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Preparation of a Protocol for Instrumental Assessment of Speech (*PRAINF*) based on psychometric and linguistic criteria

Elaboração de um Protocolo de Avaliação Instrumental da Fala (PRAINF) baseado em critérios linguísticos e psicométricos

ABSTRACT

Objective: Propose a protocol for instrumental assessment of adult speech considering psychometric and linguistic criteria. **Methods:** The choice of words was based on previously defined Brazilian Portuguese linguistic criteria after a search on the "Portal da Língua Portuguesa" database using the Portuguese Orthographic Vocabulary (VOP). The defined linguistic criteria considered grammatical class, vowel context, number of syllables, stress, and presence of words in the daily life of Brazilian adults. The choice of the images to represent the words considered the criteria of imageability, clearness, and cultural aspects. The words and images were rigorously evaluated by 13 non-specialist judges and six specialist judges. After being examined by the judges, the words were tested in adults through instrumental assessment. **Results:** The protocol was composed of 19 words and images, with prevalence of nouns over adjectives. Each word included one target sound in Onset Medial position, in the context precedent and following the vowel [a], trisyllabic and paroxytone words. The adults that attended the instrumental assessments succeeded in producing the list of words spontaneously. The data obtained through the assessments provided adequate analysis. **Conclusion:** This study provided additional information on psychometric and linguistic criteria in addition to providing a protocol for instrumental assessment of adult speech.

RESUMO

Objetivo: Propor um protocolo para avaliação instrumental da fala de adultos, considerando critérios linguísticos e psicométricos. **Método:** A escolha das palavras para compor o protocolo foi baseada em critérios linguísticos do Português Brasileiro (PB), previamente definidos, após busca no banco de dados do Portal da Língua Portuguesa, utilizando o Vocabulário Ortográfico Português (VOP). Os critérios definidos foram em relação à classe gramatical, ao contexto vocálico, ao número de sílabas, à tonicidade e à presença das palavras no cotidiano dos adultos brasileiros. A escolha das figuras para representarem as palavras levou em consideração os critérios de imageabilidade, clareza da figura e aspectos culturais da imagem. **Resultados:** O instrumento foi composto por 19 palavras/figuras, prevalecendo substantivos em relação aos adjetivos, cada palavra contemplando um fonema-alvo na posição de *Onset* Medial, no contexto vocálico seguinte e precedente à vogal [a], trissílabas e paroxítonas. As palavras e figuras passaram por criteriosa avaliação de 13 juízes não especialistas e 6 juízes especialistas. Após a fase de apreciação pelos juízes, as palavras foram testadas em adultos mediante avaliação instrumental. Os adultos que realizaram as avaliações instrumentais conseguiram produzir a lista de palavras espontaneamente, e os dados obtidos através das avaliações possibilitaram adequada análise. **Conclusão:** Este estudo forneceu informações a respeito de critérios psicométricos e linguísticos, e disponibilizou um protocolo para avaliação instrumental de fala para adultos.

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INTRODUCTION

Speech intelligibility is an important variable in the oral communication, and it is indispensable to characterize all levels involved in this process, which are responsible for the correct and intelligible production of sounds. There are five main levels: resonance, articulation, phonation, respiration and prosody[1]. Changes in any of these levels may compromise speech intelligibility, characterizing phonetic deviations or disorders, dysphonia, dysarthria, etc.

In these cases, people who present impairments in speech production are referred for speech and language assessment and therapy. However, there are few standardized evaluation instruments aimed at the adult population[2,3], especially instruments with linguistic and psychometric criteria, and that allow the achievement of quantitative results.

In relation to the adult population, the main instruments for the perceptual speech evaluations are: the Sentence Intelligence Test (SIT)[4], the Protocol for the Evaluation of Dysarthria[3], the Protocol for the Evaluation of Speech Intelligibility in Dysarthria - PAIF[5,6], and the Verbal and Nonverbal Apraxia Protocol[7].

In addition to perceptual speech evaluations, there are currently quantitative instrumental evaluations, such as speech ultrasonography and nasometry, among others, that allow the clinician to identify each level of speech production and to obtain reliable parameters regarding the levels involved in speech production[8].

Therefore, in order to favor the interpretation of several speech disorders, as well as to improve the diagnosis and the therapeutic process, it is prudent to combine qualitative and quantitative methods, that is, perceptual and instrumental evaluations, in the analysis of speech production.

