Case Report

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Speech-language pathology, gerontology and obstructive sleep apnea: case report

Fonoaudiologia, gerontologia e a apneia obstrutiva do sono: relato de caso

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ABSTRACT

The effectiveness of speech-language therapy is proven for obstructive sleep apnea (OSA), especially for the adult population. However, studies with a population over 65 years are scarce. Thus, the aim of the present study was to analyze the longitudinal clinical evolution of an OSA elderly subject undergoing Orofacial Myofunctional Therapy (OMT). Male clinical case, 72 years old, with OSA submitted to OMT, polysomnography (PSG) exams, otorhinolaryngological clinical evaluation, Epworth sleepiness scale application, Mallampati classification and orofacial myofunctional speech evaluation in 3 different moments in time (before OMT, after OMT and after 22 months of OMT). OMT was configured to perform isometric and isotonic exercises for the orofacial and pharyngeal regions and functional training in weekly sessions of 30 minutes for 5 months. After that period, the sessions were spaced for biweekly, monthly and quarterly. After 22 months of OMT, an evolution was observed in the objective and subjective parameters related to sleep, identified by polysomnography (baseline test: 24.5 events / hour and last test of 4.63 events per hour), improvement in excessive daytime sleepiness and improvement of myofunctional orofacial parameters. Thus, it was observed that OMT demonstrated efficient and effective results of speech therapy intervention and therapeutic treatment based on OSA in this case report of an elderly person. It is noteworthy that such results were monitored and controlled through multidisciplinary evaluation in a longitudinal way.

Keywords: Speech, Language and Hearing Science; Obstructive sleep apnea; Sleep; Aged; Stomatognathic system

RESUMO

A eficácia da terapia fonoaudiológica está comprovada para a apneia obstrutiva do sono (AOS), principalmente para a população adulta. Entretanto, estudos com população acima de 65 anos são escassos. Assim, o objetivo do presente estudo foi analisar a evolução clínica longitudinal de um sujeito idoso com AOS submetido à terapia miofuncional orofacial (TMO). Caso clínico, sexo masculino, 72 anos, com AOS, submetido à TMO após ter realizado avaliação clínica, exames de polissonografia (PSG) e avaliação clínica otorrinolaringológica, bem como a aplicação da escala de sonolência de Epworth, a classificação de Mallampati e a avaliação fonoaudiológica miofuncional orofacial em três momentos distintos: antes da TMO, após a TMO e após 22 meses da TMO. A TMO se configurou na realização de exercícios isométricos e isotônicos para região orofacial e faríngea, treino funcional em sessões semanais de 30 minutos, durante cinco meses, quando, então, as sessões foram espaçadas. Após os 22 meses de TMO, observaram-se evoluções nos parâmetros objetivos e subjetivos relativos ao sono, que foram analisados e identificados por meio de uma nova polissonografia (PSG), com os seguintes dados: exame basal, 24,5 eventos/hora e último exame de 4,63 eventos/hora. Verificou-se acentuada melhora da sonolência diurna excessiva e, ainda, melhora dos parâmetros miofuncionais orofaciais. Deste modo, pôde-se constatar que a TMO demonstrou resultados eficientes e eficazes na intervenção e no tratamento terapêutico fonoaudiológico, tendo como base a AOS do paciente idoso. Ressalta-se que tais resultados foram acompanhados e controlados por meio de avaliação multidisciplinar de modo longitudinal.

Palavras-chave: Fonoaudiologia; Apneia obstrutiva do sono; Sono; Idoso; Sistema estomatognático

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INTRODUCTION

The aging process entails structural, functional and chemical neurobiological changes. It is a natural process in human development, but it may result in cognitive, physical and behavioral deficits, influenced by internal (cell degeneration, which impairs cell function responses, free radicals) or external factors (balanced diet and regular exercising) to the organism(1).

Age-related skeletal-muscle loss, known as sarcopenia, is one of the symptoms affecting not only sedentary subjects, but also healthy, active individuals, impairing, to a greater or minor extent, the activities of daily living, thus resulting in the autonomy decrease. Differing factors influence sarcopenia, such as hormone changes, loss of motor nerve cells, imbalanced diet, physical inactivity and levels of chronic inflammation(2).

