

Case reports

Morphofunctional analysis of the stomatognathic system in conventional complete dentures users from the Integrated Health Center

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ABSTRACT

This study aimed at characterizing the speech and chewing of users of conventional complete dentures (CCD) before and after speech therapy and prosthetic functional adaptation. The participants consisted of 10 users, divided into two groups: experimental (G1) and control (G2). Both groups underwent the same speech therapy and chewing evaluation before and 15 days after prosthetic functional adaptation; G1 underwent speech therapy in the period before prosthetic functional adaptation, and G2 underwent prosthetic functional adaptation without speech-language intervention. As observed, G1 presented 60% of participants with phonetic and/or articular distortions and inadequate cut of the food and 80% with unilateral chewing; after therapy, no speech and masticatory alterations were observed, but the altered cut was seen in 100% of the group. In G2, 80% of the participants had speech and chewing alterations and 40% had an inadequate cut. After the therapy period, 60% of the subjects remained with speech alterations and 100% with altered cut and chewing alterations. It can be concluded that after prosthetic functional adaptation, the group that underwent speech therapy did not present the alterations initially detected, except for the cut of the food, as opposed to G2 in which the changes persisted, showing that prosthetic rehabilitation alone, did not reestablish functional patterns, speech-language intervention being required.

Keywords: Stomatognathic System; Speech Therapy; Dental Prosthesis

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INTRODUCTION

The Stomatognathic System (SS) is composed of static structures (mandible, maxilla, dental arches, TMJs and hyoid bone) and dynamic structures (masticatory, supra and infrahyoid muscles and tongue, lips and cheek muscles) that act together¹ as they are balanced and controlled by the central nervous system performing the stomatognathic functions: suction, breathing, swallowing, speech and chewing.

Speech is one of the main means of social interaction, and its production is closely related to the morphology of the stomatognathic system, in which the teeth, bones and muscular groups play a fundamental role for determination of acoustic and articulatory patterns². An effective mastication requires balance between SS structures.

Chewing is one of the most important functions of the Stomatognathic System, since it starts the process of feeding, grinding and preparing the food, favoring swallowing and digestion, and consequent quality of nutrition. Efficient chewing requires the balance of SS structures, including muscles, teeth and bones³. Chewing should occur after cutting the food with the incisors, with closed lips, without noise or exaggerated participation of the perioral musculature, with lateralization and alternating bilateral mastication, with rotational movements of the mandible and with muscular strength symmetry⁴.

It is noteworthy that despite advances in dentistry, Brazilian people still present a high incidence of tooth loss, be it partial or total. The number of Complete Dentures (CDs) will grow around 2.0% by 2020, what represents an increase of approximately 300 thousand individuals requiring CDs⁵.

Edentulism induce changes in the SS, especially in the maxillomandibular relationship and in the shape of bone structures that cause a neuromuscular imbalance, hindering the correct performance of stomatognathic functions, and also likely to interfere in the adaptation of the dental prosthesis³. Moreover, the vertical dimension of occlusion (VDO) also changes, affecting the aesthetic appearance and postural condition of edentulous patients.

Besides the aesthetic benefit, dental prostheses present prospects of improvement for the stomatognathic functions of speech, chewing and swallowing. However, prosthetic adaptation may be impaired by oromiofunctional alterations, as well as the stomatognathic functions may be altered to the detriment of the condition and type of dental prosthesis³, what suggests

the need and importance of an integrated work with Speech Therapy.

Speech therapy, as part of the interdisciplinary team, can contribute to the prosthetic adaptation and rehabilitation of stomatognathic functions within the limitations found, so as to provide a better quality of life of the affected subjects⁶.

The aim of this study was to characterize the speech and chewing of users of conventional complete dentures before and after speech therapy and prosthetic functional adaptation in a collaborative work between Speech Therapy and Dentistry.

Case Report

Descriptive research of longitudinal and interdisciplinary character, of the case report type, developed with total edentulous individuals using Conventional Complete Dentures (CCD) and assisted at the Integrated Health Center (IHC) of the Institution of origin, between June and November 2015. The study was approved by the Ethics and Research Committee of the Potiguar University - UnP under Opinion nº 1,065,231/2015.

