

# AUDITORY-VOCAL PERCEPTUAL RESULTS AFTER THYROPLASTY TYPE I AND VOICE THERAPY IN A CASE OF VOCAL FOLD PARALYSIS

## *Resultados vocais perceptivoauditivos após tireoplastia tipo I e fonoterapia em um caso de paralisia de prega vocal*

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### ABSTRACT

To verify the auditory-vocal perceptual modifications after surgical intervention and voice therapy. Case report of man is 32 years old, with the right vocal fold paralysis due to traumatic brain injury by a firearm, subjected thyroplasty type I and six sessions of therapy. Auditory perceptual voice evaluation of spontaneous speech by RASATI scale and aspects: pitch and resonance, performed before and after surgery and after voice therapy. The audios were analyzed by three speech therapists with experience in voice and analyzes were considered together to determine the judgment prevalent in each parameter. The voice therapy consisted of: method of overarticulation, lip constriction and cardinal points with the tongue. After surgery, there was improvement in breathiness (moderate degree became discrete), asthenia (discreet became normal), tension (moderate became discrete) and pitch (discreet became normal); worsening of hoarseness aspect (discreet became moderate) and there were no modifications in the instability (remained moderate), hypernasal resonance (remained intense), roughness (normal). After voice therapy, showed improvement in the hoarseness (moderate became normal) and instability (moderate became discrete). Other aspects showed no modifications. The thyroplasty type I, improved the auditory-vocal perceptual aspects of breathiness, asthenia, tension and pitch and worsened hoarseness without influencing the instability and resonance, and the voice therapy improved aspects of hoarseness and instability. Thus, it is emphasized the importance of voice therapy after laryngeal surgeries.

**KEYWORDS:** Dysphonia; Voice Disorders; Speech, Language and Hearing Sciences; Voice

### ■ INTRODUCTION

The vocal production is considered a dependent neurophysiological function of a number of roads that connect the laryngeal muscles and the corresponding brain areas, being a complex activity that requires the interaction of the different levels of the Central Nervous System (CNS) and Peripheral Nervous System (PNS), in addition to scheduled and coordinated action of sensory receptors<sup>1-3</sup>.

Accordingly, changes in the CNS and PNS can result in disturbances in muscular control over the mechanisms of speech articulation, and may cause paralysis, weakness or incoordination of the speech muscles, setting the medical condition called dysarthria or dysarthrophonia<sup>1,2,4</sup>.

Disartrofonias are motor speech disorders of neurological arising origin of central and / or peripheral disorders of muscle control<sup>3</sup>. They refer to the motor execution problems that can compromise beyond the vocal production, breathing, resonance, articulation and prosody<sup>3,4</sup>.

Injury to the CNS or PNS may also affect the motor command for the movement of the vocal folds, setting the vocal fold paralysis, which may

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be unilateral or bilateral and affect the recurrent laryngeal nerve, superior laryngeal or both<sup>5</sup>. The paralysis of the vocal folds can further aggravate the box dysarthrophonia because besides affecting voice quality, reduces lower airway protection (inability to produce cough) with increased risk of aspiration of food<sup>2,5,6</sup>, requiring the performance of voice therapy.

The vocal speech therapy is one way of treating dysarthrophonia and seeks to bring all the aspects that are altered, such as those related to articulation, breathing, resonance, prosody and phonation<sup>2,3,6,7</sup>. However, there are cases that only speech therapy is not able to correct the difficulties of producing voice and speech, resulting from injury to the nervous system and it is required surgical procedures such as Thyroplasty Type I<sup>2,7,8</sup>.

The Isshiki thyroplasty type I is a reversible surgical procedure used in cases of unilateral vocal fold paralysis in abduction position and consists of the displacement on the paralyzed vocal fold to the medial position<sup>2,5,7-9</sup>. The benefit of this surgery is related to the reduction of breathiness, improving glottal closure and providing a properly phonation<sup>2</sup>.

The speech therapist for vocal rehabilitation, after surgery, is essential for the rehabilitation of the aspects that are altered<sup>2,7,10</sup>. Therefore, it is necessary to adopt the audiologist parameters vocal assessment, so it is possible to compare and observe the evolution before and after the therapy, such as perceptual evaluation of the voice, which is essentially based on the evaluator's impression about the voice<sup>2,3,6</sup>.

The perceptual evaluation of vocal patient is a subjective evaluation, in which, through the scale of some parameters such as: voice, focus resonance, pitch, loudness, pitch modulation and loudness, pneumophonoarticulatory coordination, helps on the characterization of voice quality. A frequently used scale is an adaptation translated into Brazilian Portuguese of Japanese graduated scale GRBASI<sup>11</sup>, called RASATI (R hoarseness, A: roughness, S: breathiness, A: asthenia, I: instability), and through consensus between the auditory judgment with physiological findings that best elucidates the acoustic characteristics considered for the classification of roughness and hoarseness, and may be applied in cases of dysarthrophonia<sup>12</sup>.

