





# Self-assessment of voice-related symptoms in individuals with thyroid cancer before, immediately after, and in the late postoperative period of thyroidectomy

## Autoavaliação de sintomas relacionados à voz em indivíduos com câncer de tireoide antes, imediatamente após e no pós-operatório tardio de tireoidectomia

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### ABSTRACT

**Purpose:** To verify the self-perception of symptoms and vocal fatigue related to thyroidectomy in individuals with thyroid cancer in the pre, immediate post and late post-operative moments, and to analyze the influence of gender. **Methods:** Intervention study before and after with 20 individuals, mean age 46 years, evaluated before surgery (M1), immediately after surgery (M2) and in the late postoperative period (M3) of thyroidectomy. Individuals answered the instruments: Voice Symptoms Scale, Vocal Fatigue Index and Thyroidectomy-Related Voice and Symptom Questionnaire. Data were analyzed descriptively and inferentially. **Results:** In self-assessment of vocal symptoms of the total domains and limitation, M1 ( $p<0.001$ ;  $p<0.001$ , respectively) and M3 ( $p=0.013$ ;  $p=0.001$ , respectively) had significantly lower values than the M2. For the physical domain of self-assessment of vocal symptoms, the M3 showed statistically lower values than the M1 ( $p=0.006$ ) and the M2 ( $p<0.001$ ) assessments. Depending on the moment, the oropharyngolaryngeal symptoms in M3 had significantly lower values than M2 ( $p=0.004$ ) and M1 ( $p=0.028$ ). Male scores were significantly lower than female scores in the self-assessment of fatigue symptoms in the fatigue and vocal limitation domain ( $p=0.035$ ), regardless of the time of assessment. **Conclusion:** Physical vocal symptoms and thyroidectomy-related symptoms decrease in the late postoperative period; total vocal symptoms and limitation increasing in the immediate postoperative period and decrease in the late postoperative period. Women have a higher perception of vocal fatigue and limitation, and of total and vocal symptoms related to thyroidectomy.

**Keywords:** Self-assessment; Fatigue; Voice symptoms; Thyroidectomy; Voice

### RESUMO

**Objetivo:** Verificar autopercepção de sintomas vocais, de fadiga vocal e relacionados à tireoidectomia em indivíduos com câncer de tireoide, nos momentos pré-operatório, pós-operatório imediato e pós-operatório tardio, e analisar a influência do gênero. **Métodos:** Trata-se de um estudo de intervenção antes e após com 20 indivíduos com câncer de tireoide, média de 46 anos de idade, avaliados em três momentos: pré-cirurgia (M1), imediatamente após cirurgia (M2) e no pós-operatório tardio (M3) da tireoidectomia. Os indivíduos responderam aos instrumentos Escala de Sintomas Vocais, Índice de Fadiga Vocal e *Thyroidectomy-Related Voice and Symptom Questionnaire*. Os dados foram analisados de forma descritiva e inferencial. **Resultados:** Na autoavaliação de sintomas vocais físicos e orofaringolaríngeos relacionados à tireoidectomia, o M3 apresentou valores estatisticamente menores que o M1 ( $p=0,006$  e  $p=0,028$ , respectivamente) e o M2 ( $p<0,001$  e  $p=0,004$ , respectivamente). Para os sintomas totais ( $p=0,001$ ) e vocais ( $p=0,001$ ) relacionados à tireoidectomia, os valores do M3 foram significativamente menores que os do M2. Na autoavaliação de sintomas vocais dos domínios total e limitação, o M1 ( $p<0,001$ ;  $p<0,001$ ) e o M3 ( $p=0,013$ ;  $p=0,001$ ) apresentaram valores significativamente menores que o M2. Indivíduos do gênero masculino apresentaram percepção de sintomas de fadiga no domínio fadiga e limitação vocal ( $p=0,035$ ) e percepção de sintomas relacionados à tireoidectomia nos domínios total ( $p=0,044$ ) e sintomas vocais ( $p=0,012$ ) significativamente menores do que os do gênero feminino, independentemente do momento. **Conclusão:** Sintomas vocais físicos e relacionados à tireoidectomia diminuem no pós-operatório tardio; sintomas vocais totais e limitação aumentam no pós-operatório imediato e diminuem no tardio. Mulheres têm maior percepção de fadiga e limitação vocal e de sintomas totais e vocais relacionados à tireoidectomia.