From a universe of 126 subjects who received assistance between the months established in the research, only 10 composed the sample, after checking inclusion and exclusion criteria. The inclusion criteria were: patients with age range between 40 and 75 years, who sought the Dentistry service of the institution for adaptation of Conventional Complete Dentures. The exclusion were: subjects who presented dentofacial deformities, neurological and cognitive problems, users of medications that could trigger increase and/or decrease in salivation, who had previously undergone Speech Therapy, and with moderate to severe hearing loss (> 56dB) according to audiometry, because hearing loss at this intensity may cause distortions that may be confused with probable changes resulting from a maladaptive prosthesis.

For audiometry, an interacoustic audiometer model AC40, calibrated in January 2015, was used in an acoustic booth manufactured by Televox, model Média, serial number 2286, with test on January 9, 2015. The sample consisted of a literate population of 7 self-declared white women, 1 brown woman, and 2 white men, aged 43 to 73 years, of which 7 already used upper and lower CCD, 2 used only superior denture, and 1 was going to start using the denture. All participants received information on the research stages and signed the Informed Consent Term.

The initial evaluation occurred between May 27 and 29 and July 8, 9, 15 and 16, when the protocol of Orofacial Assessment for Users of Dental Prostheses adapted by *KALIL, MTAC; CAVALCANTI, RVA & BIANCHINI, EMG was applied* (1) (APPENDIX 1), 11 phrases balanced with words of different syllabic extensions and predominance of the fricative phonemes /s/, /z/, /ç/ and /j/ (2), 19 phrases characterized by the predominance of the same phoneme of the Brazilian Portuguese language proposed by *Berretin Apud Cunha* (2004) (3), in which the volunteers were instructed to read the phrases aloud and judge the difficulty to pronounce them attributing a score from 0 to 10, with 10 for the most difficult phrase to pronounce.

Concerning speech alterations, the presence or absence of omissions or substitutions of phonemes, alteration of articulatory points, lisping, changes in speech integrity and amplitude of mandibular movements were investigated.

The applicability of the protocol was made through the anatomo-functional observation of the static structures (maxilla, mandible, TMJ and dental arches) and dynamic structures (masseter, buccinator, and mental muscles, lips and tongue) of the stomatognathic system, palpation, counter-resistance using wooden spatula, verbal commands of mobility (opening, closure, protrusion, retraction, lateralization and vibration) and facial measurement using a 150mm plastic caliper 6 in. DISMA.

The masticatory function was personally assessed by two evaluators and analyzed through photographic records and filming by a third evaluator. French bread (salt bread) baked in the previous day was used for this analysis, requesting that the subject chewed five times in a habitual way. Only the last four chews were considering, however, because the participant could direct the mastication in an attentive and controlled manner, as he or she was under evaluation and filming, according to the proposed protocol⁷.

During chewing, the type of food cut (anterior, lateral, hand or tear), chewing type (unilateral or bilateral, simultaneous or alternating) and lip position during mastication were analyzed, as well as the number of masticatory cycles of each of the four portions, considering the average of this variable.

Equal masticatory cycles for both sides; cut of the food in the anterior region, with the central and lateral incisors; bilateral mastication with alternating movements and lip sealing during the whole mastication, were considered appropriate for greater

reliability of the evaluation. To characterize the proposed masticatory type⁸, the number of cycles performed on each side (right and left) in the 4 portions analyzed was counted, considering unilateral mastication when more than 66% of the cycles occurred predominantly on the same side of the 4 portions, and bilateral when presented with less than 66% of the masticatory cycles in the total of 4 portions.

The sentences were read, recorded and analyzed by the three evaluators. All procedures were performed using gloves, obeying the principles of biosafety, and photographed and filmed by a digital *SONY® N50 MODEL No. SEL 16F28*.

The study sample was divided into two groups, G1 (Experimental Group) and G2 (Control Group), with 05 users each, selected for convenience. G1 patients underwent initial evaluation, speech-language therapy pre-installation of the prosthesis and final evaluation 15 days after prosthetic functional adaptation; and G2 patients underwent initial evaluation, prosthetic installation and final evaluation 15 days after prosthetic functional adaptation. Cases of presence of alteration after functional adaptation would receive a speech-language intervention. Both groups (G1 and G2) underwent dental follow-up in order to reestablish the Vertical Dimension of Occlusion - VDO and recover the lip and aesthetic support, and speech therapy with the purpose of rehabilitating the oromiofunctional alterations found, promoting prosthetic adaptation.