Based on the above, the objective of this study was to verify the perceptivoauditivas vocal changes in pre and post-implementation of type I thyroplasty and speech therapy in a patient with paralysis of the right vocal fold.

## ■ CASE PRESENTATION

The research was characterized because it is a case of a longitudinal and quantitative character. The participant received the necessary clarifications about the study and signed the Instrument of Consent Form (ICF) as the standard 196/96 recommendations of the National Commission for Ethics in Research. The research was part of a parent project, approved by the Research Ethics Committee under protocol number 23081.016945 / 2010-76.

This case is a report of a male patient, 32 years old, 1.75m tall and 68Kg, who attended the Voice department of a school-clinic with the complaint of Speech 'could not speak'. The patient reported changes in voice and speech, frequent coughing, voice failures, fatigue and difficulty speaking, symptoms that began after suffering head trauma resulting from a shot gun.

In otorhinolaryngological appraisal before the speech therapy, the report was "mobility alteration right vocal fold (paralysis), mobility alteration soft palate and tongue to the left, suggesting injury to the jugular foramen level (cranial nerves IX, X and XI). "

For perceptual evaluation, a sample of spontaneous speech was recording for at least a minute and it was performed in three stages: before the surgery (M1), immediately after surgery (M2) and after six sessions of speech therapy vocal: for auditory perceptual assessment, recording a sample of spontaneous speech, for at least a minute, was carried out in three stages (M3).

The collections of the three voice samples were carried out in an environment with noise level below 50dB, verified by the sound pressure meter Instrutherm, Dec Model - 480<sup>6,13,14</sup>. For the issue of spontaneous speech, the subject was asked to answer the question "What do you think of your voice?", remaining in the standing position with outstretched arms along the body, supported on both feet, in usual pitch and loudness<sup>13-15</sup>. The vocal emissions were recorded with Behringer microphone (unidirectional, 96 kHz, 16 bits) coupled to a professional digital recorder brand Zoom H4n model, positioned at an angle of 90 ° from the subject's mouth, keeping a distance of ten centimeters between the microphone and mouth<sup>15-18</sup>.

The perceptual voice evaluation was performed by three speech therapists with experience in voice, individually, they were not aware of the research objectives and that these were several samples of the same subject, also they don't have the knowledge of the evaluations carried out by other speech therapists. The judges received vocal recordings, along with the vocal guidance and protocols by e-mail, and were instructed to listen to the voices many times

as necessary<sup>19</sup>. The evaluation was performed by RASATI scale that evaluates the parameters of hoarseness (H), roughness (R), breathiness (B), asthenia (A), tension (T) and instability (I). Two parameters have been included for evaluation: pitch and resonance. For each of the items of the scale, there were attributed different degrees of deviation: 0 = normal, when no vocal deviation is perceived by the listener; 1 = to a slight deviation, or in case of doubt whether the deviation is present or not; 2 = moderate, when the deviation is evident and 3 = for extreme deviations vocals<sup>5,12,20</sup>. The three speech assessments were considered together to determine the prevailing judgment in each parameter range<sup>10,20,21</sup>.

Between M1 and M2, the patient underwent thyroplasty surgery for type I to medialization of the right vocal fold. Among M2 and M3, the vocal therapeutic process was performed, which lasted six sessions of forty-five minutes, held weekly. For each exercise, three sets of fifteen repetitions were performed<sup>22</sup>. At the end of each series, the subject had a range of 30s of passive rest (absolute silence)<sup>14,22-25</sup>. The patient was also instructed to

perform the techniques at home four times a week. The exercises performed were: method sobreaticulação, lip constriction and cardinal points with the language.

Data were tabulated, and the variables were analyzed descriptively.

## ■ RESULTS

In perceptual voice analysis before therapy was shown the following: slight hoarseness, breathiness moderate, mild asthenia, moderate tension, moderate instability, high pitch discreet and hypernasal resonance.

After surgery, there were improvement in breathiness (moderate to mild), asthenia (mild to normal), voltage (moderate to mild) and pitch (discreetly keen to normal); worsening of hoarseness aspect (discrete to moderate) and there weren't changes in instability (remained moderate) and resonance (hypernasal remained intense). After speech therapy, there were improvement in hoarseness (moderate to normal) and instability (moderate to mild) (Table 1).

