Case report

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Evaluation of speech before and after speech therapy associated with ultrasound biofeedback of tongue and bucomaxillofacial prosthesis in oral cavity cancer

Avaliação da fala pré-tratamento e pós-tratamento fonoaudiológico associado ao *biofeedback* ultrassonográfico de língua e de prótese bucomaxilofacial no câncer de cavidade oral

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ABSTRACT

The oral maxillofacial prostheses (PBMF) aim the oral rehabilitation of patients with mutilations resulting from oral cancer surgery. The oral rehabilitation was composed of speech therapy associated with ultrasound biofeedback of the tongue, which allows better precision in speech production. The present study aims to characterize the speech production of an individual with a history of multiple oncological surgeries with total glossectomy with the aid of an individualized acrylic device, designed based on the partnership between Dentistry and Speech Therapy and made by a prosthetic dentist, undergoing therapy and speech therapy with visual biofeedback by ultrasound. The individual is a 45-year-old man, retired teacher with a history of tongue squamous cell carcinoma with episodes of recurrence. The cancer treatment was performed by several surgeries associated with radiotherapy over seven years. This treatment resulted in total glossectomy and the presence of osteoradionecrosis (ORN) of the mandible. The sequel to radiotherapy also required multiple surgical approaches with loss of a large part of the jaw, causing severe impairment of swallowing and speech functions. During the multidisciplinary care provided by the Dentistry and Speech Therapy team at a university hospital. The creation of an individualized acrylic device was conceived, aiming to improve the speech intelligibility of the patient. This device was made by a prosthetic dentist and adjusted together with the Speech Therapy team. With the adapted acrylic device, the individual started speech therapy associated with biofeedback by means of tongue ultrasound with the aim of promoting the refinement of the speech production of the fricative headphones [s] and [ʃ]. When comparing the pre-therapy and post-therapy assessment (after the analysis of the speeches by judges) it was possible to identify an improvement in the Percentage of Consonants Correct (PCC) from moderately-severe to slightly-moderate, as well as speech intelligibility from insufficient to regulate. The individualized device with speech therapy associated with biofeedback produced satisfactory speech results, considering the severity of the case and the high degree of mutilation of the patient.

Keywords: Head and Neck Neoplasms; Glossectomy; Speech disorders; Ultrasonography; Rehabilitation

RESUMO

As próteses bucomaxilofaciais (PBMF) têm como objetivo a reabilitação oral de pacientes com mutilações decorrentes de cirurgias de câncer de boca. Como parte dessa reabilitação oral, a terapia fonoaudiológica associada ao *biofeedback* ultrassonográfico da língua possibilita melhor precisão da produção de fala. O presente estudo teve por objetivo caracterizar a produção de fala de um indivíduo com histórico de múltiplas cirurgias oncológicas que levaram à glossectomia total, com auxílio de um dispositivo individualizado de acrílico, idealizado a partir da parceria Odonto-Fonoaudiologia da instituição e confeccionado por especialista em PBMF e terapia fonoaudiológica, utilizando o *biofeedback* visual com ultrassonografia. O indivíduo era homem, 45 anos, professor aposentado com histórico de carcinoma epidermóide de língua com episódios de recidiva. Como tratamento oncológico, foram realizadas diversas cirurgias associadas à radioterapia, ao longo de sete anos. O tratamento oncológico culminou com a glossectomia total e instalação de osteorradionecrose de mandíbula. O tratamento desta sequela da radioterapia também exigiu múltiplas abordagens cirúrgicas, com perda de grande parte da mandíbula, levando ao severo comprometimento das funções de deglutição e fala. Durante o atendimento multiprofissional da equipe Odonto-Fonoaudiologia de um hospital universitário, foi idealizada a confecção de um dispositivo individualizado de acrílico, objetivando melhorar a inteligibilidade da fala do paciente. Tal dispositivo foi confeccionado por dentista especialista em PBMF e ajustado em conjunto com a equipe de Fonoaudiologia. Com o dispositivo de acrílico adaptado, o indivíduo iniciou a terapia fonoaudiológica associada ao *biofeedback*, por meio da ultrassonografia de língua, com o objetivo de promover o refinamento da produção de fala dos fones fricativos [s] e [ʃ]. Ao comparar a avaliação pré-terapia e pós-terapia, foi possível identificar, após a análise das falas por juízes, melhora quanto à Porcentagem de Consoantes Corretas, de moderadamente severa para levemente moderada, bem como a inteligibilidade de fala, de insuficiente para regular. O dispositivo individualizado com a terapia fonoaudiológica associada ao *biofeedback* produziram resultados de fala satisfatórios, considerando-se a gravidade do caso e o elevado grau de mutilação do paciente.