The use of speech-language assessment instruments, such as speech ultrasonography, allows the clinician to perform articulatory analysis synchronized to the acoustic signals of the production[9]. In addition, these tools can also serve as therapeutic resources in the form of biofeedback to the patient, enhancing and accelerating effectiveness in rehabilitation[10].

In addition to this technique, there are other quantitative evaluations of speech, such as Radiography, Magnetic Resonance, Electromagnetic Articulography, among others. There are also techniques for the analysis of resonance, such as nasometry, pressure-flow technique, acoustic rhinometry and rhinomanometry, nasopharyngoscopy and videofluoroscopy[11].

Nasometry allows the estimation of speech resonance by means of nasalance measurement, a physical quantity that reflects the relative amount of nasal acoustic energy during speech[12]. The visual feedback during speech therapy has also been shown as an alternative instrument application, such as electropalatography, nasometry, ultrasonography, among others, which have been presenting positive results in the attendance to several speech disorders[13].

The use of these instrumental resources in adults requires a specific protocol that allows detailed analysis of the production of speech sounds. Therefore, the choice of words to compose such a protocol should take into account specific linguistic criteria such as phonetic-phonological context, besides the need to verify the prosodic context of occurrence of these words.

In this way, this work aims to elaborate and make available a protocol for the quantitative instrumental evaluation of the speech of adults based on linguistic and psychometric criteria, contemplating all consonant phonemes of Brazilian Portuguese (BP), and serving as a protocol for the empirical data, for later instrumental analysis.

METHODS

This research was approved by the Research Ethics Committee (CEP / UFSM), under n. 1.316.911. The study was performed only by signing the Term of Free and Informed Consent - TCLE, where the subjects agreed with their participation, being aware of its risks, benefits and the objective of this research. This study was carried out in accordance with the directives and norms regulating research involving human beings, as determined by the National Health Council in Resolution 466/12.

The development of the protocol began by selecting the words, choosing the vehicle phrase and standardizing the instructions of the instrumental evaluation.

As shown in Figure 1, firstly a word search was performed in the Portuguese Language Portal database, whose target consonants should be in the position of Medial Onset (OM), between the vowel [a]. From this result, the following linguistic criteria were applied: trissyllabic words, paroxytone, excluding words composed of two identical consonants (a consonant equal to the target consonant, for example: [ma.'ka.ko].

In relation to the phonetic and phonological context of these words, the vowel context and the consonantal context in which the phoneme is inserted, as well as the adjacent consonant segments were also considered, insofar as anticipatory coarticulations are present in speech production[14,15].
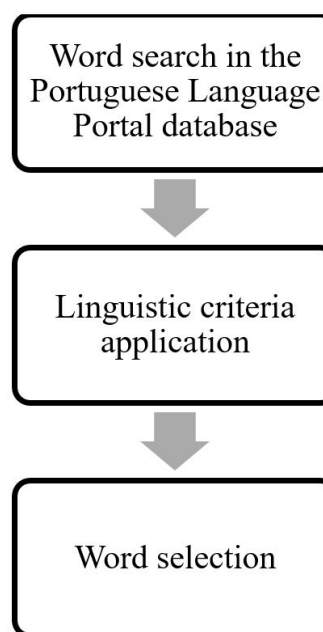

Figure 1. General description the process of selecting words

After the use of these criteria, the choice of words took into account the occurrence of the words of daily life of adults, excluding words that might have negative or offensive connotations.

In order to facilitate spontaneous naming, the selected words should be represented by figures, which were chosen taking into consideration three factors: correspondence of the figure with the imageability of the word, that is, the mental image created by the speaker for each word/concept; the figure clearness, so that the figure was self-explanatory and the target word was in evidence; finally, the familiarization of the figures with the Brazilian culture, in order to facilitate the consensual denomination among the speakers[16].

The process of selecting words, figures and evaluating their suitability is shown in Figure 2.

After the choice of figures, there was an evaluation of the adequacy of words and figures by specialist and non-specialist judges. Thirteen non-specialist judges chosen by convenience made the evaluation of the correspondence between word and figure. All the judges were academics attending the fourth semester of the Speech-Language Pathology and Audiology undergraduate course, and they already had theoretical experience in orofacial motricity.

