



Speech and dental prosthesis: integrative review

Fala e reabilitação oral protética: revisão integrativa

Habla y prótesis dental: revisión integradora

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Abstract

Speech is affected by the loss of teeth and the installation of dentures, it has been considered in the prosthetic oral rehabilitation process. There is scarcity of studies in the literature that address speech pathology or dental treatment outcome in the speech, though. The purpose of this study was to investigate how the speech in denture users is reported in the literature to contribute to the clinical practice by emphasizing the scientific evidence on the subject. The integrative review was elected as a searching methodology. The bibliographical survey was conducted on PubMed, LILACS, Scopus and Cochrane, from May to June, 2013, through the following combination of descriptors in Brazilian Portuguese and English: speech, phonetics and speech therapy with dental prosthesis, dentures and dental implants. In the total, 5,426 studies were found. Inclusion and exclusion criteria were applied regarding titles and abstracts, 13 articles were selected. In the speech approach, phonetic was used for the prosthesis molding, and the phoneme [s] was cited for the detection and adjustments of speech disorders and vertical dimension of occlusion. The palatal contour and ruga molding was also highlighted to improve speech. The studies' level of evidence was low, highlighting the scarcity of controlled and randomized clinical studies or experimental studies in this area. No article cited the adequacy of speech with phonetic training in speech therapy. Thus, we conclude that speech in individuals undergoing prosthetic oral rehabilitation is

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Received: 15/04/2014 **Accepted:** 23/10/2014



addressed in the literature through phonetic tests and modifications in the prosthesis performed by dentists.

Keywords: Aged; Speech; Dental Prosthesis; Rehabilitation.

Resumo

A fala pode ser afetada com a instalação de próteses dentárias, sendo que as características fonarticulatórias resultantes da reabilitação oral têm sido consideradas para mensuração do sucesso do tratamento odontológico. Embora a fala seja citada no processo de adaptação das próteses dentárias, há escassez de estudos na literatura que abordam o resultado do tratamento fonoaudiológico ou odontológico na fala. Assim, o objetivo do estudo foi verificar como a fala em usuários de prótese dentária é abordada na literatura, de modo a contribuir com a prática clínica ao destacar evidência científica sobre o tema. A revisão integrativa foi eleita como metodologia de busca. O levantamento bibliográfico foi realizado nas bases de dados PubMed/MEDLINE, LILACS, Scopus, e Cochrane, no período de maio a junho de 2013, pela combinação dos seguintes descritores, nas línguas portuguesa e inglesa: fala, fonética e fonoterapia com prótese dentária, dentaduras e implantes dentários. No total, foram encontrados 5.426 estudos nas bases de dados. Critérios de inclusão e exclusão foram aplicados no título e nos resumos, sendo selecionados 13 artigos, os quais foram analisados criteriosamente. Na abordagem da fala, a fonética foi utilizada para moldagem da prótese, sendo o fone [s] citado para detecção e ajustes das alterações de fala e da dimensão vertical de oclusão. A moldagem do contorno e das papilas palatinas também foi destacada para melhorar a fala. O nível de evidência dos estudos foi baixo, salientando a falta de estudos clínicos controlados e randomizados ou experimentais nesta área. Nenhum artigo citou a adequação da fala com treino fonético na terapia fonoaudiológica. Desta forma, pode-se concluir que a fala em indivíduos submetidos à reabilitação oral protética é abordada na literatura por meio de testes fonéticos e modificações nas próteses, realizados por odontólogos.

Palavras chave: Idoso. Fala. Prótese dentária. Reabilitação.

Resumen

El habla puede verse afectada por la instalación de prótesis dental, y las características phonoarticulatorias resultantes de la rehabilitación oral ha sido considerado para medir el éxito del tratamiento dental. Aunque se menciona el habla en el proceso de adaptación, existen pocos estudios que destacan el resultado del tratamiento fonoaudiológico o odontológico en el habla. Por ello, el objetivo de este estudio fue verificar como el habla en usuarios de prótesis dental es abordada en la literatura, con el fin de contribuir a la práctica clínica, mediante la evidencia científica sobre el tema. El método de búsqueda seleccionado fue una revisión integradora.

