

Voice Assessment and Voice-related Quality of Life in Patients with Benign Thyroid Disease

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Abstract

Objective. To identify the relationship between vocal self-assessment, the assessment of voice by a speech-language pathologist (SLP), and the effect of voice on the quality of life of patients with benign thyroid diseases.

Study Design. Cross-sectional study.

Setting. University hospital.

Subjects and Method. A total of 67 women with a mean age of 44.7 ± 14.8 years and a diagnosis of benign thyroid disease were included in the study. Vocal self-assessment and SLP assessment were performed using a visual analogue scale (VAS). The Voice-related Quality of Life Questionnaire (V-RQOL) was used to identify the effect of voice on quality of life. The Mann-Whitney and Kruskal-Wallis nonparametric tests were used. Correlations between assessments were verified by the Spearman correlation test. The significance level was 5%.

Results. Patients with vocal complaints had lower scores in all assessments. Patients with thyroid nodules performed worse on the SLP assessment and on the physical functioning domain of V-RQOL. A moderate correlation was found between the self-assessment and quality of life and between the physical functioning domain of V-RQOL and the SLP assessment. A weak correlation existed between the self-assessment and the SLP assessment.

Conclusion. Patients with benign thyroid diseases had lower scores in vocal self-assessment, the clinical evaluation of voice, and the V-RQOL. These dimensions of voice assessment showed correlations ranging from mild to moderate and should complement the clinical routine.

Keywords

thyroid gland, voice, voice disorders, self-assessment, quality of life

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Introduction

Evidence exists that thyroid hormone receptors are present in the lamina propria of the human vocal folds¹ and that the voice is therefore sensitive to disorders associated with thyroid hormone imbalances.^{2,3} Thyroid disorders represent the second most common endocrine condition after diabetes mellitus.⁴ This underscores the importance of studies that explore the relationship between thyroid hormone disorders and the voice.

Voice disorders are one of the most frequent conditions in hypothyroidism^{5,6} since the hypothyroidism-associated increase in hyaluronic acid concentrations leads to the retention of fluids (myxedema) in and the thickening of the vocal folds.^{3,7-9} The hoarseness and vocal fatigue reported in hyperthyroidism could be the result of a reduction in subglottal pressure caused by respiratory muscle weakness.¹⁰ Thyroid nodules may also cause vocal alterations, depending on their size, position, and compressive potential.^{2,11} Finally, thyroidectomy-related vocal alterations can be caused by pathophysiological or iatrogenic factors such as vocal cord palsy or paralysis, benign laryngeal diseases (ie, nodules, cysts, polyps, granulomas), or respiratory diseases, which may be present in the presurgery phase or arise postsurgically.^{2,3,12-17}

Studies have shown that benign alterations of the thyroid, in addition to pathophysiological thyroid disorders, impact quality of life, often using general health tools to obtain this information.¹⁸⁻²⁰ These tools may be hard to interpret clinically when investigating a specific health condition such as a vocal disorder. In this case, the use of specific questionnaires makes the relevant aspects of the assessment easier to identify and guarantees greater accuracy than general questionnaires.¹⁹

Quality of life reductions related to voice disorders are defined as reductions in physical, social, or economic status

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arising from a disturbance of voice.²¹ As such, the point of view of patients and their expectations are regarded as vital to voice assessment and the management of vocal rehabilitation,²² complementing findings from the traditional methods of clinical voice assessment.²³ However, no studies to date have specifically addressed in patients with benign thyroid disease the relationship between the 3 forms of vocal assessment utilized by clinicians: self-assessment, the perceptive-auditory assessment of voice by a speech-language pathologist (SLP), and the effect of voice on quality of life. To better understand vocal behavior, it is essential to conduct voice assessment in a multidimensional manner.^{13,15} As such, the purpose of this study was to identify the relationship between these 3 forms of vocal assessment in patients with benign thyroid diseases.

Methods

This is a cross-sectional study approved by the Human Research Ethics Committee of the Onofre Lopes University Hospital (number CAAE 14323313.8.0000.5292). All participants were informed of the objectives of the study and signed a free informed consent form prior to study entry. The study consisted of 72 patients, aged between 19 and 80 years, with a diagnosis of thyroid disease who were treated in the Endocrinology Department of a university hospital located in the northeastern region of Brazil between March 2012 and June 2013. Patients diagnosed with thyroid cancer or patients who had craniofacial anomalies, syndromes, temporomandibular dysfunction, difficulty in understanding simple instructions, or neurological, neuromuscular, or neurodegenerative alterations were excluded. Patients were also excluded if they had undergone prior thyroid surgery, suffered traumatic injuries, or received prior chemo-radiation treatment in the head and neck region.