**Table 1 – Descriptive analysis of qualitative variables RASATI scale in M1, M2 e M3**

	R	A	S	A	T	I	Pitch	Resonance
<b>M1</b>	Discrete	Normal	Moderate	Discrete	Moderate	Moderate	high discreet	Hypernasal remained intense
<b>M2</b>	Moderate	Normal	Discrete	Normal	Discrete	Moderate	Normal	Hypernasal remained intense
<b>M3</b>	Normal	Normal	Discrete	Normal	Discrete	Discrete	Normal	Hypernasal remained intense

Legend: M1=moment one (before the surgery); M2=moment two (immediately after surgery); M3=moment three (after six sessions of speech therapy vocal); R=hoarseness, A=roughness, S=breathiness, A=asthenia, T=stress; I=instability.

## ■ DISCUSSION

The etiology of neurological or dysarthrophonia dysphonia is multifactorial and may result from any lesion or abnormality of the peripheral or central components of the nervous system involved in the production of voice and speech<sup>2,4</sup>. The main causes are traumatic disorders that have as a triggering factor automobile disaster, fall, sports accident or firearm<sup>2,6</sup>. This fact can be observed in this case because, after injury by firearm and injury to the cranial nerves, the patient developed dysarthrophonia.

In order to evaluate the speech quality at both the source and the vocal filter used the perceptual analysis of speech through RASATI scale, which provides the description of the acoustic signal through the hearing aids, since the identification of severity of dysphonia, is one speech therapy practice widely used to detect changes, and assist the verification of therapeutic evolution<sup>6,26</sup>. Studies using a perceptual analysis to other populations underscore the scales using the human ear are important tools in the identification of vocal quality<sup>24,25,27</sup>.

The literature suggests that the main types of voices presented by patients with dysarthrophonia

associated with vocal fold paralysis are voice quality hoarse, breathy and rough<sup>2</sup>. The study confirmed that the voice quality of subjects with vocal fold paralysis in different positions found predominance of hoarseness, roughness and tension; breathiness, asthenia and general instability and high degree of vocal deviation<sup>26</sup>. In the present study, it was found in M1 hoarseness mild, moderate breathiness, but the absence of roughness. Additionally, other aspects were changed as asthenia (mild), stress (moderate), and instability (moderate) and slightly sharpened pitch (Table 1).

The resonance of the voice can also be altered with the presence of hypernasality, which can impair speech intelligibility in various degrees<sup>2</sup>, agreeing with the present study in which the patient presented in M1 abnormal resonance (hypernasal intense). Hypernasality is due to the velopharyngeal dysfunction, which promotes nasal resonance of oral phonemes by the lack of seal between the oral and nasal cavity<sup>28</sup>, occurring in M1, M2 and M3 due to the change of mobility of the soft palate resulting from injury to the vagus nerve (IX).

The early referral for speech rehabilitation helps to decrease the development of vocal and laryngeal compensations considered negative for voice production<sup>2,29</sup>. It is noteworthy that the speech therapy becomes important pre and post-surgery. The therapeutic work with vocal techniques, vocal hygiene and psychodynamic helps the patient avoid behaviors hyperfunctional compensation, perfect breathing and abdominal support and improve the strength and mobility of the intrinsic muscles of the larynx<sup>10</sup>.

Based on the results of this study, it was found that medialization of vocal folds from surgery thyroplasty type I, which provides a greater glottal closure, reduced breathiness due to the reduction of air leakage during phonation, decreasing the asthenia and hence the tension, possibly generated by compensatory effort during coaptation of the vocal folds. Moreover, the heightened pitch also showed improvement. Study that used pre and post-perceptual speech therapy with 13 patients with mobility disorders of the vocal folds found similar results, with improvement of the pitch in two patients (15.4%)<sup>10</sup>.

However, after surgery, there was a worsening of hoarseness aspect (mild to moderate), which can be justified by the fact that medialization have increased the glottal closure, but, due to unilateral paralysis, there was presence of aperiodicity vibration, generating increased noise. Still, this data can be enhanced with the results found in M1, which was classified with hoarseness and breathiness

mild to moderate, while the opposite occurred after surgery.

After speech therapy, there was improvement in hoarseness (moderate to normal) and instability (moderate to mild). These results emphasize the importance of performing vocal techniques after surgery, as they provide the reduction of aperiodicity vibration, reducing noise and vocal instability, and consequently, diminished hoarseness. Perceptivoauditivas work that analyzed the characteristics of subjects with paralyzed vocal folds before and after speech therapy through GRBASI scale, found that after speech therapy improvements were evident in breathiness aspects, the degree of dysphonia and asthenia. Also found improvement in roughness aspect, encompassing hoarseness and roughness, after speech therapy, although not statistically significant, which may be related to improvement in the frequency of glottal closure<sup>6</sup>.