The judges received a list with several figures arranged in a table, where they should name each figure with the respective word. All the judges were informed about the purpose of the research and they were also oriented to consider the linguistic criteria of the words at the time of the appointment of the figures.

After this analysis, three expert judges evaluated the selected figures and words: speech language pathologists and specialists in voice, language and oral motor skills, with experience in speech motor disorders. For each word corresponding to the target phoneme, the judge should indicate which of the alternatives was the most adequate for the collection of the speech data. In the case of only one alternative, it should be answered only if the word and the figure were adequate for the collection or not, suggesting reformulations, if necessary.

For the evaluation of words and figures, the linguistic criteria and the factors of imageability, image clearness and cultural aspects of the image should be taken into account, that is, the level of difficulty in eliciting the target words through the visualization of the figures.

In order to participate in the final stage of the protocol elaboration, three PhD speech therapists with experience in the elaboration of evaluation instruments and speech therapy using figures were chosen. In this way, the judges should point out which of the figures was the most appropriate alternative for spontaneous naming of the target word.

In order to verify if the stimuli chosen were adequate, in a real evaluation situation, 10 individuals of both genders, without communication disorders, typical BP speakers, were invited to perform the quantitative instrumental evaluations[7]. All of them were submitted to an initial speech-language evaluation to ascertain the aspects of speech, voice, orofacial motor and hearing; and to two instrumental evaluations: nasometry and ultrasonography.

For each quantitative instrumental evaluation, the volunteers should reproduce the word list, performing 05 repetitions of each word, seeking greater trustworthiness and consistency of the productions. The words were inserted in a carried sentence: "Say [target word] again", to keep words in the same prosodic and phonetic context, avoiding possible changes in acoustic parameters.

Considering that the most reliable way of obtaining speech samples is spontaneous naming, figures were displayed on the computer screen for the adult to spontaneously speak the target word during quantitative instrumental assessments, eliminating repetitive bias (auditory stimulus) and of the reading (written word).

In a situation of instrumental assessment of nasalance, using Nasometry, through the Nasometer II software[17], the following order was given: "You will see some images in the monitor that is in front of you. For each image, you must reproduce five times the following phrase 'Say [the name of the figure] again'. For example, if you see the picture of a horse, you should reproduce the phrase 'Say horse again'".

In a situation of instrumental assessment of articulation, using Ultrasonography through the Articulate Assistant Advanced software[18], the following order was given: "You will see some images in the monitor that is in front of you. For each image, you must reproduce the following phrase 'Say [the name of the figure] again'. For example, if you see the picture of a horse, you should reproduce the phrase 'Say horse again'. The figures will be presented in a random manner, so after the first reproduction of all words is finished, the procedure will be repeated four more times."

To participate in quantitative instrumental assessments, adult volunteers should be in accordance with the following established criteria: be born and/or raised in Santa Maria/RS; be aged between 19:00 and 44:11 (age determined by WHO to classify
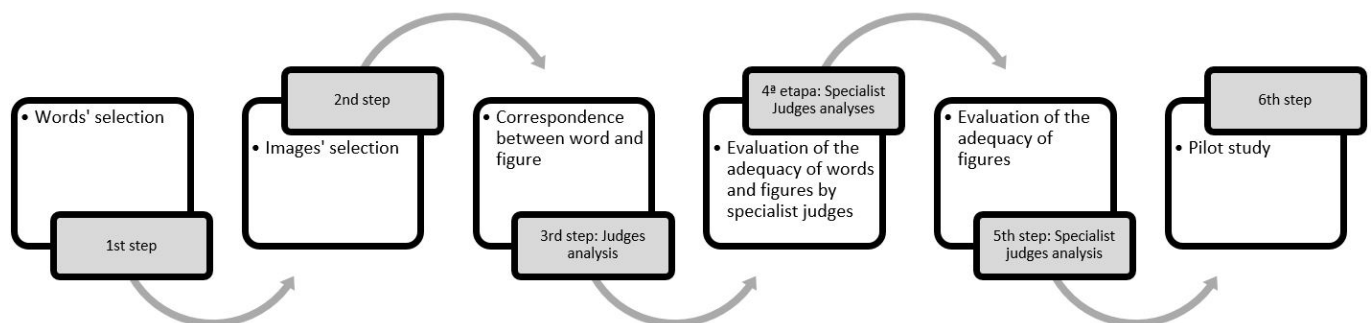

Figure 2. General description of the analysis process of selected words

young adults); have all speech-language assessments within the normal range (adequate oral and expressive language, adequate orofacial structures and functions, adequate voice to the speaker, adequate respiratory type and mode, and auditory thresholds within the normal range); have normal otorhinolaryngological report; have a nasalance degree of less than 27%[19].