The decrease of the muscle fibers and strength is not restricted to the major body segments. Orofacial and pharyngeal structures are also influenced by such age-related alterations. Presbyphonia is one of those, defined as the age-related vocal changes in the muscles of the larynx and vocal cords(3), as well as the presbyphagia, or the physiological degeneration of the swallowing mechanism, due to the aging of nerve and muscle fibers in healthy older subjects(4). Thus, orofacial and pharyngeal muscle loss may result in the alteration of the stomatognathic system, that is, chewing, swallowing, speech and breathing(3,4).

Specifically, regarding breathing and the obstructive sleep apnea (OSA), that is, a breathing disorder impairing the quality and amount of sleep, which may lead to prospective cognitive deficits related to the intermittent hypoxia, sleep architecture disorders and metabolite accumulation(5), the adaptation of the Continuous Positive Airway Pressure (CPAP) treatment improves excessive daytime sleepiness, decreases fatigue to perform the activities of daily living, reduces depressive symptoms, and improves the quality of life(6).

The performance of the speech-language therapy to treat sleep disorders has been consolidated as one of the isolated or combined options for respiratory sleep disorders, such as the OSA, with adult-adapted methods(7). The effects of the orofacial, myofunctional speech therapy are related to the decrease of the apnea and hypopnea index (AHI), the awakening index, the report of excessive daytime sleepiness, and the increase in the quality of sleep and in the quality of life(7). Yet, there is still an important gap in order to understand the direct effects on muscles and on the older population, which is of concern, due to the greater prevalence of OSA during the aging process(8).

Studies have found alterations in the muscle fibers of the larynx tissue in patients suffering from OSA(9). Comparing to subjects without OSA, a decrease was found in Type II fibers, of fast twitch and highly fatigue-resistant, from the superior constrictor muscle of the pharynx, which may lead to an efficiency decrease of that muscle, and its involvement in the disease physiopathology. In addition, it was also found the presence of Type 1-collagen proteins, usually present in aging, thus favoring the decrease of tissue elasticity. Therefore, older subjects with OSA are prone to presenting more harm in the mechanism of patency maintenance of superior airways, straight dependent on the sensitivity and twitch of the orofacial, pharyngeal muscles(9).

Thus, this study objectifies to analyze the longitudinal clinical evolution of an older subject with OSA, submitted to orofacial, myofunctional speech therapy.

PRESENTATION OF THE CLINICAL CASE

The current study was approved by the Ethics Board on Research with Human Beings of the University of Brasília – UnB, register 37/2004. The participant signed the Free Informed Consent Form.

Male subject, 72 years old, body mass index (BMI) = 28.3 kg/m2, hypertensive, making use of hydrochlorothiazide, clomipramine maleate, blood pressure ranging between 16x10 and 14x9. The patient initially reported slight snoring. However, according to his wife, snoring was heavy to the point of waking her up during the night; excessive daytime sleepiness, frequent daytime drowsiness, and fatigue report at waking up; concentration and memory problems, affecting the quality of life and the performance of the activities of daily living.

The patient had been previously diagnosed with moderate OSA, and by means of the polysomnography type 1, he was referred to CPAP (in titration, pressure recommended at 7cm H^2O). However, for financial purposes and difficult adaptation, CPAP therapy was discontinued. Speech therapy follow-up was medically recommended. No alterations in the otorhinolaryngological assessment and in the nasofibrolaryngoscopy were evidenced.

Evaluation instruments

Controlled parameters were adopted for measuring OMT results at three moments in time: before starting the OMT, five months of the OMT, and after 22 months from the start of the OMT.

Objective sleep evaluation

For the objective sleep evaluation, Type1-polysomnography was conducted, Alice 3 v1.20 © *Healthdyne* equipment. The following parameters were analyzed and considered(10):

- AHI – apnea and hypopnea index per sleep hour: mild – five to 15 apnea episodes/hour; moderate – 15 to 30 apnea episodes/hour, severe – over 30 apnea episodes/hour(10);
- MAI – micro-awakening index: number of awakening episodes, greater than three seconds and less than 15 seconds per hour of sleep;
- Sleep architecture: distribution of NREM (non-rapid eye movement) and REM (*rapid eye movement*) sleep levels during the night;
- Percentage of REM sleep: 20% to 25% of the total sleep hours;
- Mean saturation of oxyhemoglobine: blood oxygen saturation;
- T90 (time below 90% of oxyhemoglobine saturation).