Personal, sociodemographic, and clinical data were obtained from medical records or directly from the patient. Patients were asked if they had any vocal complaints and the answers were dichotomized as yes or no. For vocal self-assessments, patients were asked to complete a visual analogue scale (VAS) assessment.²⁴ This scale consists of a 100 mm line on which the patients are asked to mark the point that represents the perception they have of their own day-to-day voice. Patients were asked to “please put a mark on a point on this line to represent your perception of your own day-to-day voice. The left extreme of this line represents an excellent voice and the right extreme represents a very poor quality of voice.” The patients used the ends of the scale as a reference, whereby the lefthand side (represented by 0) corresponded to minimum vocal alteration and the righthand side (represented by 100) corresponded to the maximum deviation. Placing a 100 mm ruler on the line enabled the clinician to obtain the exact value marked by the patient.

The impact of voice on quality of life was measured using the Voice-related Quality of Life (V-RQOL) questionnaire, designed by Hogikyan and Sethurman²⁵ and validated in Brazil by Gasparini and Behlau.²⁶ The V-RQOL is a tool consisting of 10 questions that address factors related to the

impact of voice on daily activities and features 3 scores: general, socio-emotional, and physical. Scores range from 0 to 100; the lower the score, the worse the voice-related quality of life.

As a means of comparing the subjective scores of the patient to a perceptive-auditory assessment conducted by an SLP, speech samples were collected by recording sustained vowel phonation [ε] and a numerical count from 1 to 20, as previously described.²⁴ The recording was made in a noise-controlled environment of less than 50 dB, using an HP Compaq 6535 model laptop with an unidirectional Clone 11070 model external microphone and PRAAT software (available at <http://www.praat.org>). The patients were seated comfortably with a microphone positioned 10 cm from their mouths. Their voices were recorded at habitual patient frequency and intensity, with a mono input frequency of 44.100 Hz, saved in wave (.WAV) format and analyzed by an SLP with over 5 years of experience in perceptive-auditory assessment and over 1 year of experience in VAS. The SLP had no prior contact with the patients and listened to each voice sample 3 times before making a final evaluation in a silent environment using a Logitech H10 model headset. The SLP derived an overall impression of the transmitted voice (general level) and registered an assessment on a VAS. This type of perceptive-auditory evaluation was based on Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)²⁷ protocol procedures.

Each vocal assessment was correlated with the voice complaint report and clinical diagnosis of the thyroid disease. The difference in averages was calculated using non-parametric Mann-Whitney or Kruskal-Wallis tests in accordance with the number of groups. When the Kruskal-Wallis test was used, the Mann-Whitney test was used post hoc with the Bonferroni correction for multiple comparisons. Spearman's correlation coefficient was used to analyze the correlation between the assessments. A *P* value of <.05 was regarded as statistically significant.

Results

A total of 72 patients were enrolled, of which 5 were male. These male subjects were excluded for statistical purposes. Therefore, a total of 67 female subjects were analyzed and included in the final sample. Patient demographics and clinical characteristics are shown in **Table I**. There was a predominance of patients with clinically diagnosed nodules and hypothyroidism as well as a high frequency of vocal complaints. The average VAS in the speech therapist assessment suggested a slight to moderate vocal alteration based on the cut-off scores for Brazilian voices.²⁸ The average of the vocal self-assessments was close to the average of the SLP speech assessments. The total V-RQOL score was lower than the cut-off score of 91.25 established for Brazilian individuals,²⁹ indicating that in this population, voice interfered with the general, emotional, and physical well-being of the patients.

Patients who reported a vocal complaint (*n* = 36; 46.26%) exhibited worse scores across each of the measurements

Table 1. Demographic and Clinical Characteristics of Women with Benign Thyroid Disease.

Variables	Values
Patients, n	67
Age, mean (SD)	44.72 (14.83)
Range	19-80
Education, n (%)	
> 15 years	38 (56.8)
≤ 15 years	29 (43.2)
Area of residence, n (%)	
Metropolitan area	19 (28.4)
Other	48 (71.6)
Clinical diagnosis, n (%)	
Hyperthyroidism	6 (9.0)
Hypothyroidism	24 (35.8)
Nodule	25 (37.3)
Other benign thyroid disease (without specific diagnosis)	12 (17.9)
Vocal complaint, n (%)	
Yes	36 (53.7)
No	31 (46.3)
Visual analogue scale (VAS), mean (SD)	
Vocal self-assessment	37.64 (30.52)
Perceptive-auditory assessment by speech-language pathologist (count from 1 to 20)	36.61 (25.81)
Perceptive-auditory assessment by speech-language pathologist (sustained vowel [ε])	41.30 (29.40)
Voice-related Quality of Life (V-RQOL), mean (SD)	
Total	73.09 (26.81)
Socioemotional	77.72 (27.10)
Physical functioning	76.25 (24.95)

Table 2. Mean Difference of Variables Related to VAS and V-RQOL According to Vocal Complaint.