**Palavras-chave:** Autoavaliação; Fadiga; Sintomas vocais; Tireoidectomia; Voz

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## INTRODUCTION

Thyroid cancer is a solid tumor cancer of the head and neck<sup>(1)</sup>. It is a cancer with an uncertain clinical development. The incidence of thyroid cancer has been increasing in recent decades with around 13,780 new cases expected for the three-year period from 2020 to 2022<sup>(2)</sup>. It is highly prevalent in women, occupying 5th place at the same three-year period<sup>(1,2)</sup>.

The main clinical manifestation that indicates thyroid alteration are nodules, which are usually asymptomatic and benign<sup>(3)</sup>. About 5% of such cases progress to cancer<sup>(3,4)</sup>.

Subjects with thyroid cancer may experience vocal changes due to hormonal alterations, the presence of benign or malignant nodules and enlargement of the thyroid gland<sup>(5,6,7)</sup>. Hoarseness, instability, vocal tremor, a deepened voice, restricted production of high tones, vocal fatigue, sensation of lumpiness in the throat, dyspnea, dry cough, dysphagia, pain and burning in the laryngeal region are some of the most frequent vocal and pharyngolaryngeal symptoms<sup>(4,5,7,8,9)</sup>. These symptoms may occur prior to an operation and are independent of surgery<sup>(9)</sup>.

The procedure of choice to confirm the malignancy of thyroid nodules<sup>(1,5)</sup> is a thyroidectomy which is a surgical procedure to remove all or part of the thyroid gland<sup>(2)</sup>. A thyroidectomy is efficient in tumor ablation, but it can lead to structural and functional sequelae<sup>(10)</sup>. Among these sequelae are lesions in the branches of the laryngeal nerve, hypocalcemia, infections, hemorrhage, metabolic alterations related to thyroid hormone and hypoparathyroidism<sup>(3,11)</sup>.

Laryngeal trauma can be caused by injury or manipulation of the laryngeal nerve<sup>(2)</sup>. The postoperative period can cause changes in the sensitivity and mobility of the vocal fold<sup>(2)</sup>. Phonation alterations occur in about 10% of cases<sup>(7)</sup>, and can be augmented by orotracheal intubation<sup>(5,10)</sup>. Hoarseness, vocal fatigue and reduction in the range of high notes are some common symptoms immediately after a thyroidectomy<sup>(11,12)</sup>.

An injury or manipulation of the laryngeal nerve during a thyroidectomy<sup>(11)</sup>, or compression or infiltration of the tumor prior to surgery<sup>(13,14)</sup> can both lead to the onset of vocal fatigue. The recurrent laryngeal nerve is directly related to the inferior thyroid artery and can be injured when the artery is divided during a thyroidectomy. Additionally the superior laryngeal nerve may be affected when the superior thyroid artery is ligated or when local cauterization is carried out, which may decrease vocal fold tension due to decreased activity of the cricothyroid muscle (CT)<sup>(11,14,15)</sup>.

These alterations, both vocal and pharyngolaryngeal symptoms tend to disappear within three months after a thyroidectomy, which is considered the late postoperative period<sup>(2)</sup>. In 0.4% of cases, the change in the mobility of the vocal folds becomes definitive<sup>(2)</sup>.

A patient's self-perception of symptoms provides data that cannot be acquired by clinical evaluation and it is very important and can motivate a patient to seek specialized speech therapy treatment as well as to adhere to any specialized treatment programs<sup>(16,17)</sup>.

There are studies that self-assess the patients' perception of voice, pharyngolaryngeal and vocal fatigue symptoms in the preoperative, immediate and late postoperative periods of thyroidectomy, however with different outcomes and in different patients. Consequently it is necessary to obtain information through a longitudinal study from the preoperative period

to the late postoperative period, in order to understand the subjects' perception of vocal and pharyngolaryngeal symptoms and of vocal fatigue. This data is important for planning and encouraging the development of public policies and a strategy of speech therapy care for patients with thyroid cancer from the preoperative period to the late postoperative period.