Concomitantly to dental care, G1 participants underwent speech therapy for a month and a half, totaling 6 sessions (at weekly basis, for one hour each) and G2 participants for one month, totaling 4 sessions (at weekly basis, for one hour each). Therapy was based on isometric, isotonic and isokinetic exercises, in addition to the training of stomatognathic speech and chewing functions^{9,10}, by alternating bilateral masticatory training, perception, production and automatization of target phonemes, stretching of the muscle fiber of the tongue, inductive massages in the opposite direction, contraction of the muscular fiber of the facial mime, using touches with pressure and discontinuous vibration performed for both groups and selected according to the changes of each individual.

Because of the $n = 10$, the results were described in a descriptive way through tables and graphs, and statistical analysis was not necessary.

RESULTS

The research universe was based on 126 subjects of the IHC waiting list, of whom 116 were excluded (80 because they were partial denture users, 12 because they had already made the prostheses or had no interest in the making them, and 24 because they did not answer the calls). The sample was made up of 10 individuals, who were equally distributed into two groups, G1 and G2.

It was found that the majority (60%) had lost all their teeth more than twenty years ago. As for the time using a same single denture, it was observed that nine (90%) individuals used to keep the same denture for more than four years. Seven participants (70%) used upper and lower complete dentures, two (20%) used

only upper denture, and only one (10%) was going to use the denture for the first time. It was found that more than half (60%) tended to have a mesocephalic face, while 20% had dolichocephalic and 20%, brachycephalic face.

Table 1 shows the characterization of orofacial structures (lips, tongue, cheek, masseter) with respect to mobility and tonicity of G1 and G2 subjects since the initial evaluation (with the old prosthesis). There was a predominance of change in lingual mobility (80% in G1 and 20% in G2); lip tone (hypotonia) (60% in G1 and G2); cheek tone (one- or two-sided hypotonia) (80% in G1 and 60% in G2) and masseter hypotonia (100% in G1 and G2).

Table 1. Characterization of orofacial structures regarding mobility and tonicity in the initial evaluations and 15 days after using the prosthesis

Structures	Initial/final evaluation				Initial/final evaluation					
	G1		G1		G2		G2			
	Qty	%	Qty	%	Qty	%	Qty	%		
Tongue	Tonicity	Altered	2	40%	0	0%	0	0%	0	0%
		Normal	3	60%	5	100%	5	100%	5	100%
	Mobility	Altered	4	80%	0	0%	1	20%	0	0%
		Normal	1	20%	5	100%	4	80%	5	100%
Lips	Tonicity	Altered	3	60%	0	0%	3	60%	0	0%
		Normal	2	40%	5	100%	2	40%	5	100%
	Mobility	Altered	1	20%	0	0%	1	20%	1	20%
		Normal	4	80%	5	100%	4	80%	4	80%
Cheek	Tonicity	Altered	4	80%	0	0%	3	60%	2	40%
		Normal	1	20%	5	100%	2	40%	3	60%
	Mobility	Altered	4	80%	0	0%	1	20%	2	40%
		Normal	1	20%	5	100%	4	80%	3	60%
Masseter	Tonicity	Altered	5	100%	0	0%	5	100%	4	80%
		Normal	0	0%	5	100%	0	0%	1	20%

G1- Group 1, G2- Group 2, Qty - Quantity and % - Percentage

The results of the initial evaluation on the chewing test showed a predominance of unilateral alternating chewing pattern observed in eight subjects (80%), while the bilateral alternating chewing pattern was seen in only one subject (10%); one participant (10%) was unable to complete the chewing test, reporting impossibility of chewing with the prosthesis he was using.

Only four (40%) individuals were observed to perform the anterior cut of the food (with the central and lateral incisors), one (10%) tore it with the lateral incisors, four (40%) tore the food with the hand, and

one (10%) was unable to complete the chewing test. Of these, 40% had the food cut properly, 50% improperly, and 10% did not complete the test.