	Vocal Complaint				P Value ^a
	Yes n = 36		No n = 31		
	Mean	SD	Mean	SD	
Visual analogue scale (VAS)					
Vocal self-assessment	53.03	26.84	19.77	24.38	<.001
PAS by SLP (count from 1 to 20)	43.94	24.04	28.10	25.53	.010
PAS by SLP (sustained vowel [ε])	47.61	27.30	33.97	30.48	.042
Voice-related Quality of Life (V-RQOL)					
Total	63.78	26.52	83.90	23.16	.001
Socioemotional	66.64	28.17	90.58	19.29	<.001
Physical functioning	67.11	26.10	86.87	18.92	.002

Abbreviations: PAS, perceptive-auditory assessment; SLP, speech-language pathologist.

^aMann-Whitney nonparametric test ($P < .05$).

(**Table 2**). Pertaining to the SLP assessment, which produced a numerical VAS score, the scores of the patients with thyroid nodules were worse than the scores of those who had hyperthyroidism and hypothyroidism (**Table 3**). Patients with a thyroid nodule obtained worse scores on the SLP perceptive auditory assessments (PAS) (numerical count from 1 to 20 and

sustained vowel phonation [ε]) relative to hypothyroidism. The same was true for the physical V-RQOL score, the only patient self-reported variable that demonstrated a difference between thyroid disorder diagnoses.

Table 4 shows that each of the variables was correlated. Low correlation values were observed between the SLP

Table 3. Mean Difference between Variables Related to VAS Assessments and V-RQOL According Clinical Diagnosis of Benign Thyroid Disease.

	Diagnosis								P Value ^a
	Hyperthyroidism		Hypothyroidism		Nodule		Other Benign Thyroid Diseases (without specific diagnosis)		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Visual Analogue Scale (VAS)									
Vocal self-assessment	31.33	35.06	36.42	29.18	40.28	28.45	37.75	37.98	.750
PAS by SLP (count from 1 to 20)	21.17 ^b	21.53	29.25 ^{bc}	25.67	48.28 ^d	21.98	34.75 ^{bcd}	44.58	.015
PAS by SLP (sustained vowel [ε])	29.67 ^b	35.69	28.08 ^{bc}	26.13	55.20 ^{bd}	25.34	44.58 ^{bcd}	29.55	.006
Voice-related Quality of Life (V-RQOL)									
Total	78.17	25.46	75.62	30.59	68.72	26.24	74.58	22.05	.584
Socioemotional	81.33	31.11	84.04	24.52	69.44	30.38	80.50	20.92	.261
Physical functioning	84.00 ^b	22.90	86.04 ^{bc}	20.35	68.80 ^{bd}	25.84	68.33 ^{bd}	27.16	.032

Abbreviations: PAS, perceptive-auditory assessment; SLP, speech-language pathologist.

^aKruskal-Wallis non-parametric test ($P < .05$) with Mann-Whitney non-parametric post hoc test with Bonferroni correction ($P < .016$). Lowercase superscript letters represent the comparisons between groups with a significant statistical difference. Identical letters indicate no significant difference between groups.

Table 4. Correlation between Assessments of the Patients and Speech-language Pathologist.

Variables	Vocal Self-Assessment		PAS by SLP (count from 1 to 20)		PAS by SLP (sustained vowel [ε])	
	Rho	P Value*	Rho	P Value*	Rho	P Value*
PAS by SLP (count from 1 to 20)	.286	.019				
PAS by SLP (sustained vowel [ε])	.370	.002	.793	.000		
Voice-related Quality of Life (V-RQOL) Total	-.542	.000	-.250	.041	-.292	.016
Voice-related Quality of Life (V-RQOL) Socioemotional	-.425	.000	-.289	.018	-.338	.005
Voice-related Quality of Life (V-RQOL) Physical Functioning	-.491	.000	-.464	.000	-.486	.000

Abbreviations: PAS, perceptive-auditory assessment; rho, Spearman correlation test; SLP, speech-language pathologist.

* $P < .05$.

assessments and the patient vocal self-assessment (VAS score). However, there was a slightly higher correlation with the SLP analysis of sustained vowel phonation and the patient vocal self-assessment. Low correlation values were also observed between the SLP assessments and the V-RQOL scores, with the exception of the V-RQOL physical score, which moderately correlated with the SLP assessments. Each of the V-RQOL scores demonstrated a moderate negative correlation with the patient VAS scores, suggesting that the worse the patient perception of the vocal condition, the worse the V-RQOL score.

Discussion

The results of this study indicate that patients with benign thyroid disease have a high frequency of vocal complaints

and that their voice has a negative impact on quality of life. This is the first study to specifically investigate the relationship between self-assessment of vocal condition, voice assessment by an SLP, and the impact of voice on the quality of life of patients with benign thyroid diseases.