Palavras-chave: Neoplasias de cabeça e pescoço; Glossectomia; Distúrbios da fala; Ultrassonografia; Reabilitação

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INTRODUCTION

Epidemiologically, it is acknowledged that oral cancer (OC) most frequently affects the male population from 40 years of age, due to several risk factors such as smoking, alcoholism, the human papilloma virus (HPV) and the genetic predisposition.

Data from the Brazilian National Cancer Institute (INCA) [1] indicate, for 2018, that the most frequent OC is squamous cell carcinoma, most of which affecting the tongue, varying around 32% of the cases; the oropharyngeal cancer, with around 18% of occurrence, and, finally, the floor of the mouth, with around 12%.

OC and its treatments can cause numerous undesirable and/or irreversible consequences in the stomatognathic system, depending on the type of medical treatment performed. Among these outcomes, surgical defects, xerostomia, tissue fibrosis, bone tissue necrosis, trismus and dysphonia stand out, beyond other factors that compromise the individual's quality of life[2].

With regard to surgical treatment, the literature demonstrates that a greater volume of tissue resected in the oral cavity is associated with a better life prognosis, but also with a worsening in speech and swallowing function. Segmental mandibular resections have a significant impact on swallowing efficiency and can affect speech production by disrupting the integrity and mobility of articulators. Segmental mandibular resection usually occurs in conjunction with extensive or posterior resections of the tongue. To that end, it is likely that the worsening in function is related to the total volume of resected tissue and the percentage of the base of the resected tongue[3].

Adjuvant radiotherapy (RTx) is indicated in cases of extensive surgery for tumors with advanced stages in the tongue and tongue base, with impairment of the structures that make up the floor of the mouth and that require surgical safety margins that partially and/or fully encompass the mandibular arch further compromising the speech and swallowing functions[4]. Depending on the patient's degree of commitment to the disease, chemotherapy (QTx) can also be associated. Both treatments can cause important side effects, such as osteoradionecrosis (ORN), also known as avascular bone necrosis, radiation necrosis and/or ischemic bone necrosis, which is commonly associated with extensive surgeries, e.g. glossectomy and mandibulectomy.

This adjuvant treatment is indicated for these cases, given that surgical safety margins that partially and/or fully encompass the mandibular arch are necessary; otherwise, it further compromises the speech and swallowing functions[4].

The impact of surgical treatments associated with radiotherapy and chemotherapy for the treatment of head and neck cancer (HNC) is evident, especially in relation to speech. Thus, it is up to the speech-language pathologist to develop effective communication strategies, such as speech adaptation or alternative non-verbal communication, for the purpose of providing the subject with a relatively better quality of life, promoting independence for daily activities and for communication[5].

One of the options for adaptation and speech improvement occurs by means of oral and maxillofacial prostheses (OMFP), which allow both aesthetic and functional rehabilitation of patients with aftermath resulting from trauma, congenital or post-surgical malformations of HNC[6]. In the case of surgeries that involve the tongue, unusual prostheses are described, such as the ones for the tongue[7] and the "palate lowering" prostheses, which are more widespread.

Recently, biofeedback through ultrasound of the tongue has been introduced as a therapeutic tool in cases of glossectomized patients[8]. In this population, most studies include tongue ultrasonography associated with the characterization of speech production, involving patients with HNC[9,10]. Tongue ultrasound provides kinematic biofeedback, that is, a connection between tongue movement and the corresponding auditory signal. In such a way, biofeedback provides an internal focus that controls the direction, timing and strength of tongue movements, which produce a certain speech sound, and an external focus that can involve the subject's attention, with a view to result in an acoustic signal perceived by the speaker and his/her listener[11].