La búsqueda bibliográfica se realizó en las bases de datos PubMed/MEDLINE, LILACS, Scopus y Cochrane para el período mayo-junio de 2013, por la combinación de los siguientes descriptores en portugués e inglés: habla, fonética, logoterapia con prótesis dental, dentaduras e implantes dentales. En total, se encontraron 5426 estudios en las bases de datos. Después de aplicar los criterios de inclusión y exclusión se seleccionaron 13 artículos que fueron analizados cuidadosamente. En enfoque del habla, la confección de las prótesis fue realizada mediante la fonética, utilizándose el fonema [s] para la detección y ajustes de las alteraciones del habla y de la dimensión vertical de la oclusión. La moldura de los contornos e de las papilas palatinas también fue destacada para mejorar el habla. El nivel de evidencia de los estudios fue bajo, destacando la falta de estudios clínicos controlados aleatorios o experimentales en esta área. Ningún artículo citó el entrenamiento fonético para la adecuación del habla en la terapia fonoaudiológica. Por lo tanto, podemos concluir que el habla en pacientes sometidos a rehabilitación oral protésica es abordada en la literatura por medio de pruebas fonéticas y modificaciones en las prótesis, realizadas por odontólogos.

Palabras clave: Anciano. Habla. Prótesis dental. Rehabilitación.

Introduction

Aging, a biological and intrinsic process that begins at the age of 60, has been increasing among the world population and has been leading to modifications in the stomatognathic system and, consequently, in its related functions¹, with a decrease of tone and strength of the orofacial muscles².

Modifications deriving from age can be maximized by the loss of teeth². The lack of dental elements can modify the speech production due to changes occurred in the morphology and muscles of the oral cavity³⁻⁵ since the teeth participate in the production of sounds by blocking the airway⁶.

One of the solutions to teeth loss is the prosthetic oral rehabilitation, with partial, total dentures or dental implants⁵. To people who need removable dentures, age advance can hinder the ability to effectively control the prosthesis during oral function⁷. Individuals who do not use dentures, or use poorly fitting dentures present losses in speech, and problems associated with this function can occur when the prosthesis is used by the first time or when it is replaced by a new one⁶.

The prosthesis that modifies the position of the teeth or the palatal contour can interfere or affect speech intelligibility and articulation⁸. The phonemes often affected are the linguodental and the alveolar⁹, lisp and tongue projection are the most common¹⁰, besides the bilabial⁸.

A decrease in the mandibular movements can also occur as a compensatory mechanism to ensure the prosthesis stability¹¹, in addition to the alteration in the articulatory pattern (locked or exaggerated articulation), reduction of lip movements and absence of saliva control¹⁰.

Quality of speech production has been considered as a success or failure criteria of oral rehabilitation¹². In the prosthesis adjustment process, the phonetic aspect has been approached⁴, it has been proposed the repositioning and the recontouring of the teeth, the establishment of the occlusal vertical dimension (OVD), the freeway space and the closest speaking space, besides the prosthesis palate remodeling. Thus, modifications or adjustments in the prosthesis have been proposed depending on the type of alteration verified in speech¹³.

The difficulty the elderly have to adjust to using a denture has also been highlighted through the speech evaluation, in which it was verified that

the speech was not adequate four months after the new denture had been installed¹⁴. Therefore, the myofunctional therapy can help in the adjustment process of dentures, enabling the performance of stomatognathic functions in a balanced and consistent manner with the prosthesis installed in the oral cavity⁶.

Although the function of speech is mentioned in the adjustment process of the dental prosthesis, no studies were found in the literature addressing the result of the speech pathology or dental intervention in the patient's speech production. Thus, the objective of this study is to verify how the speech in dental prosthesis users is reported in the literature in order to contribute to clinical practice by highlighting scientific evidence on the theme.

Methods

The integrative review was specified as a literature review methodology, following six development phases: identification of the theme and development of the hypothesis or guiding question, search in the literature, data collection, critical analysis of the studies included, discussion and interpretation of the results and presentation of the integrative review^{15,16}.