This study aims to verify the subjects self-perception of vocal symptoms, vocal fatigue and those related to thyroidectomy in subjects with thyroid cancer in the pre, immediate postoperative and late postoperative periods of thyroidectomy, and to analyze the influence of gender.

## METHODS

This is a before and after intervention study design. The research was approved by the Research Ethics Committee of the Faculty of Ceilândia of the University of Brasília (CEP/FCE/UnB) protocol number 3,559,812. All participants were informed about the research procedures and signed a consent form.

The data was collected at the University Hospital of Brasília with the head and neck team. Patients were recruited from the institution's thyroidectomy waiting list who had prescheduled surgery.

Inclusion criteria was: subjects had to be aged over 18 years old and undergoing partial or total thyroidectomy as primary treatment for thyroid cancer and goiter. Exclusion criteria were: surgical or clinical sequelae of the head and neck in the vocal tract or larynx, neurological or cognitive alterations in oral comprehension and language or use of iodine therapy. Eligibility criteria was taken from medical records data.

A sample calculation was carried out to estimate the sample size based on a pilot study with ten subjects. The calculation was made using the average scores of the Voice Symptom Scale (VoiSS)<sup>(16)</sup> immediately after surgery (average=48.27) and in the late postoperative period (average=22.81) were used, as well as the standard deviation of the difference between the averages of 29.86. Test power was 90% and significance level was 5%. The estimated sample size was 17 subjects. 20 subjects with thyroid cancer were selected to participate in the study comprising of 16 women and four men with an average age of 46 years old, who met the eligibility criteria.

Outcomes were evaluated in three moments, (M1) preoperative moment of thyroidectomy; (M2) immediate postoperative period with a period of up to eight days after thyroidectomy, and (M3) late postoperative period with a period of three to six months after thyroidectomy. Data from M1 and M2 was collected in person, and data from M3 was collected by telephone and/or online. In the three evaluations, the subjects answered the following instruments Voice Symptom Scale (VoiSS), Thyroidectomy-related Voice and Symptom Questionnaire (TVSQ) and Vocal Fatigue Index (VFI). In M1, subjects also answered a questionnaire about sociodemographics and health data.

The sociodemographic and health data questionnaires was prepared by the researchers to characterize the sample. The data collected was as follows age, gender, smoking habits, drinking habits, profession, family history, anatomopathological diagnosis, type of resection, neck dissection and the surgical technique utilized.

The VoiSS aims to assess vocal symptoms and their impact<sup>(17)</sup>. A validated version in Brazilian Portuguese was

used<sup>(16)</sup>. The VoiSS consists of 30 items that are subdivided into three domains: emotional, physical and limitations. Each item is scored according to frequency between never (0) and always (4). The score for each domain and the total is obtained by simple summation of the items. The higher the score, the greater the self-perception of vocal symptoms.

The TVSQ evaluates the perception of the frequency of vocal complaints and representative symptoms of laryngopharyngeal reflux, vocal fold paralysis and changes in swallowing after thyroidectomy<sup>(11,18)</sup>. A validated Brazilian Portuguese version was used<sup>(19)</sup>. The instrument has 20 items subdivided into three domains, vocal symptoms, oropharyngolaryngeal symptoms, discomfort in swallowing, breathing and in the cervico-thoracic region. Each item is scored according to frequency between never (0) and always (4). The protocol is calculated by summing all of the responses. The higher the score the greater the vocal, oropharyngeal and swallowing symptoms the subject perceives<sup>(20)</sup>.

The VFI aims to assess the perception of vocal fatigue (VF) symptoms in dysphonic subjects<sup>(21)</sup>. A validated version in Brazilian Portuguese was used<sup>(12)</sup>. The VFI consists of 17 items subdivided into the total domain and four other factors namely fatigue and vocal limitation, vocal restriction, physical discomfort associated with voice, and recovery with vocal rest. Each item is scored according to frequency between never (0) and always (4). The score factor is calculated by summing all of the items. The total score is calculated from the sum of the factors with inversion of the value of the factor recovery with vocal rest. The higher the score, the greater the subjects's perception of vocal fatigue symptoms.