Before the initial evaluation some participants demonstrated speech alterations, either changes of articulatory points, lisps, speech unintelligibility and/or diminution of the amplitude of mandibular movements; seven subjects (70%) presented one or more of these phonetic changes and only three (30%) showed no alterations in these aspects.

The main alterations found were interdentalizations /t/ /d/ in (20%) of individuals, distortion of /r/ (10%), decrease in articulatory amplitude (30%), anterior lisp (20%), lateral lisp (10%), distortion of /f/, /v/, /s/ and /"j"/ (20%), distortion of /"ch"/ (40%) and no change (30%).

Figure 1 presents the judgment about the difficulties of pronunciation listed by the subjects before the 23

phonemes of the Brazilian Portuguese language¹¹. In the evaluation, the phoneme chosen as having the most difficult pronunciation was the /"ch"/ (4 subjects - 40%), also confirmed in speech - language evaluation, followed by the affiliated phoneme /"dj"/ (2 subjects - 20%), in the same proportion for the phonemes /z/, /v/, /R/ and [r] (each with 10%).

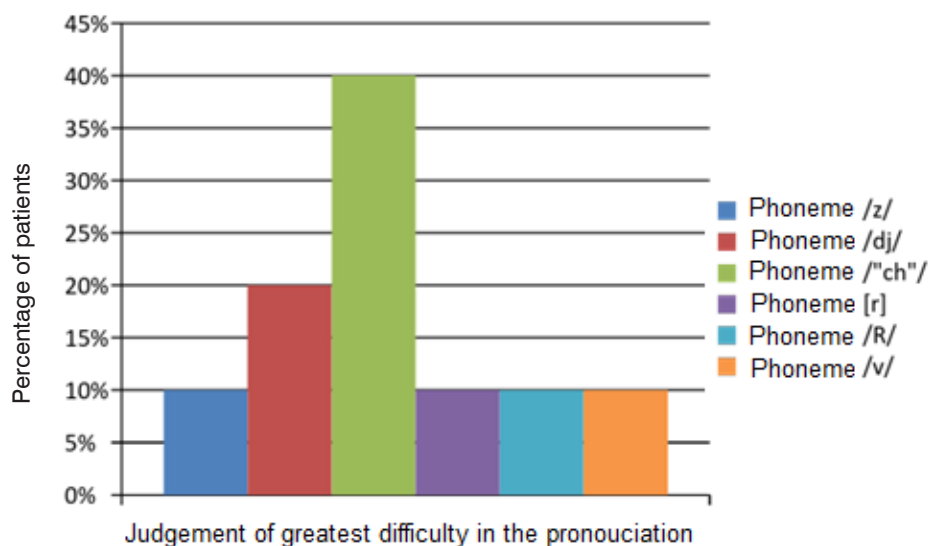


Figure 1. Judgment of pronunciation - phoneme considered the most difficult one in the initial evaluation

The comparison of the initial and final chewing evaluation presented in Table 2 showed that the G1, which underwent speech therapy prior to the installation of the new prosthesis, achieved adequate mastication (alternating bilateral chewing with labial sealing), cutting the food with the hand, which corroborates another study³. Regarding the G2, which had not undergone previous therapy, there was a predominance of alternating unilateral chewing, with lip sealing and food cutting with the hand.

Table 3 presents the comparison between the aspects of the initial and final speech evaluation (after prosthetic functional adaptation) per subject. The results showed phonetic and/or articular distortions in three individuals (60%) in the G1 and four (80%) in the G2 with in the initial evaluation, and no individual (0%) in the G1 and three (60%) in the G2 in the final evaluation.

Table 2. Characterization of mastication in the initial and final evaluations

Subjects		Final chewing evaluation					L/P
		Cut			Type		
		A	W/H	T	BI	UNI	
GROUP 1	SUB 1		X			X	W/S
	SUB 2		X			X	W/S
	SUB 3	X			X		W/S
	SUB 4		X			X	W/S
	SUB 5	X				X	W/S
GROUP 2	SUB 6	X				X	W/S
	SUB 7			Did not complete the chewing test			
	SUB 8	X				X	W/S
	SUB 9		X			X	W/S
	SUB 10			X		X	W/S
Subjects		Initial chewing evaluation					L/P
		Cut			Type		
		A	W/H	T	BI	UNI	
GROUP 1	SUB 1		X		X		W/S
	SUB 2		X		X		W/S
	SUB 3		X		X		W/S
	SUB 4		X		X		W/S
	SUB 5		X		X		W/S
GROUP 2	SUB 6		X			X	W/S
	SUB 7		X			X	W/S
	SUB 8		X			X	W/S
	SUB 9		X			X	W/S
	SUB 10			X		X	W/S