As keywords, the combination of the following descriptors in Brazilian Portuguese and English were used: (1) speech (*fala*) and dental prosthesis (*prótese dentária*), (2) speech (*fala*) and dentures (*dentaduras*), (3) speech (*fala*) and dental implants (*implantes dentários*), (4) phonetics (*fonética*) and dental prosthesis (*prótese dentária*), (5) phonetics (*fonética*) and dentures (*dentaduras*), (6) phonetics (*fonética*) and dental implants (*implantes dentários*), (7) speech therapy (*fonoterapia*) and dental prosthesis (*prótese dentária*), (8) speech therapy (*fonoterapia*) and dentures (*dentaduras*), (9) speech therapy (*fonoterapia*) and dental implants (*implantes dentários*).

In the bibliographic survey, a search for scientific articles was carried out on the PubMed/MEDLINE, LILACS, Scopus, and Cochrane databases.

The search was carried out online from May to June, 2013 and the presentation of the data was made descriptively.

The inclusion criteria for the selection of the articles were: full articles available electronically

without time limit, published in Brazilian Portuguese or English, addressing the speech in rehabilitation with dental prosthesis and including the elderly in the casuistry. The exclusion criteria were: articles related to palatal prosthesis in cases of velopharyngeal dysfunction, an approach of satisfaction and quality of life of the users regarding the prosthesis and a casuistry consisting of neurogenic, oncologic population, with syndromes, deformities or malformations. Such criteria were initially applied in the title and, later, in the abstracts selected.

For data collection and critical analysis of the studies, which were made by only one researcher, a tool was used with information on identification, type of publication, methodological features of the study, including level of evidence, and evaluation of the methodological rigor regarding the clarity in the identification of the whole methodological stage of the study, as well as limitations¹⁷.

Literature review

A This study proposal was to search, in the literature, for scientific evidence having the evaluation and rehabilitation of speech in the dental prosthesis as a guiding question. Thus, it was possible to analyze and select studies on the theme, connect data from dental and speech pathology areas and confirm the lack of scientific papers with this approach.

During the search on the databases with the combination of descriptors, 5.426 studies were found. This result is shown in Table 1. PubMed database was the one with more studies published on the theme, followed by Scopus, LILACS and Cochrane. Among the descriptors, the combination speech with dental prosthesis, dentures and dental implants found the greater number of studies, while the term speech therapy obtained the smaller number.

Table 1 – studies found on the databases with the descriptors listed

| Descriptors | PubMed/ MEDLINE | Lilacs | Scopus | Cochrane |
|---------------------------------|--------------------|--------|--------|----------|
| Speech + Prosthesis | 1.065 | 14 | 483 | 27 |
| Speech + Denture | 684 | 22 | 795 | 30 |
| Speech + Dental implant | 241 | 0 | 296 | 13 |
| Phonetics + Prosthesis | 412 | 25 | 78 | 4 |
| Phonetics + Denture | 254 | 29 | 130 | 3 |
| Phonetics + Dental implant | 75 | 0 | 50 | 3 |
| Speech therapy + Prosthesis | 333 | 0 | 0 | 0 |
| Speech therapy + Denture | 145 | 0 | 122 | 1 |
| Speech therapy + Dental implant | 49 | 0 | 43 | 0 |
| Total | 3.258 | 90 | 1.997 | 81 |

This review final sample was composed of 13 articles¹⁸⁻³⁰, according to the criteria established.

The selection process can be verified in the Figure 1.