The data was analyzed descriptively and inferentially using SPSS 25.0 software. In the descriptive analysis of continuous quantitative and ordinal qualitative variables, measures of central tendency (average and median), variability (standard deviation) and position (minimum, maximum, first and third quartiles) were calculated. In the descriptive analysis of the nominal qualitative variables, the absolute frequency and the percentage relative frequency were calculated. In the inferential analysis, the comparison of the quantitative variables according to the protocols, the ANOVA test of repeated measures was used. In cases where there was a statistical difference, multiple comparisons were performed using Tukey's test. A significance level of 5% was considered for inferential analyses.

## RESULTS

Twenty subjects participated in the study with an average age of 46 years. There were 16 women and four men all with a diagnosis time of 40.85 months. The most common subjects were those who denied being smokers or drinkers and with any other disease with a family history, who underwent total resection, who did not undergo neck dissection and whose

anatomopathological examination indicated papillary carcinoma. These results are displayed in Tables 1-2.

There was a statistically significant difference in the total ( $p=0.041$ ), limitation ( $p=0.049$ ) and physical ( $p=0.002$ ) domains of the self-assessment of vocal symptoms depending on the time of assessment. In the total and limitation domains, M1 ( $p<0.001$ ;  $p<0.001$ , respectively) and M3 ( $p=0.013$ ;  $p=0.001$ , respectively) presented significantly lower values than M2. For the physical domain, M3 showed statistically lower values than the first ( $p=0.006$ ) and second ( $p<0.001$ ) assessments (Table 3).

There was a statistically significant difference in the self-assessment of general vocal complaints and representative symptoms of laryngopharyngeal reflux, vocal fold paralysis and swallowing alterations in patients with recommendations or submitted to thyroidectomy. As a function of the moment in the total domain ( $p=0.046$ ), vocal symptoms ( $p=0.027$ ) and oropharyngolaryngeal symptoms ( $p=0.009$ ). The values of M3 were significantly lower than those of M2 in the total factor ( $p=0.001$ ) and in vocal symptoms ( $p=0.001$ ), whereas in oropharyngolaryngeal symptoms, M3 presented values significantly lower than M2 ( $p=0.004$ ) and M1 ( $p=0.028$ ). There was also a difference according to gender in the total factor ( $p=0.044$ ) and in vocal symptoms ( $p=0.012$ ). Men's values were significantly lower than women's in the domains total ( $p=0.044$ ) and vocal symptoms ( $p=0.012$ ) (Table 4).

Male subjects had statistically lower values of self-assessment of symptoms in the domain fatigue and vocal limitation ( $p=0,035$ ) (Table 5).

## DISCUSSION

The main endocrine neoplasm of the head and neck is thyroid cancer and a thyroidectomy is the preferred surgical procedure in these cases<sup>(1,3)</sup>. During surgery, one of the objectives is to maintain the integrity of the laryngeal nerves<sup>(10)</sup>. Subjects with thyroid alteration tend to suffer from vocal and oropharyngolaryngeal symptoms<sup>(4,7,8,9)</sup> during pre and immediate postoperative surgery, which tends to minimize during the late postoperative period<sup>(8,11)</sup>. There is a lack of data about the general perception of the patient along the treatment line and the purpose of this study is to evaluate the self-perception of vocal, fatigue and thyroidectomy-related symptoms in subjects with thyroid cancer undergoing thyroidectomy.

The prevalence of thyroid cancer is 3:1 in women<sup>(2,3)</sup> and the our sample also showed a higher incidence in women. The presence of the hormone estrogen in the thyroid follicular cells of women seems to be associated with the pathogenesis of the thyroid<sup>(22,23)</sup>. There is a extreme reduction in this hormone<sup>(24)</sup> between the ages of 45-55 years old, and a higher incidence of the disease being diagnosed<sup>(3,25)</sup>, which was found as a central age tendency of the subjects in this study.