Epworth Sleepiness Scale (ESS)

It is a self-reported questionnaire, which measures the propensity of excessive daytime sleepiness during eight situations of daily activities. General scores range from 0 to 24, and above 10 indicates excessive daytime sleepiness[11].

Orofacial myofunctional evaluation

MBGR (Marchesan, Berrentin-Felix, Genaro, Rehder) protocol, adapted for OSA cases[7], was used, aiming at measuring the performance of muscles and orofacial functions by setting scores. The higher the score, the greater alterations in the orofacial myofunctional evaluation.

That evaluation was conducted by means of body posture observation (head, cervical region, shoulder, and face profile), the usual posture; the symmetry; the morphology and mobility, and tonus of the orofacial structures (lips, cheeks, masseter muscle and temporal muscle, hard palate, soft palate, and tongue).

Regarding the evaluation of the functions of the stomatognathic system – breathing, chewing, swallowing – breathing was assessed by means of the thoracic-abdominal movements in order to identify breathing mode and type, as well as the pneumophonoarticulatory coordination. Improper or decreased contraction of certain muscle groups and facial pains while chewing, and/or jaw lowering (temporomandibular joint (TMJ) pain) were considered.

Another major assessed aspect was related to missing teeth or the use of dental prosthesis, probable compromising aspects due to the close relation to the oropharyngeal muscles. The higher the protocol score, the more impaired the structures and functions.

For the analysis of the modified Mallampati test, the subject was requested to swallow and open his mouth, keeping his tongue relaxed. In this moment, the structural aspect was observed, and if visualization of the posterior pharyngeal wall, palatine tonsils, uvula palatine arches was possible (class I), full/partial uvula and partial visibility of the tonsils and arches (class II), minimum visibility of the soft palate, and if tonsils and pillars could not be seen, covered by the base of the tongue (class III), or if only the hard palate could be seen (class IV)[7].

Speech therapy intervention (OMT)

In the first phase, OMT was weekly conducted for 30 minutes each session, with six to eight exercises being performed. Exercises were proposed for posture adequacy, mobility and orofacial, pharyngeal muscle strength. Priority was given to those structures related to the obstruction due to the superior airway collapse during sleep: floor of the oral cavity; tongue; chewing muscles; buccinators; masseter, lateral and medial pterygoid; soft palate and uvula; supra and infrahyoid muscles; pharyngeal musculature and breathing, chewing and swallowing functions[7] (Chart 1).

Adherence control was conducted by means of the subject's report, who kept a positive feedback, in addition to the performance analysis of the proposed exercises. He was recommended to keep on doing the OMT daily between the sessions.

In the 4th phase, four to five exercises were performed daily, with recommended exercises for the orofacial functions, for the strength and mobility of the orofacial muscles. The mean time taken for the home exercises was ten to 15 minutes. Thirty-two (32) sessions were held during the 22 months of follow-up.

Importantly, the same speech-language pathologist conducted the assessments and the therapy.

In this case, general anthropometric and clinical data were monitored to identify the source of the changes, or not, longitudinally, in the speech therapy treatment. Thus, steady parameters were observed, as BMI primarily stood out, which may influence muscular and functional treatment in Speech Therapy in a positive or negative way (Table 1).

Polysomnography test showed significant longitudinal improvement, pointing out the systematic follow-up conducted to encourage the daily exercises performed by the subject (Table 2). The subject, who seemed to be motivated by the subjective results of sleep improvement and quality of life, attended all the 27 speech therapy sessions.

The orofacial, myofunctional evaluation evidenced considerable improvement in muscles and orofacial functions, primarily strengthening posture and tongue mobility, as well as the breathing mode, chewing efficiency and swallowing (Table 3).

DISCUSSION

Speech-language therapy intervention in respiratory sleep disorders has seemed to be an alternative of efficient treatment, by means of the adequacy of stomatognathic system structures and functions. However, considering that the prevalence of OSA among the older population is higher, and that population has been increasing worldwide, the description of the possibilities and limitations of the speech therapy intervention is deemed necessary, specifically in those cases.