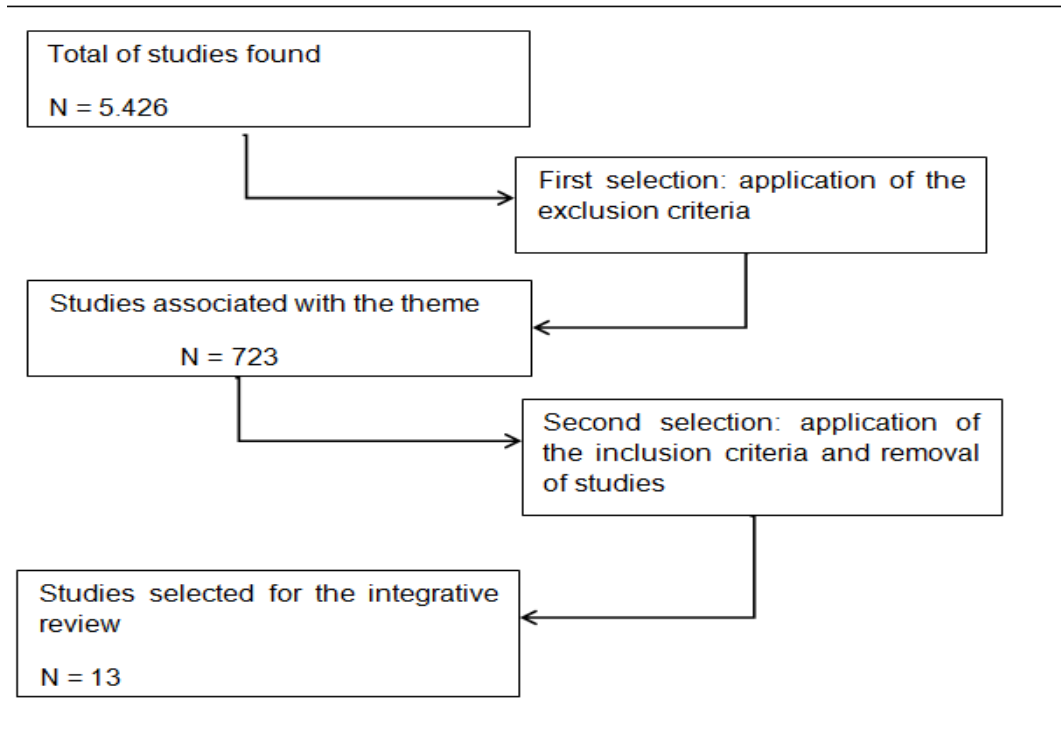


Figure 1–Phases of the literature review process

Os artigos selecionados foram lidos na íntegra, avaliados conforme instrumento de coleta de dados e submetidos à análise crítica, sendo que os dados coletados encontram-se apresentados na Figura 2.

| Number | Article Title | Authors/Year | Objective | Form of rehabilitation | Conclusion/Remarks | Level of Evidence |
|--------|--|---|---|--|--|-------------------|
| 1 | Dentures with phonetically contoured palate: a simple technique of adding customized rugae and palatal contours to the maxillary denture ¹⁸ | Krishna V, Reddy VV, Kumar NP, Raju KV(2012) | To describe a simplified prosthesis production technique in order to achieve normal speech patterns in completely edentulous patients. | Add customized rugae and palatal contours to the denture. | The prosthodontist needs to create the customized rugae and palatal contours in complete dentures aiming to achieve normal speech, besides eliminating the waiting and training period after the denture insertion. | 5 |
| 2 | CAD/CAM fabricated complete dentures: concepts and clinical methods of obtaining required morphological data ¹⁹ . | Goodacre CJ, Garbacea A, Naylor WP, Daher T, Marchack CB, Lowry J(2012) | To describe a clinical procedure to record the morphology of the complete denture based on the suitable phonetic and muscular location. | The impression must record the suitable muscular and phonetic location to place the teeth in the denture. Isolated sounds and words are used. | The use of the CAD/CAM technology tends to be commercialized in the fabrication of complete dentures. | 5 |
| 3 | Customizing a palatal contours of a denture to improve speech intelligibility ²⁰ . | Kong HJ, Hansen CA (2008) | To describe a technique for customizing palatal contours of a maxillary complete denture to improve speech intelligibility. | This technique uses the palatogram as a diagnostic tool, the dynamic impression of the tongue and the autopolymerizing acrylic resin to reproduce the palatal contours of the complete denture. | The technique can be used to reach a better speech result. | 5 |
| 4 | Phonetics and tongue position to improve mandibular denture retention: a clinical report ²¹ . | Bohnenkamp DM, Garcia LI(2007) | To report the clinical use of phonetics and tongue position during the fabrication and insertion of the complete denture in order to improve its stability and retention. | The fabrication of the new denture was carried out focusing on retention and stability. During border molding and making of the mandibular definitive impression, the patient was instructed to pronounce the sound "e", as in the word "knee" to aid in positioning the tongue and buccinator muscles. | The patient must be instructed to pronounce specific sounds to train the tongue and buccinator muscles aiming to make the mechanism necessary to improve the retention and stability of the inferior denture. | 5 |
| 5 | Utilizing speech to simplify a personalized denture service. 1970 ²² . | Pound E (2006) | To discuss the highlights of making personalized dentures. To show how the position of the teeth is influenced by the correlation with speech. | The position of the upper anterior teeth can be defined by the production of the "F" and "V" sounds and the position of the lower anterior teeth by the production of the repetitive "S" sound, known as the "S" position with a space of 1.0 to 1.5 mm. It proposes modifications in the denture when distortions occur, establishing the "S" position as base. | The solution of many of the problems in complete denture construction consists of simply recording, as guided by muscle memory of the mandibular movements made during speech. This automatically restores the vertical and horizontal overlaps which can be used to control factors of occlusion. | 5 |
| 6 | Morphologic comparison of | Makzoum JE | To compare the neutral zone | The phonetic technique: to | The phonetic neutral zone appears to be | 4 |