**Table 1.** A descriptive analysis of age and diagnosis time variables

Variable	Average	SD	Minimum	Maximum	1Q	Median	3Q
Age (years)	46.95	11.07	26.00	64.00	39.25	46.50	57.75
Diagnosis time (months)	40.85	45.05	4.00	192.00	12.00	24.00	60.00

Descriptive analysis

**Subtitle:** SD = Standard deviation; 1Q = First quartile; 3Q = Third quartile



**Table 2.** Descriptive analysis of the variables gender, smoking, alcoholism, family history, other disease, type of resection, neck dissection, level of neck dissection and pathology

Variables and categories	n	%
Gender		
Female	16	80.00
Male	4	20.00
smoking		
Yes	4	20.00
No	16	80.00
Alcoholism		
Yes	6	30.00
No	14	70.00
Family history		
Yes	15	75.00
No	5	25.00
other disease		
No	17	85.00
Yes	3	15.00
type of resection		
Partial	3	15.00
Total	17	85.00
neck dissection		
Yes	8	40.00
No	12	60.00
Level of cervical emptying		
II, III and IV	4	50.00
II, III, IV and V	2	25.00
IV	1	12.50
II, VI	1	12.50
Anatomopathological		
Goiter	9	45.00
papillary carcinoma	11	55.00

Descriptive analysis

**Subtitle:** n = Absolute frequency; % = Relative frequency

Family history of thyroid cancer was the most frequent risk factor in this study. The genetic basis of thyroid cancer is not fully understood<sup>(3)</sup>.

Total resection of the thyroid was the most common surgical approach, without neck dissection, whose anatomopathological examination indicated papillary carcinoma. This is the most frequent histological type<sup>(1)</sup>, whose tumor is derived from follicular cells, responsible for the synthesis of thyroid hormone<sup>(1,3)</sup>. Total resections in the Brazilian National Health Service (SUS) tend to be larger due to the long waiting period for diagnosis. The average in the study is 40 months about 1200 days, as opposed to the 200 days for cancer treatments as estimated by SUS<sup>(26)</sup>.

The perception of symptoms by patients with thyroid cancer is an alert factor in the search for diagnosis and treatment, in addition to being related to adherence to treatment and medical conduct. The perception is subjective and considers the physical, emotional, social and quality of life factors of individuals<sup>(27)</sup>. One way to understand the patient's perception of symptoms is through self-assessment<sup>(15)</sup>.

It is believed that VoiSS, VFI and TVSQ, used together, are able to cover the global scope of vocal, fatigue and oropharyngolaryngeal symptoms that are most frequent in patients with thyroidectomy.

Women had higher scores than men in the total number of factors and vocal symptoms of self perception of symptoms related to thyroidectomy measured with the TVSQ, and in the factor fatigue and vocal limitation measured with the VFI. TVSQ still does not have a cutoff point. It was found that women had scores above the cutoff point of the VFI which indicates a risk for dysphonia, contrary to what was found in men whose values were within the normal range<sup>(12)</sup>. Some general discussions for the difference between genders should be raised, such as the fact that women as opposed to men have better self-perception of anatomical factors related to laryngeal ossification and a greater susceptibility to mechanical trauma, which may explain the occurrence of more general symptoms and vocal disorders related to thyroidectomy, as well as greater fatigue and vocal limitation<sup>(11,20)</sup>.

The general and vocal symptoms related to thyroidectomy seem to be greater in the immediate postoperative period than in relation to later stages; whereas the general vocal symptoms and the limitation of vocal use resulting from the symptoms seem to be greater in the immediate postoperative period as well as in the preoperative period.

The TVSQ was recently adapted to Brazilian Portuguese and as already mentioned does not yet have a cutoff point. In the total domain of the VOiSS we find that at all times the vocal symptom scores are above the cutoff point of the instrument, indicating that the risk for dysphonia related to general vocal symptoms remains even after surgery, however in the late postoperative period the values are already very close to those expected for healthy voices<sup>(16,17)</sup>. As for the limitation of activities generated by vocal symptoms, it was found that the scores in the late postoperative period are already within the normal range<sup>(16,17)</sup>. Such data is important, because it shows that despite the maintenance of the perception of vocal symptoms still being in the borderline range, it reduces and no longer brings limitations to the daily activities of individuals in the late postoperative period.