Blyth et al.[8] reported that ultrasound imaging, during speech tasks, allows patients to focus their attention on the tongue movement, learning the necessary adjustments to improve joint accuracy. The authors also highlighted that this is an advantageous process, as it allows the subject to achieve sound production with more elements approaching, to such a degree, natural speech, based on the structure resulting from glossectomy[8].

Based on literature data, there is a scientific scarcity on the real effectiveness of the use of OMFP in subjects considered as "therapeutic limit" in speech-language rehabilitation, as well as on the speech-language therapy practice associated with new assistive technologies in the rehabilitation process with the use of tongue ultrasound with visual biofeedback in glossectomized patients.

Considering the individual characteristics of post-surgical HNC patients and the particularities of the outcomes, there is great difficulty in recruiting individuals with similar characteristics, which allow the standardization of therapeutic protocols. Based on the above considerations, it is noteworthy that the present study aimed to characterize the speech production of an individual with a history of recurrent OC, treated with multiple surgeries and RTx cycles for the treatment of CA and osteoredianecrosis, using a device made by an OMFP specialist. In addition to that, it was proposed an intervention methodology using visual biofeedback with ultrasound.

CLINICAL CASE PRESENTATION

This research has been approved by the Ethics Committee on Research with Human Beings (CEPSH), linked to the Federal University of Santa Catarina - UFSC, with approval number 3.686.654 and CAAE 63084016.8.0000.0121. The research subject read and signed the Informed Consent Form (ICF).

Subject (A.) was male, 45 years old and a retired teacher. In 2007, A. was diagnosed with a malignant neoplasm of the tongue, left-sided, moderately differentiated squamous cell carcinoma type, and underwent the first surgical intervention – a left hemiglossectomy – with a history of two microsurgical reconstructions: the first one with pectoralis muscle flap and the second one with an arm muscle flap. The HNC surgery team in charge of the patient performed all the surgeries. In this case, adjuvant RTx was indicated, with 38 sessions and with a total radiation dose of 63 Gy by the Intensity Modulated Radiation Therapy (IMRT) technique (or Intensity Modulated Radiation Therapy). The results were considered satisfactory, the patient ate orally and underwent multidisciplinary follow-up at the reference cancer hospital; however, it was not possible

to obtain precise information about the therapeutic planning during this period.

In 2016, A. presented a new tumor and underwent one more surgical intervention of partial glossectomy and segmental mandibulectomy. In 2018, after a new recurrence, he underwent a total glossectomy and a new segmental mandibulectomy, with the retromolar and ascending ramus of the mandible (left side) and the lower premolars and molars (right side) remaining. Consequently, the patient underwent a new IMRT radiation protocol, with a total dose of 60 Gy.

After the oncological treatment of the recurrent primary lesion, the patient developed osteoradionecrosis (ORN) in the region of the left medial mandibular stump. Episodes of exacerbation of the ORN condition, associated with the lower blood supply resulting from RTx, caused the skin rupture on the face and the exteriorization of the bone stump. For this reason, a new surgery, now reconstructive plastic surgery, was performed with the aim of controlling the ORN and restoring the continuity of the facial skin.

The patient was kept under follow-up with a multidisciplinary team, including the speech-language therapist, throughout the medical treatment. The speech and language therapies, carried out in the service of origin, aimed to rehabilitate speech and swallowing to maintain oral feeding, through indirect and direct swallowing therapies, since A. ate through an alternative route. (nasoenteral probe).

The patient underwent an objective examination of swallowing (videofluoroscopy), performed by cause of the presence of clinical complications, e.g. aspiration pneumonia and poor evolution in speech-language rehabilitation with direct swallowing therapy. In the videofluoroscopy exam, it was possible to verify the presence of severe oropharyngeal dysphagia, with no possibility of reintroducing safe oral feeding considering the presence of silent aspiration of all consistencies, absence of airway protection reflex and/or effective cough. Ergo, we opted for the alternative route of long-term feeding (gastrostomy).