| | | | | | | |
|----|---|---|---|--|--|---|
| | two neutral zone impression techniques: a pilot study ²⁰ . | (ZU04) | impression technique through phonetics and swallowing. | mold the lateral segment, the subjects were asked to pronounce the phoneme "SIS" 5 times followed by the phoneme "SO" once, clearly and slowly to induce muscle contraction, until the material had polymerized. To mold the lateral segment: the subjects pronounced successively the phonemes "DE, TE, ME, PE, SE" until the polymerization of the material was complete. | narrower posteriorly compared to the swallowing neutral zone, thus limiting premolar and molar positioning. | |
| 7 | A simple method of adding palatal rugae to a complete denture ²⁴ . | Gitto CA, Esposito SJ, Draper JM (1999) | To present quick and easy methods of adding palatal rugae to complete dentures. | Dental procedure to add palatal rugae to a complete denture. | The procedure is easy. In the event that patient's speech is not improved, it is worsened, or the patient finds the texture annoying, the prosthesis can be easily modified. Unfortunately, the addition of rugae to a prosthesis is not a full-proof method of improving speech. Some patients may still experience difficulty with speech accommodation. | 5 |
| 8 | Palatogram assessment of maxillary complete dentures ²⁵ . | Farley DW, Jones JD, Cronin RJ (1998) | To review mechanics of speech as well as the problems due to removable maxillary prosthesis. | It mentions the palatogram as a tool to record the contact between the tongue and the hard palate and the teeth when some sounds are produced. It can be used to assess phonetics alterations after the insertion of the prosthesis. It presents a table with the possible causes of the alteration of the "S" sound, as well as the procedures for diagnosis and treatment. | Palatograms are helpful in the evaluation of phonetics of the complete denture patient. | 5 |
| 9 | Structural changes for speech improvement in complete upper denture fabrication ²⁶ . | Palmer JM (1979) | To assess situations in which the patients seem to develop speech problems associated with dentures. | Carry out changes in the teeth position, correction of the vertical dimension of occlusion and adequate tongue space. To insert artificial papilla. | The nonanatomic papilla can improve speech. The location and effectiveness of the structural change can be planned and judged with the cooperation of a qualified speech pathologist. | 5 |
| 10 | Controlling anomalies of vertical dimension and speech ²⁷ . | Pound E (1976) | To propose a control map to facilitate repositioning the incisal edge and the VDO. | The VDO control is made by tooth to tooth and tooth to tissue relations, this is - the position of the anterior superior teeth - determined by the adjustment of the speech by the position of the "S". | The map identifies the problem when it occurs and helps the dentist to reach the result desired. | 5 |
| 11 | Analysis of speech in prosthodontic practice ²⁸ . | Palmer JM (1974) | To provide reasonable information about the evaluation of the speech, to illustrate the types of problems of speech that can develop in patients with dentures and suggest some general approaches to alleviate those problems. | Establish a waiting period for accommodation. In the maxilla, verify the teeth positioning, examine the manner the tongue approaches the teeth to produce the necessary sound. Examine the palatal rugae. Adjustments in the inferior prosthesis in the molar region. | The analysis of speech sound production in prosthodontic practice should be based on some understanding of the nature of the speech sounds themselves, how they are made, and the anatomic and physiologic structures involved. When in doubt or verify the need, ask for the opinion of a speech language pathologist. | 6 |
| 12 | The problems of functional conflicts between anterior teeth ²⁹ . | Murrel GA (1972) | To discuss and propose solution to the conflict of teeth positioning in denture construction. | It proposes the incisive teeth positioning of the denture based on phonetics. It uses the "F" and "V" sounds for the upper and the "S" and "Z" sounds for the lower. | The phonetic positioning of the anterior teeth promotes the occlusal balance during the function of speech with complete dentures. | 5 |
| 13 | The speaking method in measuring vertical dimension ³⁰ . | Silverman MM (1953) | To discuss the method of measuring vertical dimension. | To measure the vertical dimension during the production of fricative sounds and the word "Mississippi". | The speaking method of measuring vertical dimension has been considered for the success of prosthetic rehabilitation. | 5 |