It is believed that the increase in general symptoms and vocal limitations immediately after surgery resulting in voice changes are associated with surgery and orotracheal intubation, which makes the anterior region of the neck uncomfortable<sup>(10,11,18)</sup>, which may influence the functionality of vocal usage. A previous study showed that patients with head and neck cancer, regardless of vocal complaints, have high VOiSS scores after a surgical procedure<sup>(28)</sup>. In addition it was seen that the total and vocal symptoms related to thyroidectomy appear to reduce in the late postoperative period, confirming the aforementioned information regarding the association with procedures related to the surgical procedure of thyroidectomy.

On the other hand vocal symptoms in the physical domain and oropharyngolaryngeal symptoms related to thyroidectomy appear to be present from the moment of presurgery, and remain during the immediate postoperative period, reducing only in the late postoperative period. The physical symptoms score corroborates this information, pointing out that the reduction in the late postoperative period makes the central tendency of the scores within the normal range<sup>(13)</sup>.

With regard to the physical domain of the VOiSS and the oropharyngolaryngeal domain of the TVSQ, which appear before surgery and reduces only in the late postoperative period, it is believed that it may be associated with a reduction in the compression of the tumor mass<sup>(6,7)</sup> and the normalization of these areas surrounding those of the surgical process. After the removal

**Table 3.** Analysis of self-assessment of vocal symptoms according to time of assessment and gender

Factor VOISS	Gender	M1		M2		M3		Total		Factor	df	F	p-value	post hoc
		Average	SD	Average	SD	Average	SD	Average	SD					
Total	Female	41.25	27.58	52.38	20.79	21.25	14.68	38.29	3.88	Moment	1	4.871	0.041*	M1 = M3 (p<0,001) < M2 (p=0,013)
	Male	16.75	8.38	53.50	22.75	6.00	4.69	25.42	7.75	Moment * Gender	1	0.441	0.515	
Limitation	Total	36.35	26.70	52.60	20.57	18.20	14.59	31.85	4.33	Gender	1	1591.350	0.155	M1 = M3 (p<0,001) < M2 (p=0,001)
	Female	21.69	15.09	31.31	12.95	12.50	9.56	21.83	2.45	Moment	1	4.438	0.049*	
Emotion	Male	7.50	4.43	32.75	13.72	3.00	2.58	14.42	4.89	Moment * Gender	1	0.521	0.480	M3 < M1 (p=0,006) = M2 (p<0,001)
	Total	18.85	14.72	31.60	12.75	10.60	9.41	18.13	2.73	Gender	1	528.067	0.192	
Physique	Female	6.81	8.81	9.00	7.55	2.88	4.16	6.23	1.18	Moment	1	0.659	0.427	M3 < M1 (p=0,006) = M2 (p<0,001)
	Male	1.50	1.91	9.75	7.93	1.50	1.00	4.25	2.36	Moment * Gender	1	0.659	0.427	
Total	Total	5.75	8.16	9.15	7.41	2.60	3.76	5.24	1.32	Gender	1	37.604	0.463	M3 < M1 (p=0,006) = M2 (p<0,001)
	Female	12.75	6.18	12.06	3.73	5.88	4.69	10.23	0.84	Moment	1	13.292	0.002*	
Total	Male	7.75	3.30	11.00	3.37	1.50	1.29	6.75	1.69	Moment * Gender	1	0.030	0.864	M3 < M1 (p=0,006) = M2 (p<0,001)
	Total	11.75	6.01	11.85	3.60	5.00	4.57	8.49	0.94	Gender	1	116.204	0.082	

ANOVA paired measures and Tukey's test; \*p-significant

**Subtitle:** VoiSS = Voice Symptom Scale; SD = Standard deviation; df = Degrees of freedom; F = Fisher-Snedecor statistic; M1 = Time of preoperative thyroidectomy; M2 = Immediate postoperative moment with a period of up to eight days after thyroidectomy; M3 = Late postoperative period with a period of three to six months after thyroidectomy; post hoc = Chance relationship of two events