After his stabilization, in December 2018, A. was referred to the Dental Support Outpatient Clinic for Patients with OC, of the Hospital Dentistry Service / University Hospital - UFSC, for a new approach to the acute phase of mandible ORN and in view of the exposure of the remaining mandibular stump. Ten ozone therapy sessions were carried out, interspersed with photobiomodulation sessions (low power laser) in the soft tissue area around the exposed mandibular stump, associated with antibiotic therapy directed by antibiogram, with an improvement in the local clinical picture and absence of purulent drainage.

During the follow-up by the team of the Hospital Dentistry Center/University Hospital - UFSC, it was found that A. fed exclusively by gastrostomy, presenting accumulation of little saliva produced in the oral cavity and sialorrhea, together with eventual presence of phlegm and wet voice after saliva swallowing.

In respect of vocal quality, it was rough, hypernasal and, at times, wet. Moreover, it was added that A. showed no interest in trying to introduce oral feeding, as the focus of his complaint in the period was strictly related to speech intelligibility.

In terms of speech, because of the various surgical interventions of lesion reconstruction resulting from ORN, A. presented speech intelligibility alterations attributable to the absence of contact structures for the formulation of the phones, communicating, in the vast majority of the time, in a written form.

The case was discussed with a multidisciplinary team and A, was referred to the preparation of an individualized acrylic speech apparatus, performed by a dentist specialized in OMFP, whose objective was to allow speech, through the touch of the lower lip in the device, providing the production of some articulatory points.

During the process, in the first stage, the individualized device was made with flexible molding material from alginate, as a means to facilitate the necessary adjustments. At the time of installation of the temporary device, the speech-language therapy team was not present.

The participation in the device production was through periodic adjustments (once a week) of its size and positioning, based on the findings in the informal reassessments of speech and sound productions, since the locations for the device production and speech-language therapy sessions were not the same. After the adjustment was considered satisfactory by the patient and the team, in the second stage, the device went through an acrilization process in the laboratory and, later, new fine adjustments in the mouth were made, with reference to the height of the device, in relation to the point of contact with the lower lip.

Considering the small opening of the mouth, the lack of support due to the presence of less than one third of the mandible and the absence of adequate teeth, it was not possible to make a lingual prosthesis or a lowering of the palate one. That is why the device used does not fit into the cases presented in the literature. It is not even classified in the book of OMFP[12]. With this in mind, this device was described as an individualized acrylic device and not as a real prosthesis; however, it allows the lower lip to touch the upper lip, partially improving the speech function, but it does not replace the lost parts. Therefore, it is a tooth-supported device, as can be seen in Figure 1.

While returning to the outpatient clinic, with the use of acrylic device assisting in phonic production, it was observed that there was an improvement in speech intelligibility, with the possibility of production of articulatory points, such as labiodental sounds [f] and [v]. Also, A. mentioned being very satisfied with the device, with good adaptation, and reported improvement in communication.

After the device preparation and its adaptation, the therapeutic process of speech training commenced with articulatory production of the target phones; notwithstanding, it was noted that the patient maintained stable evolution, that is, traditional therapy showed therapeutic limit, demonstrating difficulty in proprioception to perform spontaneous speech adjustments.

Hence, A. was referred for speech-language therapy associated with biofeedback through tongue ultrasound, whose therapeutic objective was the production of [s] and [ʃ] with the use of the device. Considering that, because of the lack of intraoral structures and functions, e.g. the absence of lip sealing and intraoral pressure, it was not possible for A. to perform the production of plosive phones. Ergo, we opted for phones that A. could produce more easily. The speech therapy sessions consisted of demonstrating and characterizing the neotongue contour to the isolated target sound, first in the therapist, with the intention that the patient could visually understand the segment of the phone production, and then in the patient. After this process, the patient practiced the production of the isolated target sounds and then associated with vowels.