A - Anterior, W/H- With the hand, T- Tear, BI- Bilateral, UNI- Unilateral, W/S - with lip sealing, L/P - Lip Posture and SUB- Subject

Table 3. Comparison per subject between initial and final speech

Subjects	Initial speech evaluation	Final speech evaluation
	Observed changes	Observed changes
GROUP 1	SUBJECT 1 1. Interdentalization of /t/ and /d/; 2. Distortion of [r]; 3. Decreased articulatory amplitude.	1. No Changes
	SUBJECT 2 1. No changes	1. No Changes
	SUBJECT 3 1. Anterior lisp /s/, /z/; 2. Distortion of /ch/; 3. Interdentalization of /t/ and /d/; 4. Decreased articulatory amplitude.	1. No Changes
	SUBJECT 4 1. No changes	1. No Changes
	SUBJECT 5 1. Anterior and lateral lisp /s/ and /z/.	1. No Changes
GROUP 2	SUBJECT 6 1. Distortion in the phonemes /s/, /j/, /ch/, /t/ and /v/.	1. Interdentalization of /t/ 2. Lateral lisp /s/ 3. Reduced articulation.
	SUBJECT 7 1. No changes	1. No changes
	SUBJECT 8 1. Decreased articulatory amplitude.	1. Interdentalization of /t/, /d/ and /n/.
	SUBJECT 9 1. Distortion in the linguodental, bilabial, labiodental and palatal phonemes due to absence of prosthesis.	1. No changes
	SUBJECT 10 1. Distortion of the phoneme /ch/	1. Interdentalization of /d/ 2. Lateral lisp /s/ 3. Reduced articulation.

DISCUSSION

The literature reports that in Brazil, the 1986 national oral health survey revealed a mean number of teeth lost of 14.9 (66.5%) in adults aged 35-44 years and 23.4 (86% of the index) in individuals aged 50-59 years¹².

Prolonged use of complete dentures cause them to gradually lose quality, mainly from the fourth year onwards; after the eighth year of use, a large part of the patients end up with masticatory problems¹³. Patients usually show satisfaction with the conventional complete upper denture, but the lower one usually presents problems of retention and stability, causing dissatisfaction to the users¹⁴.

Edentulism affects motor and sensorial aspects of the masticatory process, favoring muscular atrophy, especially of the masseter³. Maladaptive dentures may lead to unilateral chewing pattern as a mechanism of protection and adaptation to structures, to avoid sequelae¹⁵, what is consistent with our findings.

The presence of altered food cut in a significant number of subjects is in line with the literature. A study with a sample of 53 elderly individuals found that 71.9% users of complete denture and/or partial removable denture had altered food cut³.

Individuals who do not use dentures, or maladaptive denture wearers, present speech impairments¹⁶. In general, when the denture is not well adapted, it causes problems such as speaking with less opened mouth so as not to lose stability and this ends up causing articulatory imprecision. Decreased mandibular movements are also evident, as well as altered movements of the jaw and lips in an attempt to compensate for and improve speech accuracy¹⁷.

The difficulty in producing the phoneme /ch/ listed by part of the participants disagrees with the literature, in which the phoneme /s/ is pointed as the most affected, because the vertical and horizontal trespasses represent a mandibular path for its pronunciation¹⁸.

The findings of the G2 are in agreement with the literature, in which unilateral chewing prevails after the installation of the denture, supposedly because a previously acquired habit persists². On the other hand, the results of the G1 differed from another study²; the speech therapy in the present research was followed by adaptation of the chewing patterns that persisted after installation of the new prostheses. This finding shows the importance of phonoaudiological monitoring for the structuring of functional patterns.

The values demonstrate the efficacy of phonoaudiological therapy on speech disorders in G1 and suggests

that the prosthesis alone does not readjust the altered speech patterns, as seen in G2.

