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Prosthetic solution for whistling in fixed prostheses on implants: a case report

Solução protética para sibilância em próteses fixas sobre implantes: relato de caso

Solución protésica para silbar en prótesis fijas sobre implantes: reporte de um caso

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Abstract
This clinical case report aims to describe the prosthetic solutions in a case of phonetic alteration reported by the patient after multiple anterosuperior rehabilitation with seven single cemented crowns type FP2, responsible for the lispting, reversing the prosthetic rehabilitation in four FP3 splinted and screwed crowns with palatal flange. Initially, the patient was unsatisfied with an upper removable partial denture. After the planning and execution of the surgical phase with eight osseointegrated implants, the osseointegration period occurred with the installation of seven single cemented crowns classified as FP2. During the adaptation period, the patient reported rattling during speech due to the passage of air in the cervical interdental region of the implant-supported prostheses (ISP), corresponding to teeth elements 22 to 12. When identifying the crowns responsible for the rattling, we elaborated a new plan with a FP3 splinted and screwed to guarantee reversibility, plus artificial cervical gum in the palatal region, called flange, replacing the lost anatomical crown and soft tissues. Several factors can result in phonetic changes; in the presented case, the multiple upper anterior prosthetic rehabilitation associated with the existence of a pronounced ogival palate and a thin gingival profile of the patient resulted in the development of whistling. The prosthetic conversion of crowns from FP2 to FP3 with palatal flange ensuring air locking between the cervical region of the FP proved satisfactory in resolving the condition of phonetic alteration, rehabilitating the lost phonemes.
Keywords: Dental implants; Dental esthetics; Dental restoration failure.

Resumo
Este relato de caso clínico objetiva descrever as soluções protéticas em um caso de alteração fonética relatada pela paciente após a reabilitação ântero-superior múltipla com sete coroas cimentadas unitárias tipo PF2, revertendo a reabilitação protéticas em quatro coroas, responsáveis pelo ceceio, para uma PF3 esplintada e aparafusadas com flange palatina. Inicialmente a paciente demonstrou insatisfação de uma prótese parcial removível superior. Após o planejamento e a execução da fase cirúrgica com a instalação de 8 implantes osseointegrados decorreu-se o período de osseointegração, quando foram instaladas sete coroas cimentadas unitárias, classificadas como PF2. Durante o período de adaptação a paciente relatou ceceio durante a fala, devido a passagem de ar na região de ameia cervical das próteses sobre implante (PSI) correspondentes aos elementos dentários do 22 ao 12. Após a identificação das coras responsáveis pelo ceceio foi elaborado um novo planejamento com confecção de uma PF3 esplintada e parafusada, a fim de garantir a reversibilidade, acrescida de gengiva cervical artificial na região palatina, denominada como flange, substituindo assim a coroa anatômica e tecidos moles perdidos. Diversos fatores podem resultar em alterações fonéticas, no caso apresentado a reabilitação protética ântero-superior múltipla associada a condição de existência de um palato ogival acentuados e um perfil gengival fino da paciente resultou no desenvolvimento de whistling. A conversão protética de

coroas de PF2 para PF3 com flange palatina garantindo o bloqueio de ar entre a região cervical das PFs se mostrou satisfatória em resolver a condição de alteração fonética, reabilitando os fonemas perdidos.
Palavras-chave: Implantes dentários; Estética dental; Falha de restauração dentária.

Resumen
Este informe de caso clínico tiene como objetivo describir las soluciones protésicas en un caso de alteración fonética reportada por el paciente después de la rehabilitación anterosuperior múltiple con siete coronas cementadas unitarias tipo protesis fija (PF2), revirtiendo la rehabilitación protésica en cuatro coronas, responsables del ceceio, para una PF3 de piel espumosa y atornillada con brida palatina. Inicialmente, el paciente demostró insatisfacción con una prótesis parcial removible superior. Tras la planificación y ejecución de la fase quirúrgica con la instalación de ocho implantes osteointegrados, se produjo el periodo de osteointegración, cuando fueron instalado siete coronas cementadas unitarias, clasificadas como PF2. Durante el período de adaptación, la paciente reportó ceceio durante el habla, debido al paso de aire en la región de medias cervicales de protesis fija sobre implantes dentales correspondientes a elementos dentales de 22 a 12. Tras la identificación de los coros responsables del ceceio, se elaboró un nuevo plan con la preparación de un PF3 sesgado y atornillado, con el fin de asegurar la reversibilidad, más gomas cervicais artificial en la región palatina, llamada brida, sustituyendo así la corona anatómica y los tejidos blandos perdidos. Varios factores pueden dar lugar a cambios fonéticos, en el caso de que se presenten múltiples prótesis antero superiores de rehabilitación asociadas a la condición de existencia de un paladar ojival pronunciado y un perfil gingival delgado del paciente que resultó en el desarrollo de silbidos. La conversión protésica de coronas de PF2 a PF3 con brida palatina que asegura el bloqueo de aire entre la región cervical los dentaduras paciais fijas fueron satisfactorios en la resolución de la condición de alteración fonética, rehabilitando los fonemas perdidos.
Palabras clave: Implantes dentales; Estética dental; Fracaso de la restauración dental.