In addition, the choice for the aforementioned phones was based on a study[8] in which the authors obtained very satisfactory

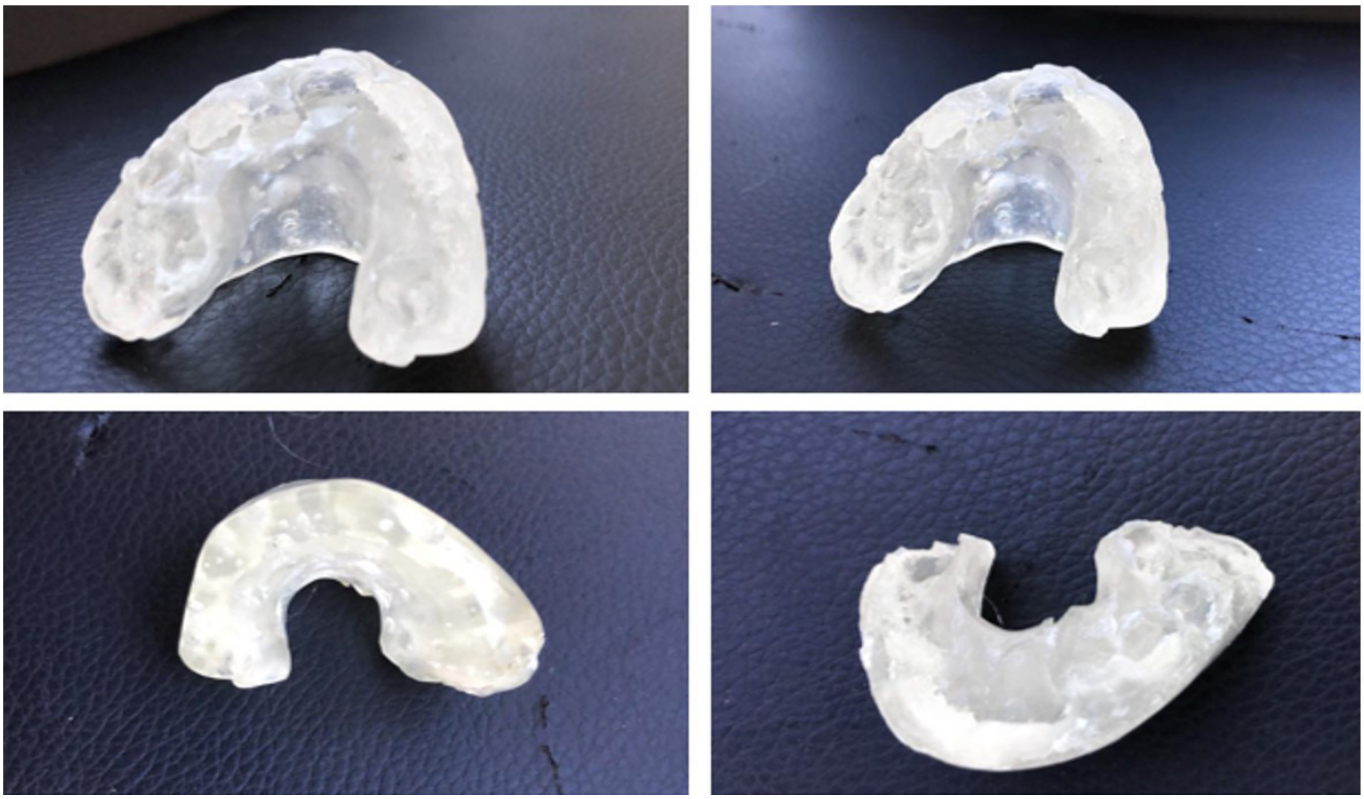

Figure 1. Individualized acrylic speech device – oral and maxillofacial prosthesis

results regarding the production training in conjunction with the intelligibility of these phones. The study also presented the evaluation and biofeedback through tongue ultrasound, using the following equipment: one-way microphone; microconvex transducer coupled to a portable ultrasound device (Mindray M5); computer; synchronizer; sound box and head stabilizer (Articulate Instruments Ltd). The corpus used for auditory-perceptual evaluation was: chave (/ʃˈave/), chica (/ʃˈika/), chuva (/ʃˈuva/), sapo (/sˈapo/), sica (/sˈika/) and suco (/sˈuko/) *(key,chika, rain, toad, sica and juice)*. These words were represented by figures and presented through the Software Articulate Assistant Advanced (AAA) – (Articulate Instruments Ltd), based on inductive and non-descriptive statistical difference. The subject was instructed to include the target word into the sentence "I say ____ very beautifully". Each target word was repeated ten times in the pre-treatment period and ten times in the post-treatment period, totaling 120 words (six words x 10 repetitions x 2 sessions (evaluation and reassessment) = 120 repetitions).