Figure 2—Articles selected that address speech rehabilitation in the prosthetic treatment

In this review, most of the studies (papers number 3, 4, 5, 9, 10, 11 e 13)^{20-23,26-28,30} mentioned in the title the aspect of speech as a guide in the rehabilitation process. Speech was listed as a method of making the prosthesis, as well as the target of dental procedures. Among the authors studied, two of them (Palmer JM and Pound E) were responsible for the publication of more than one article. Most of the authors are dentists, there is only one speech-language pathologist (author of the studies 9 and 11)^{26,28}. Recent studies were found, three of them had been published in the last five years. Most are older, though. They are more often from the seventies. Regarding the objectives presented, there was a prevalence of description, discussion or proposal of techniques or procedures for making and adjusting the prosthesis considering the speech. Only one study (number 6)²³ aimed to compare techniques.

For speech investigation, different ways of prosthesis impression were addressed, not only teeth positioning but also palatal contour. The most frequent one was the use of phonetics (studies 2, 4, 5, 6, 8, 9, 10, 12 and 13)^{19,21-23,25-27,29,30}, and the repetition of isolated sounds, words and sentences was requested. The phoneme /s/ was the most mentioned sound to detect and adjust speech alterations (studies 5, 6, 8 and 12)^{22,23,25,29}, as well as to determine the vertical dimension of occlusion (studies 9, 10 and 13)^{26,27,30}. Besides that, the molding of the palatal contour and the palatal rugae was listed for obtaining an improvement in speech (studies 1, 3, 7, 8 e 11)^{18,20,24,25,28}.

In the evaluation of speech intelligibility with the prosthesis, if distortions occur such as anterior lisp or whistle, adjustments of the prosthesis are carried out²⁰. For some authors, the phonetic training and the adequate tongue positioning should

be established as a procedure of the construction and installation of complete dentures²¹.

According to the authors' remarks, the result of speech was the goal the molding techniques reached. Addition of technology and the use of palatogram were proposed in the rehabilitation process, as well as the insertion of sound production training to obtain a better retention and stability of the prosthesis. The mandibular movements and the phonetic positioning of the incisors during speech, besides serving as a functional result, represent a way to restore the occlusion. The use of palatogram has been considered as a communication facilitator between the dentist and the speech language pathologist during the evaluation of the patient²⁵.

To some authors, the making of the palatal and rugae contour of the prosthesis can eliminate the need of speech training after the installation of the prosthesis in the oral cavity⁸. However, toother authors, only the presence of rugae wouldn't be enough to improve speech since patients can keep presenting difficulties in the speech production with prosthesis²⁴. In this process, the performance of a specialized speech-language pathologist can help in the location and efficiency of the change of the nonanatomic papilla²⁶.

The anatomical and physiological aspects of the sound production were described to help in the dental practice when analyzing the speech sounds, it is recommended to ask for the opinion of a speech-language pathologist whenever in doubt. Speech evaluation before the prosthesis installation was considered since distortions can be present before the placement of the prosthesis for a long period of time. This evaluation should be carried out with and without the new prosthesis. If necessary, changes regarding teeth positioning, correction of the vertical dimension of occlusion and an adequate tongue space should be considered firstly²⁶.

Although the studies proposals of speech evaluation before and after the installation of prosthesis, the molding based on phonetics and adjustments through speech production, no article described speech adequacy with phonetic training in speech therapy.

The prevalent level of evidence of the studies analyzed was of 5, which refers to evidences deriving from experience or case reports. Such level is considered low and reflects the scarcity

of controlled and randomized clinical studies or experimental studies in this area.

Conclusion

Speech in individuals subjected to prosthetic oral rehabilitation is addressed in the literature through phonetic tests and modifications in the prosthesis carried out by dentists, which evidences the need of clinical studies focused on the role of the speech-language pathologist in this population.

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