Adults would be excluded if they reported complaints about speech, voice and / or hearing; if they presented language alterations; if they had already taken speech therapy; if they had a history of phonetic and / or phonological alterations; if they had allergic conditions; if they use dental prosthesis or fixed or mobile dental appliance; if they were people with special needs and, for example, used a wheelchair; if they were users of controlled drugs, alcohol, tobacco and illicit drugs; if they presented neurological or psychiatric conditions.

The study consisted of initial speech-language evaluations to select the study group, and quantitative instrumental evaluations (Ultrasonography and Nasometry) for data collection.

To verify the adequacy of the correspondence between word and figure, the "Percentage of Concordance" method was used.

$$\%concordance = \frac{number\ of\ participants\ who\ agreed}{total\ number\ of\ participants} \times 100 \tag{1}$$

In order to measure the proportion of agreement of answers among the expert judges, the calculation of the Content Validity Index was used.

$$IVC = \frac{number\ of\ answers\ "3"\ or\ "4"}{total\ number\ of\ answers} \tag{2}$$

Being "3" quite clear and "4" very clear.

RESULTS

Table 1 represents the initial results of the search in the Portuguese Language Portal database. The words were searched in relation to the vowel context, the position of the phoneme, the consonantal phoneme in the position of Onset Medial, and the grammatical class: nouns or adjectives.

The selection of these words after the application of the linguistic criteria took into account the frequency of the word in the daily life of adults and the possibility of representation by figures. Some words, such as "sacada", "casados", "machado", "cajado" and "banhado" were the only ones that fit the linguistic criteria for the target phoneme in question.

From this selection, non-specialist judges were asked to inform the correspondence between word and figure, as explained in Chart 1.

The evaluation of the correspondence between figures and words was given through a list of figures, where non-specialist judges should name the figure, according to Chart 2. The results were analyzed according to "Percentage of Concordance", as it is a simpler measure of concordance between judges and inter

observers in the initial phase of the survey[20]. The acceptable rate of concordance is above 90%, and should not be less than 78% among evaluators[21].

It can be seen in this chart that, of the 44 words evaluated, the words with concordance above 78% totaled 19 words (43.18%). The hits above 90% totaled 11 words (25%), and there were 100% correct answers for only 08 words (18.18%). Considering that there were words in which there was not an adequate concordance among the judges, a new verification of the adequacy of the words with specialist judges was carried out.

Table 1. Quantitative results of the existing words found in the Portuguese Language Portal database, observing the linguistic criteria adopted

Context	Position	Phoneme	Nouns		Adjective	
[a]	Medial Onset	[p]	T	1398	T	1044
			LC	23	LC	10
		[b]	T	1487	T	1314
			LC	31	LC	10
		[t]	T	2704	T	2010
			LC	31	LC	16
		[d]	T	4467	T	10658
			LC	20	LC	05
		[k]	T	6592	T	2746
			LC	31	LC	10
		[g]	T	1126	T	1061
			LC	26	LC	10
		[f]	T	466	T	475
			LC	11	LC	06
		[v]	T	1168	T	791
			LC	26	LC	11
		[s]	T	4723	T	1019
			LC	29	LC	10
		[z]	T	632	T	499
			LC	20	LC	09
		[ʃ]	T	314	T	256
			LC	10	LC	05
		[ʒ]	T	262	T	188
			LC	09	LC	04
		[l]	T	2624	T	2388
			LC	60	LC	28
		[λ]	T	1032	T	601
			LC	15	LC	08
		[R]	T	1112	T	653
			LC	41	LC	09
		[r]	T	3995	T	2398
			LC	48	LC	14
		[m]	T	2327	T	1787
			LC	34	LC	15
		[n]	T	3368	T	4880
			LC	42	LC	18
		[ɲ]	T	457	T	289
			LC	09	LC	05