After the initial evaluation of both groups, the G1 was submitted to therapy in the period of preparation of the prostheses, whose protocol consists of six weekly 60 minutes sessions. The therapy timer¹⁹ suggests a treatment time of less than 6 months, with a frequency of twice a week, and duration of 30 minutes each session, which fits the time adopted in the study. Only three (60%) subjects attended all sessions and the others (40%) performed only five, and missed one session. The aim of the therapies was to strengthen lingual musculature, buccinator, lips, masseter and musculature of the facial mime, as well as to work on tongue mobility, buccinator, bilateral mastication and speech training, as well as stretch the tongue musculature in the case of one subject (20%) who had a short lingual frenulum. Exercises for mobility, tone, proprioception and function monitoring are necessary when using a prosthesis, to aid motricity to reach standards compatible with oral rehabilitation⁶.

After the final evaluation, the G2 required speech therapy (as indicated by changes shown in Tables 2 and 3), and this was performed in a similar manner to the therapeutic process in G1, with four weekly 60 minutes sessions (more sessions are unnecessary). All G2 participants required therapy, although only four were willing to do it, and one gave up therapy before starting. The therapies were mainly focused on the functional training of speech and chewing, but also adapting the musculature in cases where it was altered.

The exercises (common to both groups) were isometric, isotonic and isokinetic^{9,10}, including masticatory training, perception, production and automation of target phonemes, stretching of the muscle fiber of the tongue, inducing massages in the opposite direction to the muscular fiber contraction of the facial mime, using pressing touches and discontinuous vibration (**Appendix 2**). Although not the main objective, at the end of the last session, the subjects reported improvement in speech, strengthening of the musculature, more balanced mastication with wider mandibular movements, thus confirming the evaluation that detected normotensive face musculature, adequate tongue tonicity and mobility for CCD users, intelligible speech, balanced articulation and bilateral chewing.

One of the important limitations of this study was the small number of participants (n = 10) using dentures who underwent phonoaudiological evaluation and

could be included in the study. However, the same limitation has been also present in other speech therapy studies^{3,20}. These data point again to the importance of interdisciplinary work, as well as of speech therapy evaluation integrated to the adaptation of the dental prosthesis.

Another bias to be discussed regards the heterogeneity of the sample, in which 7 used upper and lower CCD, 2 used only upper denture, and 1 was going to use the prosthesis for the first time. Because they presented distinct patterns and adaptations, the comparison of some variables presented limitations. The inclusion of these subjects was due to the limited number of CCD users who sought the dentistry service of the institution studied. More homogeneous samples are recommended for the next studies.

CONCLUSION

The methodology employed in the present study allowed to detect in initial moments, in both groups, changes in tonicity and mobility of oromiofunctional structures, predominance of unilateral mastication, inadequate food cut and speech changes of the interdentalization type of /t/ and /d/, anterior lisp /s/ and /z/, distortion of the phoneme /ch/ and decreased articulatory amplitude. After the prosthetic functional adaptation, the group that had undergone speech therapy (G1) did not present the alterations initially found, except for the cut of the food, suggesting the efficacy of the therapy used. On the other hand, the changes persisted in the G2, because functional adaptation alone did not reestablish functional patterns, requiring phonoaudiological intervention.

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Appendix 1

(1) OROFACIAL MIOFUNCTIONAL EVALUATION PROTOCOL FOR DENTAL PROSTHESIS USERS

I – Interview

1 - Identification:

Name:

Age:

Birthdate:

Date of Examination:

Gender:

Profession:

Responsible dentist surgeon:

2 - For how long has the patient lost teeth and for which reasons:

3 - Time without dental prosthesis:

4 - Time with dental prosthesis:

5 - Does the patient present difficulties in fitting the prosthesis? Which difficulties?

6 - Did the patient have speech problems before using the prosthesis? Which difficulties?

7 - Does the patient have speech problems today? Which difficulties?

8 - Does the patient have masticatory problems? Which difficulties?

9 - Does the patient have hearing problems? Which difficulties?