The subject was submitted to auditory-perceptual evaluation, through the target words recorded in the ultrasound evaluation, and the distortion severity of the words was based on the calculation of the Percentage of Correct Consonants Index – Revised (PCC-R). From the results obtained from the PCC-R, it was possible to classify the severity of distortions as: severe (PCC <50%); moderate-severe (50% < PCC < 65%), mild-moderate (65% < PCC < 85%) and mild (85% < PCC < 100%)[13]. The evaluation was performed by three judges experienced in phonetic transcription, with no experience in speech language pathology for oncology patients. The judges work in the outpatient clinic that analyzes ultrasound audios and images of various speech disorders and have experience with articulatory analysis. Speech samples were available remotely and the analysis was performed separately, without interaction between judges, and at different times.

In terms of speech intelligibility level (SIL), the following markings were used for each target word:

1. Insufficient and/or incomprehensible: when most of the word is misunderstood, thus making it difficult to comprehend the main message;
2. Regular and/or incomprehensible: when judges understand half of the word and, thereby, deduce the main message;
3. Good and/or understandable: when it is possible to understand the whole word clearly, as well as the main message[14].

With the obtained data, an average was performed to classify the percentage of the results.

The subject was submitted to ten sessions, comprising two sessions for recording the speech evaluation and eight for the therapy sessions. Each therapy was 50 minutes long, being 30 minutes for visual biofeedback from tongue ultrasound and 20 minutes for traditional approach and training for auditory speech perception.The traditional approach consisted of complementing the ultrasound biofeedback approach and, for this, it was used the auditory bombardment strategy, adapted for the subject, with the phones [s] and [ʃ].

The words selected for the stimulation of the segments [s] e [ʃ], in the traditional approach, were: *sair, sala, salada, sapato, seco, celular, seguro, senha, seta, sério, sétimo, sinal, cinco, cinema* and *chove, choque, brechó, choro, chocolate, choupana, chuteira e machucou* (leave, room, salad, shoe, dry,

mobile phone, safe, password, arrow, serious, seventh, sign, five, cinema, rain, shock, thrift shop, weep, chocolate, cottage, football boots and hurt).

For both approaches to therapy, based on the study by Blyth et al.[8], levels of linguistic complexity were used: from phones to syllables, from syllables to words and, finally, from words to sentences involving the target sound. The stimulus material for practice in conventional therapy was obtained from online resources, performed with words and texts with the target phones, carefully analyzed, verifying and respecting the levels of articulation complexity at the time of choice.

The first session, being pre-therapy, consisted of ultrasound recording of the neotongue movements in the production of balanced phrases, containing the Brazilian phones with the device. From the second to the seventh session, the phones [s] and [ʃ] were stimulated, using the criteria previously mentioned. From the eighth to the ninth session, sentence training was performed to verify the application of the target phones stimulated to analyze the retention level of the phones previously practiced. The tenth session was used to collect the speech sample by ultrasound, in order to compare the evolution and/or acquisition of the target phone by the subject (Chart 1).

With biofeedback support, the therapy session was characterized in highlighting the neotongue contour related to the isolated target sound, that is, the therapist provided the subject the model on the production to be achieved. Firstly, the therapist performed the speech production model. Then, he sanitized the probe and requested the patient's speech. Soon after the model, the subject reproduced it during the therapies, practicing the production of the isolated target sounds associated with the vowel [a]. It was possible to perceive that the subject was able to see his speeches on the ultrasound monitor in real time, while the therapist performed constant verbal feedback, signaling the performance and allowing him to cognitively self-evaluate himself on the neotongue movements (Figure 2).

In order to obtain the results of the pre-therapy and post-therapy percentage of consonants correct index, it was performed a descriptive quantitative analysis and, with a focus on accessing the results of the auditory-perceptual evaluation and self-assessment, it was performed a qualitative analysis.

The PCC for the phones used throughout the two phases of the study ([s] and [ʃ]) showed improvement during the intervention. At the time of the pre-therapy evaluation, the judges' evaluation found a moderate-severe PCC (59.96%) and, at the time after therapy, a mild-moderate PCC (68.45%) was observed (Table 1).