Caption: T = total of the words found*; LC = words found with the linguistic criteria. *Words were considered in the singular as well as in the plural, including any gender (feminine, masculine and neutral)

Chart 1. List of the selected words after applying linguistic criteria for analysis by specialists and non-specialists judges

Target phoneme	Word	Transcription	Target phoneme	Word	Transcription
/p/	Sapato (Shoe)	[sa.ˈpa.to]	/ʃ/	Machado (Axe)	[ma.ˈʃa.do]
	Tapado (Covered)	[ta.ˈpa.do]			
	Chapada (Plateau)	[ʃa.ˈpa.dɐ]			
/b/	Tabaco (Tobacco)	[ta.ˈba.ko]	/ˈʒ/	Cajado (Crook)	[ka.ˈʒa.do]
	Abaixo (Beneath)	[a.ˈbaj.ʃo]			
	Cabala (Cabala)	[ka.ˈba.lɐ]			
/t/	Batalha (Battle)	[ba.ˈta.ʎɐ]	/l/	Salada (Salad)	[sa.ˈla.da]
	Atado (Tied)	[a.ˈta.do]		Palácio (Palace)	[pa.ˈla.sio]
	Ataque (Attack)	[a.ˈta.ke]		Balada (Balled)	[ba.ˈla.dɐ]
/d/	Cadarço (Shoelace)	[ka.ˈdar.so]	/ʎ/	Palhaço (Clown)	[pa.ˈʎa.so]
	Adaga (Dagger)	[a.ˈda.gɐ]		Malhada (Spotted)	[ma.ˈʎa.dɐ]
				Palhada (Straw)	[pa.ˈʎa.dɐ]
/k/	Sacada (Balcony)	[sa.ˈka.da]	/r/	Barata (Cockroach)	[ba.ˈra.ta]
				Baralho (Deck)	[ba.ˈra.ʎo]
				Parada (Stop)	[pa.ˈra.dɐ]
/g/	Bagagem (Luggage)	[ba.ˈga.ʒej]	/R/	Barraca (Tent)	[ba.ˈRa. kɐ]
	Lagarto (Lizzard)	[la.ˈgar.to]			
	Bagaço (Bagasse)	[ba.ˈga.so]			
/f/	Mafalda (Mafalda)	[ma.ˈfaw.dɐ]	/m/	Damasco (Apricot)	[da.ˈmas.ko]
	Safari (Safari)	[sa.ˈfa.ri]		Chamada (Call)	[ʃa.ˈma.dɐ]
	Afago (Cuddle)	[a.ˈfa.go]		Camaro (Camaro)	[ka.ˈma.ro]
/v/	Cavalo (Horse)	[ka.ˈva.lo]	/n/	Canário (Canary)	[ka.ˈna.rio]
	Lavabo (Lavatory)	[la.ˈva.bo]		Granada (Grenade)	[gra.ˈna.da]
	Navalha (Razor)	[na.ˈva. ʎɐ]		Manada (Herd)	[ma.ˈna.dɐ]
/s/	Passagem (Boarding pass)	[pa.ˈsa. ʒej]	/ŋ/	Banhado (Marsh)	[bã.ˈŋa.do]
	Massagem (Massage)	[ma.ˈas. ʒej]			
	Caçada (Hunt)	[ka.ˈsa.dɐ]			
/z/	Casados (Married)	[ka.ˈza.dos]			

Chart 2. Results of the correspondence between words and images by non-specialists judges answers