In that sense, the reported case was about an older subject of 72 years (initially), which was unprecedented, once there had never been other sleep related speech therapy interventions to compare. It is worth mentioning that the displayed results were only significant for the clinical case reported in this study. Further studies are necessary with a larger population within a randomized, controlled clinical trial design, so that the possibilities and limitation of the speech- therapy performance can be established among the elderly population on respiratory sleep disorders.

The foundations of that performance could be established by means of the mechanisms involved in the OSA pathogenesis, and how anatomic, neuromuscular alterations and the central fat distribution may indicate that increase in prevalence among older subjects[1,2,8]. Exemplifying those neuromuscular alterations, a current study has shown a decrease in the pharyngeal constriction during the swallowing function, causing compensations, multiple swallowing and slowness in the bolus transit from the oral to the pharyngeal phase, thus featuring the presbyphagia[12]. Taking those data to the moment the subject is lying down, under heavy action of the gravity in that region, more delay in the amplitude of the oropharyngeal light is expected, standing out, even more, the muscular and functional work held by the Speech-Language Pathology[7,13].

In the first evaluation, the subject reported excessive daytime sleepiness and resistant hypertension, frequently found in OSA cases[1,5,7,11]. Regarding the excessive daytime sleepiness, significant

Chart 1. Description of the therapeutic objectives, exercises and exercise modes during the orofacial myofunctional therapy

Sessions duration	Objective	Exercise Performed	Mode/frequency of performance
1st Phase	To work mobility of lip and risorius orbicularis muscles.	Protrude and retract lips.	4 series from 5 to 10 repetitions.
16 sessions	To work intrinsec and extrinsic tongue muscle mobility; supra and infrahyoid muscles.	Protrude and retract the tongue.	4 series from 5 to 10 repetitions.
During 5 months	To work mobility of intrinsic tongue muscles.	Place the tip of the tongue right and left in the inner labial commissures.	4 series from 5 to 10 repetitions.
	To work intrinsic and extrinsic muscle mobility and supra hyoid muscle mobility.	Sweep hard palate with the tip of the tongue.	4 series from 5 to 10 repetitions.
	To work intrinsic and extrinsic tongue muscle mobility and suprahyoid muscle mobility	Roll the tongue in the oral vestibule.	4 series of 5 clockwise and counter clockwise repetitions.
	To work the tonus of intrinsic and extrinsic tongue muscles and suprahyoid muscles	Suck tongue into the palate and hold static contraction.	4 series for 10 to 20 seconds in static contraction.
	To work muscle mobility and tonus of the palatine veil and uvula.	Utter A/Ã	4 times 20 repetitions, then hold the contraction for up to 20 seconds.
	To work muscle tonus of the pharynx, soft palate and buccinators, respiratory muscles.	Breathe in and blow, inflating the cheeks.	5 to 10 times.
	Respiratory Mode	Cleaning with saline solution and nasal alternation.	Those guidelines and training were included subsequently to the corresponding muscle work.
	Chewing pattern	Bilateral chewing without the associated muscle contraction.	In this phase, the exercises should be performed 4 times at home every day.
	Swallowing	No associated muscle contraction.	
	Speech	Range of utterance.	
2nd Phase			
4 sessions		Exercises were kept four times a day.	
2 months			
3rd Phase			
6 sessions		Exercises were kept 3 times a day.	
6 months			
4th Phase	To work intrinsic and extrinsic tongue muscle mobility and supra and infrahyoid muscles.	Protrude and retract the tongue.	4 series from 5 to 10 repetitions.
6 sessions	To work intrinsic and extrinsic tongue muscle mobility and suprahyoid muscles.	Sweep hard palate with the tip of the tongue.	4 series from 5 to 10 repetitions.
During 09 months	To work intrinsic and extrinsic tongue muscle mobility and suprahyoid muscles.	Roll the tongue in the oral vestibule.	4 series of 5 clockwise and counter clockwise repetitions.
	To work intrinsic and extrinsic tongue muscle tonus and suprahyoid muscles.	Suck tongue into the palate and keep static contraction.	4 series for 10 to 20 seconds in static contraction.
	To work muscle mobility and tonus of the palatine veil and uvula.	Utter A/Ã.	4 times 20 repetitions, and then hold the contraction for up to 20 seconds.

