 3 thyroplasty, more than half of patients still reported some degree of voice handicap, highlighting the importance of subjective voice evaluation during postoperative follow-up. The median (IQR) total TVHI-10 score was higher in the surgery group than in the control group. Similarly, T-SVQS scores were significantly higher in the surgery group (Mann-Whitney U test, $p < 0.001$; Table 1). The distribution of responses to each item of the T-SVQS was analyzed using the chi-square test. Statistically significant differences were observed between the surgery and control groups for items 1,2,4,5,6,7,8,9, and 10 (all $p < 0.05$). Only item 3 did not show a statistically significant difference ($p > 0.05$), which suggests consistent item-level sensitivity across most survey questions (Table 2). To explore the relationship between perceived voice quality and voice handicap in the surgical group, Spearman's rank correlation coefficient was used. Strong positive correlations were observed between the T-SVQS scores and the emotional ($r = 0.841$, $p < 0.001$), physical ($r = 0.836$, $p < 0.001$), and functional ($r = 0.814$, $p < 0.001$) subscales of the TVHI-10, as well as the total score ($r = 0.861$, $p < 0.001$). All correlations were statistically significant ($p < 0.001$; Table 3). The construct validity of the T-SVQS was assessed by EFA. The data were deemed suitable for factor analysis as indicated by a KMO value of 0.725 and a significant result in Bartlett's test of sphericity ($\chi^2 = 152.594$, $df = 45$, $p < 0.001$). A single-factor solution was extracted using Varimax rotation, explaining 63.5% of the total

Table 1. Comparison of scale and survey scores by groups

Variant	M (Q3-Q1)		p-value
	Surgery (+) (n=31)	Surgery (-) (n=31)	
Emotional	3 (5-0)	0 (0-0)	<0.001*
Physical	3 (8-0)	0 (0-0)	<0.001*
Functional	7 (12-3)	1 (2-0)	<0.001*
TVHI-10	14 (23-4)	1 (2-0)	<0.001*
T-SVQS	9 (14-5)	2 (3-1)	<0.001*

*: p<0.05 there is a statistically significant difference between groups, n: Number, M: Median, Q1: First quartile (25th percentile), Q3: Third quartile (75th percentile), T-SVQS: Turkish Self-evaluation of Voice Quality Survey, TVHI-10: Turkish Voice Handicap Index-10

Table 2. Comparison of Turkish Self-evaluation of Voice Quality Survey questionnaires by groups

Variant	Group	n/%	Group		Total	χ^2	p-value
			Surgery (+) (n=31)	Surgery (-) (n=31)			
Q1: Do you think that your voice pitch is deep enough for your age, gender, work and social life?	Never	n/%	6/19.4%	0/0.0%	6/9.7%	25.268	<0.001*
	Sometimes	n/%	17/54.8%	5/16.1%	22/35.5%		
	Always	n/%	8/25.8%	26/83.9%	34/54.8%		
Q2: Does the pitch of your voice prevent you from practicing your profession?	Never	n/%	15/48.4%	30/96.8%	45/72.6%	21.316	<0.001*
	Sometimes	n/%	14/45.2%	1/3.2%	15/24.2%		
	Always	n/%	2/6.5%	0/0.0%	2/3.2%		
Q3: Is your voice perceived differently on the phone than your gender identifies?	Never	n/%	23/74.2%	27/87.1%	50/80.6%	3.496	>0.05
	Sometimes	n/%	6/19.4%	4/12.9%	10/16.1%		
	Always	n/%	2/6.5%	0/0.0%	2/3.2%		
Q4: Do you ever have trouble controlling the pitch of your voice?	Never	n/%	6/19.4%	24/77.4%	30/48.4%	24.435	<0.001*
	Sometimes	n/%	21/67.7%	7/22.6%	28/45.2%		
	Always	n/%	4/12.9%	0/0.0%	4/6.5%		
Q5: Do you ever experience a high pitched voice?	Never	n/%	10/32.3%	20/64.5%	30/48.4%	12.334	<0.01*
	Sometimes	n/%	15/48.4%	11/35.5%	26/41.9%		
	Always	n/%	6/19.4%	0/0.0%	6/9.7%		
Q6: Does your voice sound hoarse to you or to those around you?	Never	n/%	9/29.0%	18/58.1%	27/43.5%	15.535	<0.001*
	Sometimes	n/%	13/41.9%	13/41.9%	26/41.9%		
	Always	n/%	9/29.0%	0/0.0%	9/14.5%		
Q7: Do you experience vocal fatigue when speaking?	Never	n/%	8/25.8%	14/45.2%	22/35.5%	14.425	<0.001*
	Sometimes	n/%	14/45.2%	17/54.8%	31/50.0%		
	Always	n/%	9/29.0%	0/0.0%	9/14.5%		
Q8: Do you ever feel breathiness in your voice?	Never	n/%	15/48.4%	26/83.9%	41/66.1%	12.225	<0.01*
	Sometimes	n/%	11/35.5%	5/16.1%	16/25.8%		
	Always	n/%	5/16.1%	0/0.0%	5/8.1%		
Q9: Do you have problems changing the loudness and volume of your voice (shouting, whispering, etc.)?	Never	n/%	9/29.0%	26/83.9%	35/56.5%	24.146	<0.001*
	Sometimes	n/%	14/45.2%	5/16.1%	19/30.6%		
	Always	n/%	8/25.8%	0/0.0%	8/12.9%		
Q10: Do you ever feel weakness in your voice?	Never	n/%	6/19.4%	24/77.4%	30/48.4%	31.869	<0.001*
	Sometimes	n/%	11/35.5%	7/22.6%	18/29.0%		
	Always	n/%	14/45.2%	0/0.0%	14/22.6%		
Total		n/%	31/100.0%	31/100.0%	62/100.0%		