Target phoneme	Words and percentage of correct answers					
	Word 1	%	Word 2	%	Word 3	%
[p]	Sapato (Shoe)	100	Tapado (Covered)	16.67	Chapada (Plateau)	0
[b]	Tabaco (Tobacco)	25	Abaixo (Beneath)	0	Cabala (Cabala)	0
[t]	Batalha (Battle)	0	Atado (Tied)	8.3	Ataque (Attack)	25
[d]	Cadarço (Shoelace)	100	Adaga (Dagger)	0	-	-
[k]	Sacada (Balcony)	100	-	-	-	-
[g]	Bagagem (Luggage)	25	Lagarto (Lizzard)	75	Bagaço (Bagasse)	41.67
[f]	Mafalda (Mafalda)	100	Safari (Safari)	86.67	Afago (Cuddle)	16.67
[v]	Cavalo (Horse)	83.3	Lavabo (Lavatory)	25	Navalha (Razor)	41.67
[s]	Passagem (Boarding pass)	33.3	Massagem (Massage)	100	Caçada (Hunt)	58.3
[z]	Casados (Married)	41.67	-	-	-	-
[ʃ]	Machado (Axe)	91.67	-	-	-	-
[ʒ]	Cajado (Crook)	50	-	-	-	-
[l]	Salada (Salad)	100	Palácio (Palace)	50	Balada (Ballad)	83.3
[λ]	Palhaço (Clown)	100	Malhada (Spotted)	83.3	Palhada (Straw)	0
[r]	Barata (Cockroach)	100	Baralho (Deck)	91.67	Parada (Stop)	100
[R]	Barraca (Tent)	91.67	-	-	-	-
[m]	Damasco (Apricot)	41.67	Chamada (Call)	41.67	Camaro (Camaro)	83.3
[n]	Canário (Canary)	58.3	Granada (Grenade)	86.67	Manada (Herd)	86.67
[ŋ]	Banhado (Marsh)	0	-	-	-	-

In this phase, specialist judges indicated which/if the word was suitable or not to the item (target phoneme) through the Content Validity Index (IVC), whose results are presented in Table 2. No notes 1 or 2 (slightly clear or unclear) were accepted, automatically characterizing the exclusion of the word.

In this way, 11 words were considered very clear for the target phoneme, and 08 words were considered quite clear. Thus, the list of words was elaborated to contemplate all the target phonemes, according to Chart 3.

In order to verify the appropriateness of the images to represent the words, a new evaluation was carried out by other specialist judges. From the answers, the following list of figures, shown in Chart 4, was elaborated.
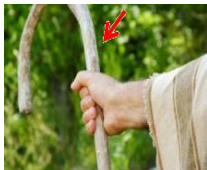
Table 2. Content Validity Index (IVC) between specialists judges

	IVC Note 3	IVC Note 4
	Tobacco	Shoe
	Tied	Shoelace
	Safari	Balcony
Target word	Apricot	Lizzard
	Grenade	Horse
	Marsh	Massage
		Axe
		Salad
		Tent
		Cockroach

Chart 3. List of words in the Instrumental Speech Assessment Protocol (Protocolo de Avaliação Instrumental de Fala)

Target phoneme	Word	Transcription	Target phoneme	Word	Transcription
/p/	Sapato (Shoe)	[sa.'pa.to]	/ʃ/	Machado (Axe)	[ma.'ʃa.do]
/b/	Tabaco (Tobacco)	[ta.'ba.ko]	/ʒ/	Cajado (Crook)	[ka. 'ʒa.do]
/t/	Atado (Tied)	[a.'ta.do]	/l/	Salada (Salad)	[sa.'la.da]
/d/	Cadarço (Shoelace)	[ka.'dar.so]	/ʎ/	Palhaço (Clown)	[pa. 'ʎa.so]
/k/	Sacada (Balcony)	[sa.'ka.da]	/r/	Barata (Cockroach)	[ba.'ra.ta]
/g/	Lagarto (Lizzard)	[la.'gar.to]	/R/	Barraca (Tent)	[ba.'Ra. kɐ]
/f/	Safari (Safari)	[sa.'fa.ri]	/m/	Damasco (Apricot)	[da.'mas.ko]
/v/	Cavalo (Horse)	[ka.'va.lo]	/n/	Granada (Grenade)	[gra.'na.da]
/s/	Massagem (Massage)	[ma.'as. ʒej]	/ŋ/	Banhado (Marsh)	[bã.'ŋa.do]
/z/	Casados (Married)	[ka.'za.dos]			

Chart 4. List of the images in the Instrumental Speech Assessment Protocol

DISCUSSION

The PRAINF was composed of 19 words, each contemplating a consonant of Brazilian Portuguese. The initial search for words was done through the Portuguese Orthographic Vocabulary (VOP), integrated into the Portuguese Language Portal. The VOP is composed of about 318,000 entries and is based on the Portuguese Language Vocabulary[22].

The words were selected according to the following linguistic criteria: target phoneme in the position of Onset Medial, between the vowel [a], in trisyllabic and paroxytone words, as indicated in a previous study[16], in order to guarantee standardization for the subsequent comparative analyzes.