Hypothyroidism and thyroid nodules were the 2 most predominant diagnoses in the patient population studied. Vocal alteration is common in hypothyroidism and, as is the case of the other signs and symptoms of this clinical condition, may have a more sudden onset than in hyperthyroidism.⁶ Benign thyroid nodules are common and can be detected by palpation in 10% of women and 2% of men.³⁰ The compressive nature of the thyroid nodule can cause damage to the laryngeal branches of the vagus nerve, resulting in a more severe and progressive compromise of vocal

quality relative to patients with hypothyroidism or hyperthyroidism.^{30,31} This could explain the lower voice assessment scores displayed in patients with thyroid nodules on the SLP assessment and the V-RQOL physical score compared with the other thyroid disease diagnoses.

We found that patients with vocal complaints registered lower scores for each of the vocal parameters analyzed when compared with patients with no complaints. In the case of vocal self-assessment using VAS, a previous study of candidates for thyroid surgery revealed a difference between the group with vocal complaints and the group without vocal complaints,²⁴ which is expected because the VAS quantifies the self-perception of vocal condition. Analysis by an SLP is vulnerable to the influence of patients regularly hearing different types of voices and assessments are often conducted in unfamiliar environments.³² Other studies indicate that data obtained exclusively using perceptive-auditory analysis do not correlate with patient self-assessment of vocal condition and the effect of voice on limiting daily activities.^{24,32-35} This evidence suggests that vocal self-assessment by the patient should be obtained. Vocal self-assessment reflects not only what a patient hears, but also how a patient feels. Therefore, what a patient reports is based not only on vocal quality but also on physical sensations such as fatigue, stress, or discomfort when speaking.³²

As in previous studies with patients indicated for thyroidectomy, we found that there was no correlation between patient perception of voice and SLP perception of voice.^{24,35} This underscores the fact that vocal self-assessment by the patient should be included as a complementary evaluation for helping professionals identify a more effective and precise treatment.²⁴

The impact of voice on the quality of life revealed low scores in patients with thyroid diseases, even in patients with no vocal complaints, enforcing the view that thyroid disorders can affect quality of life even when symptoms are not reported by the patient.²⁰ Poor vocal self-assessment correlated with a negative impact on each of the domains assessed by V-RQOL, similar to the result demonstrated in a previous study of patients suffering from thyroid disease with an unspecified diagnosis.³⁵

The most significant correlations occurred between the physical functioning domain of the V-RQOL and the other assessments (the vocal self-assessment and the SLP assessments). This domain encompasses issues specifically related to alterations in vocal quality, intensity, intelligibility, and stability,^{25,26} aspects of the voice that, according to physiopathology, may be altered in patients with thyroid disease and influence patient self-perception.

The sustained vowel phonation is a task that indirectly reflects the integrity of the glottal area. We observed the highest correlation between the SLP assessment and the subjective patient self-assessment when the sustained vowel phonation task was performed, particularly within the physical domain of V-RQOL. This finding indicates that the observation of the SLP closely approximates the patient's self-perception when the integrity of the glottal area is

evaluated. It should be pointed out that perception of the health condition and assessment of quality of life are different concepts,³⁶ the former measured by the VAS and the latter measured by V-RQOL. The correlation shown between VAS and V-RQOL scores showed these vocal assessments may be complementary and reflects the subjectivity inherent in quantitative vocal self-assessment. It is possible that the patients with thyroid disease in this study not only took into account the vocal signal perceived but also the impact of voice on their physical, social, and emotional well-being.

This survey revealed certain limitations. The predominance of individuals diagnosed with hypothyroidism and thyroid nodules may have represented a biased patient population. The recording of thyroid hormone levels and the number, size, and location of thyroid nodules was inconsistent, precluding the analysis of this information. Logistical issues resulted in only a few patients undergoing a laryngoscopy analyzed, although the symptoms reported by patients do not always directly correlate with the laryngeal exam.¹⁵ Thus, information from the laryngeal exam was not included in the analysis. Acoustic analysis, which is considered an objective evaluation, was also rejected. We recommend that these aspects be considered in future similar studies.

To conclude, the results of this study indicate that in cases of benign thyroid disease, vocal quality should be investigated and in addition to vocal evaluation by an SLP, patient vocal self-assessment should be performed.

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Author Contributions

Leandro de Araújo Pernambuco, conception, design, acquisition, analysis, interpretation, critical revision, and final approval of the version to be published; **Marluce Nascimento de Almeida**, acquisition, analysis, interpretation, critical revision; **Keliane Gomes Matias**, acquisition, analysis, interpretation, critical revision; **Erika Beatriz de Morais Costa**, acquisition, analysis, interpretation, critical revision, and final approval of the version to be published.

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