Table 1. Clinical evolution of the complaints in the male case aged 72 years

Parameter	1st Evaluation	2nd Evaluation	3rd Evaluation
	Pre-OMT	Post-OMT (5 months)	Post-OMT (22 months)
Age (years)	72	72	74
ESS (scoring)	13	1	1
Arterial pressure (mmHg)	140/90	120/80	120/80
BMI (kg/m²)	28.3	28.6	28.5

Subtitle: OMT = orofacial myofunctional therapy; ESS = Epworth Sleep Scale; mm Hg = millimeters of mercury; BMI = body mass index; kg/m² = kilogram per square meter

improvement was observed in the immediate and longitudinal evaluation after the speech therapy, corroborating the literature[7,13], as well as the control and maintenance of the arterial pressure (AP) at normal rates after the OMT, according to the patient's report. Although there was no objective control of the clinical data, or habit changes related to that issue, OMT might have influenced the improvement of the respiratory permeability during sleep, contributing to better respiratory parameters, which, in turn, help the management of the OSA-related cardiovascular disorders; Concerning the systemic arterial hypertension (SAH), the patient started to respond positively to the pharmacological treatment used[14]. Yet, there were no changes in the BMI, which could be another factor to hinder that straight correlation[15].

The longitudinal improvement and maintenance of the muscular and functional performance, demonstrated by the MBGR protocol, are according to literature, which shows the impact of the treatment on the polysomnography parameters[7,8,10], also identified in the current study. That effect must be jointly monitored with the BMI maintenance so that effect overlapping does not occur[15]. In this case, that was possible to control by the assessments, and significant BMI change did not occur during the two-year follow-up.

Despite the observed improvement, not only in the MBGR protocol, but also in the self-reported questionnaire and in the polysomnography, that was a limitation in the current study: the failure in the use of blinding in the process of evaluation and application of the OMT. Further studies should replicate the methodology, in a larger double-blind case study.

The association between OSA, oral or mixed breathing, alterations in chewing, vocal and swallowing patterns has been commonly described in sleep-related speech therapy[3,7,13]. In this study, those findings were confirmed, with mixed breathing (oronasal breathing), functional changes in swallowing, head-projection movements, lip tightening, intraoral sensory disorder, and strength decrease in the chewing and tongue muscles, hindering the efficiency of the chewing process.

In Mallampati Classification, the current case initially featured class IV, in which only hard palate is visible. That finding corroborates the involved physiopathology in the narrowing and collapse of the upper airways in cases of OSA, due to the imbalance of the constricting and dilating forces, which keep the patency of the pharyngeal light[12]. During

Table 2. Clinical evolution of the polysomnography parameters in the male case aged 72 years

PSG parameter	1st Evaluation	2nd Evaluation	3rd Evaluation
	Pre-OMT	Post-OMT (5 months)	Post-OMT (22 months)
AHI (e/h)	24.5	19.1	4.63
MO2Sa (%)	90	92	92
T90 (%)	7,8	1,9	4,6
N. MA	96	172	70
MA (e/h)	18.3	21.8	9.01
NREM2 (%)	65.6	56.2	52.4
REM (%)	13.9	14	22.2

Subtitle: PSG = polysomnography; OMT = orofacial myofunctional therapy; AHI = apnea/hypopnea index; e/h = events per hour; MO2Sa = mean oxyhemoglobin saturation; % = percentage; T90 = time of oxygen saturation below 90%; MA = microawakening index; REM = *rapid eye movement*; NREM2 = *Non-rapid eye movement* phase 2

Table 3. Clinical evolution of the orofacial myofunctional evaluation in the male case aged 72 years