Concerning the descriptive results with respect to the degree of speech intelligibility observed by the judges in pre-therapy, the individual presented insufficient speech intelligibility (52.16%) and, after speech-language therapy intervention, speech intelligibility was regular (54.16%) (Table 2).

Chart 1. Therapy data associated with ultrasound feedback according to each session and its purpose

Therapeutic Data			
Sessions	**Objective**	**Instruments or methodology**	**Results achieved**
1st session	Speech sample collection	Recording of image data (ultrasound) and audio through Motu (audio interface tool).	Pre-intervention evaluation.
2nd session	Biofeedback therapy	Perception of phone production, undulating neotongue movements with ultrasound.	Perception of the phones [s] and [ʃ].
3rd session	Biofeedback therapy	Vocal training of the phones [s] and [ʃ]; introduction of the articulatory point with ultrasound.	Production of the phones [s] and [ʃ].
4th session	Biofeedback therapy	Vocal training of the phones [s] and [ʃ]; syllable [s]+[a] and [ʃ]+[a] with ultrasound.	Production of the phones [s] and [ʃ] linked to a vowel
5th session	Biofeedback therapy	Vocal training of the phones [s] and [ʃ]; syllable ([s]+[a]) and [ʃ]+[a]; and words with ultrasound.	Systematic pronunciation of words with the phones [s] and [ʃ].
6th session	Biofeedback therapy	Vocal training of the phones [s] and [ʃ]; syllable ([s]+[a]) and [ʃ]+[a]; and words with ultrasound.	Systematic pronunciation of words with the phones [s] and [ʃ].
7th session	Biofeedback therapy	Introduction of sentences containing the words practiced during therapy.	Self-perception regarding the improvement of speech intelligibility.
8th session	Biofeedback therapy	Connected speech training with the phones [s] and [ʃ] in while reading texts with ultrasound assistance.	Connected speech training with the phones [s] and [ʃ] in while reading a text
9th session	Biofeedback therapy	Connected speech training with the phones [s] and [ʃ] in while reading texts with ultrasound assistance.	Automation of the phones [s] e [ʃ] in speech.
10th session	Speech sample collection	Recording of image data (ultrasound) and audio through Motu (audio interface tool).	Post-intervention evaluation.

Table 1. Descriptive Measures of the Percentage of Consonants Correct Index

PCC			
Judges	**Pre-therapy**	**Post-therapy**	**Dif.**
Evaluator 1	58.47%	62.50%	**4.03**
Evaluator 2	50.83%	67.22%	16.39
Evaluator 3	70.58%	75.63%	5.05
Average	59.96	68.45	8.49

Subtitle: Dif. = difference; PCC = Percentage of Consonants Correct

Table 2. Analysis of pre-therapy and post-therapy speech intelligibility

Classification	
Pre-therapy	
Judges	**SIL**
Evaluator 1	Regular (78%)
Evaluator 2	Insufficient (51%)
Evaluator 3	Insufficient (53.33%)
Average	Insufficient (52.16)
Post-therapy	
Judges	**SIL**
Evaluator 1	Good (63.33%)
Evaluator 2	Regular (46.66%)
Evaluator 3	Regular (61.66%)
Average	Regular (54.16)

Subtitle:SIL = Speech Intelligibility Level

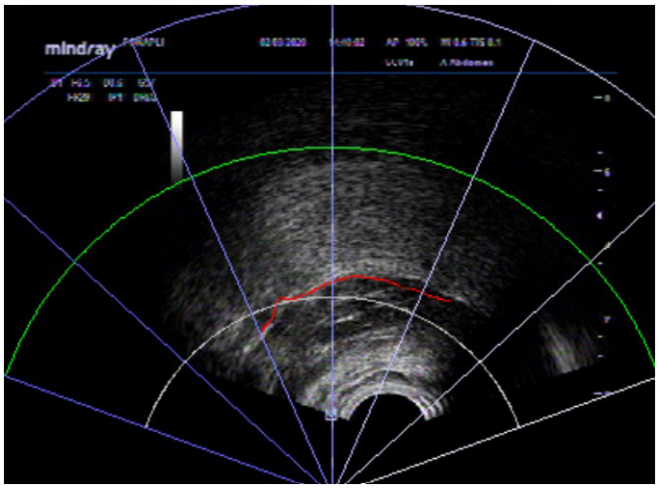

Figure 2. Tracing of the neotongue surface in the anterior and posterior part with the use of tongue ultrasound biofeedback.