**Table 4.** Analysis of self-assessment of general vocal complaints and representative symptoms (TVSQ) with recommendation for, or undergoing thyroidectomy depending on the time of assessment and gender

Factor TVSQ	Gender	M1		M2		M3		Total		Factor	df	F	p-value	post hoc
		Average	SD	Average	SD	Average	SD	Average	SD					
Total	Female	33.00	19.73	39.00	15.65	16.88	17.22	29.63	3.26	Moment	1	4.604	0.046*	M3 < M2 (p=0,001)
	Male	12.25	8.10	23.75	5.12	5.50	3.70	13.83	6.52	Moment* Gender	1	0.773	0.391	
	Total	28.85	19.76	35.95	15.39	14.60	16.06	21.73	3.65	Gender	1	2394.017	0.044*	
Vocal Symptoms	Female	18.56	10.789	22.81	8.66	9.94	9.64	17.10	1.83	Moment	1	5.775	0.027*	M3 < M2 (p=0,001)
	Male	4.75	2.500	10.25	2.36	2.00	1.63	5.67	3.65	Moment* Gender	1	1.541	0.230	
	Total	15.80	11.181	20.30	9.31	8.35	9.19	11.39	2.04	Gender	1	7.842	0.012*	
Oropharyngeals symptoms	Female	8.94	4.582	9.56	5.37	4.38	5.06	7.63	0.97	Moment	1	8.429	0.009*	M3 < M2 (p=0,004) = M1 (p=0,028)
	Male	5.25	3.594	7.25	4.35	1.00	0.82	4.50	1.95	Moment * Gender	1	0.011	0.919	
	Total	8.20	4.572	9.10	5.16	3.70	4.71	6.06	1.09	Gender	1	2.056	0.169	
Discomfort in swallowing, breathing and cervico-thoracic region	Female	5.38	5.830	6.63	4.80	2.50	3.79	4.83	0.83	Moment	1	0.717	0.408	M3 < M2 (p=0,004) = M1 (p=0,028)
	M	2.25	2.630	6.50	4.20	2.25	2.06	3.67	1.65	Moment * Gender	1	0.717	0.408	
	Total	4.75	5.437	6.60	4.58	2.45	3.47	4.25	0.92	Gender	1	0.400	0.535	

Paired measures ANOVA and Tukey's test; \*p-significant

**Subtitle:** SD = Standard deviation; df = Degrees of freedom; F = Fisher-Snedecor statistic; M1 = Time of preoperative thyroidectomy; M2 = Immediate postoperative moment with a period of up to eight days after thyroidectomy; M3 = Late postoperative period with a period of three to six months after thyroidectomy; post hoc = Chance relationship of two events