*: p<0.05 there is a statistically significant difference between groups, n: Number, %: Percentage

Table 3. Correlations between scale and survey scores

Points	Value	Emotional	Physical	Functional	TVHI-10
T-SVQS	r	0.841	0.836	0.814	0.861
	p	<0.001*	<0.001*	<0.001*	<0.001*
Emotional	r		0.854	0.925	0.967
	p		<0.001*	<0.001*	<0.001*
Physical	r			0.887	0.939
	p			<0.001*	<0.001*
Functional	r				0.968
	p				<0.001*

*: p<0.05 there is a statistically significant difference between groups, r: correlation coefficient, T-SVQS: Turkish Self-evaluation of Voice Quality Survey, TVHI-10: Turkish Voice Handicap Index-10

Correlations were calculated based on data from participants who had undergone surgery (n=31)

variance. Factor loadings for the items ranged from 0.354 to 0.844. The internal consistency of the T-SVQS was high, with a Cronbach's alpha coefficient of 0.845. Item-total correlation coefficients ranged between 0.307 and 0.763, indicating acceptable reliability for all items. These results support the validity and reliability of the Turkish version of the T-SVQS for assessing self-perceived voice quality.

DISCUSSION

This study investigated the need for voice therapy after type 3 thyroplasty using self-assessment of voice. Type 3 thyroplasty is considered a definitive treatment, this surgery effectively lowers vocal pitch without compromising vocal quality (5). Chandra et al. (13) reported a significant subjective improvement in patients with puberphonia, with VHI scores decreasing from a preoperative 53 to a postoperative 29.

However, the comparison of scale and survey scores among groups in our study revealed a statistically significant difference. Our results indicate that individuals continue to experience emotional, physical, and functional voice problems after type 3 thyroplasty; therefore, voice therapy is necessary.

Kizilay and Firat (11) reported, based on the voice assessment form for patients with puberphonia, that the highest pre-treatment handicap scores were observed in the emotional subgroup, whereas post-treatment the highest scores shifted to the physical subgroup. This increase in post-treatment physical scores reflects the challenges patients encounter when adapting to their new voices and underscores the ongoing need for voice therapy.

Comparison of responses to the T-SVQS across groups revealed that individuals did not experience problems with gender perception despite the decrease in fundamental frequency following surgery. However, they exhibit hypofunctional voice characteristics such as vocal fatigue, breathiness, asthenia, reduced loudness, and difficulty controlling intensity. While the reduction in fundamental frequency and the resolution of gender-perception issues are expected outcomes of type 3 thyroplasty,

the decrease in vocal fold tension postoperatively seems to lead to glottic gap formation and discordant vocal fold vibration. This hypofunction results in decreased voice quality. Therefore, voice therapy by a speech and language therapist is essential to ensure proper voice use, to provide respiratory support, and to prevent potential hypofunction after surgery (10).

Findings from correlation analysis between the scales indicated that as T-SVQS scores increased, the TVHI-10 Scale total and subgroup scores also increased. Emotional subgroup scores were associated with increases in the total score and in other subgroup scores. Physical subgroup scores were correlated with increases in total-scale and functional-subgroup scores. Functional subgroup scores were also positively correlated with total scale scores. These analyses suggest a strong relationship between T-SVQS scores and the TVHI-10, showing that the emotional, physical, and functional subgroups are interconnected.

In conclusion, patients who underwent type 3 Thyroplasty exhibited emotional, physical, and functional problems related to their voice. In these patients, adjunctive voice therapy alongside surgery is necessary to prevent potential vocal hypofunction, improve voice quality, preserve vocal health, and reduce emotional, physical, and functional effects associated with voice disorders.

Study Limitations

This study has several limitations. First, using an online platform to administer study questions may have introduced variability in participants' understanding because of sociocultural differences, potentially affecting response consistency. Second, the number of patients included in the study was limited because type 3 thyroplasty is a highly specialized, infrequently performed surgical procedure. This reduced the sample size and may limit the generalizability of the findings. Finally, the limited availability of literature on type 3 thyroplasty, owing to its non-routine application, restricted comparison and corroboration of the study's results with existing evidence.

CONCLUSION

This study demonstrated that individuals who underwent type 3 thyroplasty continued to experience emotional, physical, and functional voice difficulties despite the surgical lowering of vocal pitch. The Turkish version of the T-SVQS was found to be a valid and reliable tool in assessing self-perceived voice quality, showing strong correlations with the TVHI-10. The results emphasize that surgery alone may not fully address the complex vocal challenges faced by these patients. Therefore, integrating postoperative voice therapy into the treatment protocol is essential to enhance voice quality, prevent hypofunctional voice patterns, and support long-term vocal health and well-being.

Appendix 1: <https://d2v96fxpocvxx.cloudfront.net/beb8919b-f013-4ea1-b1c8-40332e840fe1/content-images/dfd0a53c-fa6d-4c82-a242-72e513648dfe.pdf>

Ethics

Ethics Committee Approval: This study was reviewed and approved by the Non-Interventional Scientific Research Ethics Committee of İstanbul Atlas University (approval no: E-22686390-050.99-28121, date: 15.06.2023).

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

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Footnotes

Author Contributions: Surgical and Medical Practices - K.Y.; Concept - B.D., K.Y.; Design - B.D., K.Y.; Data Collection and/or Processing - B.D.; Analysis and/or Interpretation - B.D., K.Y.; Literature Search - B.D.; Writing - B.D.

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