	1st Evaluation	2nd Evaluation	3rd Evaluation
	Pre-OMT	Post-OMT (5 months)	Post-OMT (22 months)
Modified Mallampati	4	3	2
EXTRAORAL EXAM (best result = 0 and the worst = 30)	11	9	8
Face (best result = 0 and the worst = 15)	6	6	6
Lips (best result = 0 and the worst = 13)	3	2	2
Masseter (best result = 0 and the worst = 2)	2	1	0
INTRAORAL EXAM (best result = 0 and the worst = 61)	7	6	4
Lips (best result = 0 and the worst = 5)	0	0	0
Cheeks (best result = 0 and the worst = 8)	2	2	2
Tongue (best result = 0 and the worst = 20)	5	4	2*
Palate (best result = 0 and the worst = 8)	0	0	0
Palatine Tonsils (best result = 0 and the worst = 4)	0	0	0
Teeth (best result = 0 and the worst = 5)		**Upper and lower full fixed prosthesis**	
Occlusion (best result = 0 and the worst = 11)	0	0	0
MOBILITY (best result = 0 and the worst = 68)	27	20	14*
Lips (best result = 0 and the worst = 27)	11	8	6
Tongue (best result = 0 and the worst = 24)	12	10	6
Palatine veil (best result = 0 and the worst = 4)	2	1	1
Jaw (best result = 0 and the worst = 13)	2	1	1
SENSITIVITY (best result = 0 and the worst = 65)	5	4	4
Tactile (best result = 0 and the worst = 55)	5	4	4
Pain on palpation (best result = 0 and the worst = 10)	0	0	0
TONUS (best result = 0 and the worst = 6)	4	1	1
Lips (upper + lower) (best result = 0 and the worst = 2)	1	0	0
Mentum (best result = 0 and the worst = 1)	0	0	0
Tongue (best result = 0 and the worst = 1)	1	1	1
Cheeks (right + left) (best result = 0 and the worst = 2)	2	0	0
OROFACIAL FUNCTIONS (best result = 0 and the worst = 123)	22	14	11*
Breathing (best result = 0 and the worst = 5)	2	0	0
Chewing (best result = 0 and the worst = 10)	4	2	1
Swallowing (best result = 0 and the worst = 36)	11	8	6
Speech (best result = 0 and the worst = 72)	5	4	4

Subtitle: OMT = orofacial myofunctional therapy; (*) the speech therapist observed evolution in the language posture, increase in the mobility of lips, tongue, cheeks and soft palate, nasal breathing after the beginning of the OMT, and better chewing and swallowing efficiency.

the longitudinal speech therapy follow-up, evolution of that parameter could be observed, similar to earlier studies[7,13], with observed improvement, specially comparing the last evaluation (class II) to the first one.

Similarly to the improvement in the modified Mallampati test, the positive effects of the OMT were more emphatically observed in the polysomnography parameters in the evaluation after 22 months: normalized AHI, improvement in the sleep architecture and efficiency, decrease in the fragmented sleep, reduction in the intensity and frequency of snoring. Slower evolution was evidenced in the OSA among the elderly population. Therefore, to that population, evaluation soon after the end of the OMT should not be the priority, waiting longer for result stability instead, with periodical longitudinal follow-up, though. That longitudinal follow-up is grounded in the current discussion on the progressive behavior of the physiological mechanisms/ OSA-related endotypes, which directly interact with the immediate and mediated response to the selected treatment[8].

The use of the CPAP is recommended as the first-choice treatment in cases of moderate and severe OSA. According to the literature, older individuals who use CPAP, improve cognitive processing, memory and executive functions, reduce their cardiovascular dysfunctions, while improving their quality of life, once the CPAP decreases respiratory arrests, normalizes the stages of sleep during the sleep cycle, improves sleep interruption and reduces the fall of the oxyhemoglobin saturation. However, acceptance (21%) and adherence (44%) to the CPAP are reduced among the elderly population[6], as evidenced in the studied case. Thus, therapeutic planning is needed jointly with the doctor responsible for the diagnosis and the multidisciplinary team. At this point, the participation of the speech therapist stands out, with the active participation of the patient, considering his/her expectations, socioeconomic conditions and motivational factors.

Effective adherence to the OMT is one of the points to be taken into account for the satisfactory clinical evolution of the individual with OSA. Elderly subjects with OSA may have more time availability and dedication in the daily, long-term practice of the proposed exercises so that their musculature, even more slowly, responds positively to the OMT stimulation.

FINAL CONSIDERATIONS

Speech-therapy intervention, by means of the OMT, resulted in positive outcomes for this specific clinical case of moderate OSA in an elderly subject, who showed satisfactory adherence to the treatment and, consequently, resulted in the longitudinal improvement in the myofunctional and orofacial parameters, and in the polysomnography findings as well. It should also be pointed out that the third evaluation found even more significant data. Thus, further studies are suggested, focusing on that specific population, aiming at elaborating standardized procedures and protocols in order for the Speech-Language Pathology to contribute more and more to the evaluation and intervention of those patients.

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