It was decided to choose trisyllabic words because of the ease in finding words with consonant in OM, between the vowel [a], in paroxytone[15,23]. In an earlier study[23], by examining a general corpus of 150,875 words, it was found that 24.9% were oxytone, 62.5% were paroxytone and 12.2% proparoxytone, corroborating with the assertion that paroxytone words are the most frequent accentuation pattern in Portuguese.

In addition, the position of the phonemes in OM was chosen due to the non-occurrence of the phoneme [r] in Initial Onset in BP. Considering the application of the protocol in several instrumental evaluations, including speech ultrasonography, we chose to analyze the phoneme in tonic syllable, since the amplitude of tongue movement in this context is greater and, therefore, it provides a better ultrasound image[24].

The non-occurrence of two equal consonants in the same word, one being the target consonant, serves to avoid co-articulation effects. In the light of Autosegmental Phonology, the coarticulation effect exists through the consonant-consonant interaction, which generates consonants in sequence that begin to share the same point of articulation. The consonant-consonant interaction may be evidenced, for example, by the finding that palatal consonants favor the palatalization of coronal plosives[25].

This theoretical model is represented by the interconnection of melodic structures, due to the principle known as OCP (Obligatory Contour Principle), which prohibits similar adjacent elements, causing either the detachment of one of these elements or the recognition of its unity by the interconnection of identical elements[26].

In relation to the correspondence between words and figures, 13 figures had direct correspondence to the word (example: the word 'sapato' (shoe) was represented by a shoe), while 06 corresponded indirectly (example: the word 'massagem' (massage) was represented by a woman receiving a massage).

Words that could not be represented directly by the figures and needed interpretation/deduction by the patient were maintained due to the linguistic criteria defined and the lack of alternative words.

In situations where some words were not named properly, the evaluator showed the written word below the target figure only at that time, assuming that the word would be named correctly in the next few repetitions.

To ensure proper naming of the word, all stimuli were demonstrated to the participant along with the written word prior to the start of the collection.

Specialist and non-specialist judges performed evaluations of word adequacy in order to verify the validity of this protocol in the collection of speech data. In addition to an evaluation by experts, the validity of content includes the process of protocol development, being evaluated through qualitative and quantitative procedures[26]. It can be considered a valid instrument when it can really evaluate its purpose, in this case, the obtaining of speech data involved in the articulation and nasalance.

Data collection through spontaneous naming/speech was favored because there is greater correspondence with speech and natural fluency, due to motor planning, movement execution and linguistic processing, which does not occur in the collection of speech data through oral or repetitive reading[27,28]. In addition, collections through oral or repetitive reading overestimate conversational intelligibility in some patients, altering the outcome of the communicative function evaluation[2].

The words were inserted in a vehicle phrase in order to maintain a prosodic context and give more naturalness to the production of the word[29]. It should be noted that for vocabulary choice we considered factors such as familiarity with vocabulary and word extension, which favor speech intelligibility due to the ability of auditory closure[30]. In this way, the speech evaluation is restricted only to its acoustic components.

Studies point to the need of using carried sentence for analysis instead of isolated words, also to obtain a greater control of the prosodic structure of the sentences, so that the production is adequate[15]. The limitations of this study include the impossibility of investigating all the Brazilian Portuguese words, due to the inexistence of an online platform with access to all the words. In addition, it is emphasized that the study was performed with few people and is still in the reliability verification phase[26].

CONCLUSION

The results of the present study bring benefits not only to the academic community, but also to the speech and language clinic, since until now there was a lack of a protocol for the evaluation of production and/or speech perception, even more considering methodologies of standardization of linguistic criteria for the instrumental evaluation of speech in adult patients.

It is indispensable that there be caution at the time of collection, since linguistic parameters (such as accent, vowel context, tonicity, syllabic pattern, etc.) cause impacts on the speech production. The reliability of the evaluation takes into account the correct application of the protocol, from the standardization of the instructions, the presentation of the stimuli to the speaker, the correct production of the same by the speaker and even the interpretation of the results by the evaluator.

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Author contributions

CRP was responsible for the study delimitation, analysis of the linguistic criteria and selection of the words and figures that composed the protocol, and data collection. EGF assisted in data collection and carried out bibliographic research and article writing. KCP supervised the collection and analysis of the data, as well as provided guidance during all stages of the study preparation.