The approach of the paralyzed vocal cord midline through thyroplasty type I, accompanied by therapeutic process, accelerates the rehabilitation of the patient and allows a functional or near normal voice production. The phonotherapy treatment seeks compensatory glottal closure, in which the healthy vocal fold must cross the midline and approach the paralyzed, providing better coaptation and, consequently, greater balance between aerodynamic forces and lung myoelastic laryngeal<sup>10,29</sup>.

A study conducted pre and post-acoustic speech therapy in a subject with unilateral vocal fold paralysis found similar results, noting a decrease in the frequency disturbance (PPQ), the disturbance intensity (APQ), the noise-harmonic ratio (NHR) and the variation of the fundamental frequency (vF0), suggesting decreased noise and improves frequency of vibration of the vocal folds after therapy<sup>10</sup>.

It is possible to get good results in a few sessions of physical therapy from the compensation mechanism of the healthy vocal fold, extrinsic muscles of the larynx, pneumophonic greater control and development of the remaining fibers of the paralyzed vocal fold<sup>10,26</sup>. It is noted that, in the literature, there is still no consensus on the number of sessions for the treatment of dysarthrophonia, so that the average session variable is found in the work, and studies estimate that between eight and twelve sessions<sup>6,10</sup> and beacon guide treatment time in Speech<sup>30</sup> suggests the realization of 24 sessions that range from one to three times per week and high assisted.

In this report, the patient underwent six sessions and gave up after therapy, justifying that the improvement obtained was sufficient for his social life. However, it is emphasized that, although it was

a few sessions, it became clear improvement in voice quality after surgery and speech therapy.

Research that also held the perceptual evaluation of the voice of subjects diagnosed with vocal fold paralysis by GRBAS, found improvement in voice quality after speech therapy in nine (69.2%) of participants<sup>10</sup>. These findings reinforce those found in this research.

In therapy, specific exercises are used to alter the pattern of poor vocal production, causing patients to adapt to the new conditions generated by paralysis<sup>5,10</sup>. In a similar study, the researchers used in the treatment for vocal fold paralysis, the following techniques: / b / prolonged yawn / sigh broadcasting of musical scales, "humming", vocal tract exercises, inspiratory phonation,

issuing fricative and vibrant thrust, attack of sudden vocal maneuver, change in posture, breathing training and vocal fry<sup>10</sup>.

## ■ CONCLUSION

After thyroplasty type I (M2), there was improvement in breathiness, asthenia, strain and pitch; worsening of hoarseness aspect and no changes in instability and resonance. After speech therapy (M3), there was improvement in hoarseness and instability. Thus, it is considered that the interdisciplinary treatment of Otorhinolaryngologist and Speech therapist are complementary and yield better results when integrated in cases of unilateral vocal paralysis.

## RESUMO

Verificar as modificações vocais perceptivoauditivas após intervenção cirúrgica e fonoterapêutica. Relato de caso de homem de 32 anos de idade, com paralisia de prega vocal direita decorrente de traumatismo cranioencefálico por arma de fogo, submetido à Tireoplastia tipo I e a seis sessões de fonoterapia. Avaliação vocal perceptivoauditiva da fala espontânea por meio da escala RASATI e dos aspectos: *pitch* e ressonância, realizada antes e após a cirurgia e após a fonoterapia. Os áudios foram analisados por três fonoaudiólogas com experiência em voz e as análises foram consideradas em conjunto para determinar o julgamento predominante em cada parâmetro. A fonoterapia consistiu em: método de sobrearticulação, constrição labial e pontos cardeais com a língua. Após a cirurgia, houve melhora da soproidade (de grau moderado ficou discreto), astenia (de discreto ficou normal), tensão (de moderado ficou discreto) e *pitch* (de discretamente grave ficou normal); piora do aspecto rouquidão (de discreto ficou moderado) e não houve modificações na instabilidade (permaneceu moderado), ressonância hipernasal (permaneceu intenso), aspereza (normal). Após a fonoterapia, houve melhora da rouquidão (de moderado ficou normal) e da instabilidade (de moderado ficou discreto). Os demais aspectos não apresentaram modificações. A Tireoplastia tipo I melhorou os aspectos vocais perceptivoauditivos de soproidade, astenia, tensão e *pitch* e piorou a rouquidão, sem influenciar a instabilidade e a ressonância; e a fonoterapia melhorou os aspectos de rouquidão e instabilidade. Com isso, enfatiza-se a importância da fonoterapia após cirurgias laringeas.

**DESCRITORES:** Disfonia; Distúrbios da Voz; Fonoaudiologia; Voz

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