**Table 5.** Analysis of self-assessment of vocal fatigue symptoms according to the time of assessment and gender

Factor VFI	Gender	M1		M2		M3		Total		Factor	df	F	p-value	post hoc
		Average	SD	Average	SD	Average	SD	Average	SD					
Total	female	28.81	17.98	37.81	17.04	19.25	11.14	28.63	2.69	Moment	1	1.685	0.211	
	Male	14.25	8.26	22.75	6.85	11.25	7.93	16.08	5.38	Moment *	1	0.460	0.506	
	Total	25.90	17.37	34.80	16.58	17.65	10.90	22.35	3.01	Gender	1	1510.017	0.052	
Fatigue and vocal limitation	Female	12.25	9.31	16.69	8.75	7.50	7.39	12.15	1.57	Moment	1	1.257	0.277	
	Male	2.75	2.22	7.25	3.59	2.50	1.73	4.17	3.14	Moment *	1	1.018	0.326	
	Total	10.35	9.19	14.80	8.81	6.50	6.92	8.16	1.75	Gender	1	611.204	0.035*	Female > Male (p=0,035)
Vocal restriction	Female	4.94	4.40	7.63	4.01	3.56	3.05	5.38	0.67	Moment	1	1.120	0.304	
	Male	3.00	1.15	5.25	1.50	1.75	1.26	3.33	1.33	Moment *	1	0.003	0.960	
	Total	4.55	4.02	7.15	3.75	3.20	2.86	4.35	0.74	Gender	1	40.017	0.187	
Physical discomfort associated with voice	Female	5.13	5.20	7.06	5.26	3.00	2.76	5.06	0.83	Moment	1	1.483	0.239	
	Male	4.25	4.19	4.75	3.77	3.00	3.83	4.00	1.65	Moment *	1	0.100	0.756	
	Total	4.95	4.93	6.60	5.00	3.00	2.88	4.53	0.92	Gender	1	10.838	0.572	
Recovery with vocal rest	Female	8.44	4.00	8.75	4.07	9.00	3.52	8.73	0.84	Moment	1	0.243	0.628	
	Male	8.25	2.06	8.00	5.48	8.50	2.08	8.25	1.68	Moment *	1	0.036	0.852	
	Total	8.40	3.65	8.60	4.24	8.90	3.24	8.49	0.94	Gender	1	2.204	0.801	

Paired measures ANOVA and Tukey's test; \*p-significant

**Subtitle:** SD = Standard deviation; df = Degrees of freedom; F = Fisher-Snedecor statistic; M1 = Time of preoperative thyroidectomy; M2 = Immediate postoperative moment with a period of up to eight days after thyroidectomy; M3 = Late postoperative period with a period of three to six months after thyroidectomy; post hoc = Chance relationship of two events

of the mass that compresses the upper digestive tract<sup>(6,7)</sup> there is a reduction in physical symptoms and functional limitations, which in parallel with healing provides an improvement in the self-perception of vocal symptoms in the late postoperative period<sup>(29)</sup>, with values approaching or entering the normal range. However despite this some symptoms still persist, which has previously been pointed out<sup>(8,14)</sup>.

It is worth noting that in cases of malignancy of thyroid tumors, treatment with iodine therapy is recommended<sup>(1,3)</sup>. One of the main alterations in the aerodigestive tract is xerostomia<sup>(1,3,7)</sup>. However in this study none of the subjects were undergoing iodine therapy.

In general, the results indicated that there was a greater perception of general vocal physical symptoms and vocal limitation, as well as general vocal and oropharyngolaryngeal symptoms related to thyroidectomy immediately after surgery, probably related to post-intervention edema<sup>(7)</sup>. The real cause of the symptoms is difficult to determine and is probably multifactorial<sup>(11)</sup>.

Changes in vocal symptoms are dynamic and variable<sup>(8)</sup>, probably brought about by post-intubation laryngeal edema altering the venous and vascular supply<sup>(11)</sup>. There may also be a relationship with surgery, for example stitches and suturing of structures. Due to the location of the thyroid, surgery can affect the oropharyngolaryngeal region and the cervico-thoracic region, influencing voice, swallowing and breathing. It is also important to point out that due to the proximity of the laryngeal nerve and the thyroid gland region, complications may occur that generate temporary or permanent alterations in the mobility of the vocal folds<sup>(30)</sup>.

The data presented in this study shows the presence of vocal symptoms in the physical and oropharyngolaryngeal scope from

the presurgery moment and the increase in symptoms, mainly related to thyroidectomy in the immediate postoperative period, which shows the need for a speech therapist<sup>(1,3)</sup> to be part of the head and neck surgical team that accompany longitudinal follow-ups of patients with thyroid cancer.

This study had limitations regarding the absence of a control group. It is suggested that future studies compare the follow-up of different types of treatment in patients with thyroid cancer to better understand the effects related to the disease and the surgical procedure, as well as a follow-up of up to 12 months from the moment of surgery.

## CONCLUSION

Physical vocal symptoms and thyroidectomy-related symptoms decrease in the late postoperative period; total vocal symptoms and limitation increasing in the immediate postoperative period and decrease in the late postoperative period. Women have a higher perception of vocal fatigue and limitation, and total and vocal symptoms related to thyroidectomy.

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