10 - Does the patient have habits like:

Onicofagy () Putting objects in the mouth () Biting lips () Biting the tongue ()

Biting the cheeks () Gnashing of teeth ()

Notes:

II - Examination:

1 - Observation Data:

Frontal and profile analysis of the face:

a - tensions: frontal () mental () cheeks () lips () peribucal region ()

Notes:

b - symmetry () asymmetry ()

Notes:

III - Craniofacial Characteristics (evident data):

1 - Face: short () medium () long ()

Upper third portion _____ medium third portion _____ lower third portion _____

2 - Profile: straight () concave () convex () biprotruso ()

Notes:

IV - Verification of structures and musculature:

1 - Lips

() closed, competent.

() semi-opened

() fully opened

() tightly closed

() upper lip protrusion

() lower lip protrusion

() contraction of the lower lip

() contraction of the upper lip

() symmetric

() asymmetric

() marks on the mucosa

Which? _____

Tensioned upper lip frenulum () long extension () normal extension ()

Tensioned lower lip frenulum () long extension () normal extension ()

2 - Orbicular of the mouth:

() satisfactory

() functional hypotonia

() functional hypertonia

Notes:

3 - Cheeks:

() symmetric

() asymmetric

() internal marks or wounds

() more enlarged on the right side

() more enlarged on the left side

() both sides equally enlarged

() right side of the face drooping

() left side of the face drooping

() both sides drooping

() compressed

4 - Buccinator:

() Balanced contraction of both sides

() Functional hypotonia of the left side

() Functional hypotonia of the right side

() Functional hypotonia of both sides

() Functional hypertonia of the left side

() Functional hypertonia of the right side

Notes:

5 - Masseter:

() Balanced contraction of both sides

() Functional hypotonia of the left side

() Functional hypotonia of the right side

() Functional hypotonia of both sides

() Functional hypertonia of the left side

() Functional hypertonia of the right side

Notes:

6 - Jaw: in normal position () retruded () protruded ()

7 - Jaw: normal () narrow ()

8 - Mental: without contraction () with contraction ()

9 - Tongue:

() normal

() extended

() without tip

() presence of marks on the sides

() presence of marks on the palatal papilla

() presence of marks in the inferior alveolar region

() compressed

() between the teeth

() between gingival ridges

() normal frenulum

() short frenulum

() filling edentulous areas

10 - Hard palate: normal () ogival () low ()

11 - Soft palate: good mobility () anterior vomit reflex ()

12 - Tonsils: present () absent () increased ()

13 - Intraoral space: normal () increased () decreased ()

V - Mobility:

1 - Lips:

Protrusion () Retraction () Lateralization: R () L () Elevation ()

Notes:

2 - Tongue:

Protrusion () Retraction () Lateralization: R () L () Snap ()

Notes:

VI - Mandibular movements: (measures, deviations, limitations, noises, pain)

1 - Opening: deviation R () deviation L () limitations () noises () pain ()

Notes:

2 - Closure: deviation R () deviation L () noises ()

Notes:

3 - Maximum aperture: measure: _____

4 - Laterality L: measure: _____

increased () decreased () relative to the right;

with stability of the prosthesis () without stability of the prosthesis ()

Notes:

Laterality R: measure: _____

increased () decreased () relative to the right;

with stability of the prosthesis () without stability of the prosthesis ()

Notes:

5 - Protrusion: measure: _____

present () absent () with deviation ()

Notes:

VII - Stomatognathic Functions:

1 - Breathing: nasal mode () predominantly oral () difficult nasal breathing ()

Notes:

2 - Mastication: bilateral ()

left unilateral predominance ()

right unilateral predominance ()

presence of previous cut: yes () no ()

presence of coalescing movement ()

Notes:

3 - Swallowing:

with labial tightening () with visible projection of the tongue ()

with liquid leakage () with head movement ()

Notes:

Filmed () Date: _____ Photographed () Date: _____

Diagnosis:

Conduct:

Adapted from KALIL, M.T.A.C.; CAVALCANTI, R.V.A. & BIANCHINI, E.M.G.

(2) LIST OF PHRASES: SPEECH ANALYSIS

1. Karina has class in the morning
2. Rats hide from cats
3. Plínio crashed the car in a block
4. The wrapping paper is large
5. The clown was crying in the rain
6. A good smell was coming from the kitchen
7. I looked at the fat cat and laughed
8. James was dancing with Janice
9. Tomorrow we will leave without fail
10. I got the potato in the truck
11. The food never ends

Balanced phrases proposed by Felício (1996) and taken from Cunha (2004).