DISCUSSION

This article aimed to verify the results obtained from the speech-language therapy intervention with biofeedback of tongue ultrasound and characterize the speech production of an individual with total glossectomy, with the use of OMFP. Although the use of biofeedback through language ultrasound is already used in cases of tongue cancer, it was noted that studies in this area are still scarce, which reveals the importance of investigating the intervention methodologies applied, seeking better efficacy for the treatment.

Total glossectomy, mainly associated with mandibulectomy, may lead the individual to have severe, limiting functional problems involving speech, chewing and swallowing. However, the efficiency of the OMFP scientifically improves the subject's speech and swallowing skills, providing him/her with a better quality of life[13,15]. According to Lauciello et al.[16], individuals with severely restricted tongue movements are able to improve their speech intelligibility with the palatal modification provided by the OMFP, owing to the establishment of palatal tongue contacts necessary to produce certain speech sounds.

The main advantages offered by OMFP include easy visualization of the local defect, which allows the detection of CA recurrences; reducing the length and costs of hospitalization; the ability to facilitate the early diagnosis of relapses and to avoid a second operation and the immediate restoration of facial morphology and oral functions, such as speech function[17].

The change in speech function is usually evaluated by the accuracy of the articulation by means of PCC-R[13] and SIL. As for PCC index, it was observed that the mean showed improvement of 8.49% after eight sessions, as the motor learning is the retention of skills learned through therapy.

Although SIL is not a sensitive measure of joint accuracy, its use is often reported in the literature when related to OC. Accordingly, focusing on one or two sounds in therapy can alleviate the difficulty of the proposed task and generate more contrasting results[18]. In this study, the intelligibility of the target sounds used showed a change in the individual's pronunciation when compared to pre-treatment and post-treatment.

Blyth et al.[8] investigated the effects of visual biofeedback on post-glossectomy speech in a single case study of two patients. The authors followed the speech progress of the two patients during four weeks of therapy, reporting better results for the phones practiced and an important effect of phone

retention over time for one patient. Additionally, studies show that speech rehabilitation acts on neuroplasticity and improves speech results after tongue surgical interventions. The literature shows that, after glossectomy, there are adaptive changes in the cerebral cortex and cerebellum, areas associated with the planning of tongue movement mechanisms[19], essential for speech rehabilitation and swallowing.

In the present study, the analysis of the subject's improvement was conducted, quantitatively and qualitatively, according to PCC results, the auditory-perceptual analysis and the own self-assessment. After eight therapy sessions, the difference between the use of the posterior part of the neotongue was notorious, when compared to pre-therapy and post-therapy, inasmuch as the patient adapted his speech production by making the greatest recruitment of these remaining structures.

No studies whose focus was on speech-language and hearing rehabilitation with the use of similar acrylic device and evaluation by PCC were found. Research on therapy for speech rehabilitation after surgical resection is scarce and no studies have been found in this sense, with the use of individualized devices, since they are unique and, therefore, it is inferable that their therapy should be individualized. Intraoral rehabilitation devices after resection should be developed through close collaboration between the speech-language therapist and the specialized surgeon-dentist. Speech-language therapy, in these cases, should aim at maintaining swallowing in a safe way and adapting speech and voice, from the remaining structures and the use of the device.

As a study limitation, the reduced sample of speech production stands out. Indeed, it is intended to perform periodic evaluations (ultrasound and auditory-perceptual) and incorporate quantitative ultrasound measures, in order to promote the robustness of the evaluations and delineate more effective therapeutic processes for cases similar to what was described in this study.

FINAL COMMENTS

After making the individualized acrylic device, it was noticed an improvement in speech intelligibility and the subject's satisfaction of the subject submitted to total glossectomy. The traditional intervention added to the visual biofeedback, through ultrasound, contributed to the refinement and neuromotor control of the new structure of the tongue after several surgical interventions.

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