(3) PRONUCIABILITY OF PHRASES

Directions:

This experiment will take 30 minutes or less of your time and you will be collaborating with our research. The results will not reveal the name of any participant. The task you will perform will not be difficult to complete. But if at any point you wish to interrupt the experiment, let us know and it will be stopped and suspended.

We are interested in studying how people find it difficult to say a few sentences. You should give a maximum score (10) for the sentence that was the most difficult to pronounce. Then you must give a score for each sentence, according to the difficulty to pronounce them, compared to the previous most difficult sentence.

This score can range from 0 to 10. For example, if you find that a sentence is the most difficult to pronounce, rate it 10. If you find you have minimal difficulty, rate it 0. You can use any of the scores (1, 2...) and fractions (1.5; 2.25...)

If you find that two sentences have the same difficulty to pronounce, you can repeat the scores.

Remember that score 10 indicates the most difficult pronunciation and 0 indicates least difficult pronunciation.

WORD LIST:

PHRASES	MOST DIFFICULT PHRASE TO PRONOUNCE	DIFFICULTY SCORE FOR EACH PHRASE
1. Dad asked for popcorn		
2. The armadillo dwells in the lair		
3. Cacá wants cokes		
4. The nanny kisses the baby		
5. Didi's finger hurt		
6. Gugu likes the cat		
7. Filó made a tape		
8. The saci knows how to whistle		
9. The kettle is full of tea		
10. Grandma dressed the dress		
11. Zizi landed at Zezé's house		
12. The jeep belongs to Juca		
13. Mom ate papaya		
14. The baby swims in the pool		
15. The little bird ate the worm		
16. Roberto drives the car fast		
17. Lili licked the lemon		
18. The tree bears fruit and flowers		
19. Dislon drives by day		

Phrases proposed by Berretin (1999), taken from Cunha (2004).

Appendix 2

Characterization of oromiofunctional exercises used in the speech therapy

TYPE OF EXERCISE	STRUCTURE INVOLVED	OBJECTIVE	FREQUENCY X DURATION	STRATEGY
ISOMETRIC	Tongue	Strengthening lingual musculature	5 to 10 times from 3 to 10 seconds. *	Through the isometric exercise of tongue sucked on the palate, keep "x" sec and snap. - exercise proposed by Rahal (2012).
	Cheek	Strengthening the buccinator muscle	5 series of 15 seconds	Through the request to inflate cheeks and sustain.
ISOTONIC	Tongue	Adapt tongue mobility	3 to 7 series of 10 movements in the rhythm of one second, with interval of 10 seconds between the series.	Through the request of antero-posterior exercises of tongue sucked against the palate. - Exercise proposed by Berrentin-Felix, Silva & Mituuti (2012)
	Cheek	Working the buccinator muscle mobility	5 to 7 series of 3 to 7 sequential movements.	Through the exercise of sucking and inflating the cheeks simultaneously and alternately.
ISOKINETIC	Lips	Strengthening lip muscles	5 to 10 times from 3 to 10 seconds. *	Through counter-resistance with the use of a spatula in lip protrusion.
	Tongue	Strengthening lingual musculature	5 to 10 times from 3 to 10 seconds.	Through counter-resistance with the use of a spatula in tongue protrusion. **
	Cheek	Strengthening the buccinator muscle	8 to 10 times from 5 to 10 seconds. (the hypotonic side will have a duplicate number of replicates relative to the normal side).	With closed teeth, the therapist will place the index finger on the inside of the cheek and force it out. The patient should force the closure of the cheek performing similar movement to that of suction.
	Masseter	Strengthening the masseter muscle (side depending on each patient)	5 to 10 times from 5 to 15 seconds.	Through the tip of the tongue in the region of the incisive papilla maintaining the support of buccal opening and hands supported in the inferior region to the mandible performing counter-resistance (attempt of buccal closure).

* Muscle contraction time gradually increased throughout the sessions.

** This exercise was not performed in the case of patients who had previous lisp.