1. Introduction

Tooth loss negatively affects phonetics due to morphological changes and changes in the musculature of the oral cavity (Cunha & Felicio, 1999). The most used solution to restore a missing tooth is prosthetic rehabilitation using a total prosthesis, partial dentures, or dental implants (Cardos & Bujes, 2010).

Prosthetic making can alter the dental position and palatal contour, directly interfering with speech integrity and articulation (Roumanas, 2009). Lingual projection and lisping, understood by the sound distortion of the consonants "s" and "z" (Meyer & Silverman, 1967), are the most affected phonetic projections if prostheses are made without the limits established for each patient (Van, *et al*., 2012). Thus, patients who present tooth loss and do not use prostheses, or use them poorly adapted, may present phonetic changes by not obstructing the passage of air during the sound production of speech or by interpositions of the tongue (Felicio & Cunha, 2005). Therefore, prosthetic preparation requires a careful analysis of the area that will be rehabilitated, eliminating interferences that may reflect and impair the phonation of the patient.

In the case of implant-supported prostheses (ISP), the prerequisites must also be respected. To minimize phonetic changes, surgical and prosthetic planning should include a multidisciplinary team with periodontists, implant dentists, prosthetists, and, in some cases, even a speech therapist, reducing the possibility of changes in speech (Bornstein, *et al*., 2009).

After the implant osseointegration period, with correct installation and evaluation of the remaining peri-implant bone (Misch, 2015), it is possible to plan the type of prosthesis to be installed. ISP can be classified according to the number of rehabilitated elements, as single or multiple. In the case of ISP with multiple elements, a large tooth loss is involved in prosthetic restoration (Buser & Von, 2000). For the type of fixation, prostheses can be classified as cemented or screw-retained. Cemented ISP are characterized by the cementation of the prosthetic crown on the implant, whereas the screw inside the crown difficult the changing or removal, if necessary. In the crowns of screw-retained prostheses, the connection screw is exposed, covered by a cover, and easily accessible if it is necessary to unscrew (Van, *et al*., 2012). The supported prostheses are classified as Fixed Prosthesis 1 (FP1) if it replaces only crowns of missing teeth, FP2 if it replaces the crown and root portion, and FP3 if it replaces anatomical crown and soft tissues (Misch, 2015).

Previous ISP have fundamental criteria for achieving the desired performance, which can be understood as good periodontal, aesthetic, phonetic, chewing, oral functions, swallowing, and neuromuscular balance (Van, *et al*., 2012; Misch, 2015). Phonetics and aesthetics contribute to the success of the previous ISP, so a treatment plan that encompasses these two components is necessary to avoid negative consequences, especially in speech and chewing (Bornstein, *et al*., 2009).

The negative influence of prosthetic rehabilitation on the phonetic establishment is associated with the presence of an anterior open bite, which can generate a defect in the phoneme of /p/, /b/, or /m/, with the teeth outside the main support zone which cannot produce lip sealing (Weir, 2008). Other negative influences related to prosthetic rehabilitation are malposition and dental absence, altered by the lingual interposition and its inactivity (Martone, 1962), contour and inadequate anatomy of the prosthesis and dental elements, evaluated by the phoneme /s/ with opposite letters such as /t/, /d/, producing whistle (Jenkis, 1970), and the discrepancy of overjet, overbite, and vertical dimension of occlusion (VDO), which is the pronunciation of /sh/ in place of the /s/ and if deficient can generate excessive horizontal overlapping (Winkler, 1987). However, errors when making the prosthesis without proper proportions can be reversed by drawing up a compensatory treatment plan, such as correction of height and dental width, the addition of gingival flanges, tuning of the lingual margins, and increase in the vertical dimension of occlusion (Teixeira, 2006).

In this context, deviation in articulation due to the negative influence on prosthetic rehabilitation is common in rehabilitation cases, especially in anterior regions (Jenkis, 1970). The two most common deviations occur due to the contour and inadequate anatomy of the prosthesis and discrepancy of overjet, overbite, and VDO. Firstly, lisping occurs when there is a broad and thin space in the tongue, so the phoneme /s/ sounds like /sh/ and is usually associated with long lips and short teeth, characterizing a marked overjet. On the other hand, the whistling phenomenon occurs when the space of the tongue is too small, or the anteroinferior teeth are positioned too far back, so there is a marked overjet, better known as whistling (Weir, 2008). Therefore, in addition to the expectations regarding the final aesthetic projection of the prosthesis, prosthetic requirements such as evaluating the crown and its respective width, height, gingival flange, and angulation are necessary for the aesthetic, well-being, and comfort of the patient (Martone, 1962).

This clinical case report aims to describe the prosthetic solutions of phonetic alteration reported by the patient after multiple anterosuperior rehabilitation with seven single cemented crowns type FP2. We reverted the prosthetic rehabilitation of four crowns responsible for lisping to a FP3 splinted and bolted with a palatal flange.

2. Methodology

The case report was submitted to the Ethics Committee on Research with Human Beings of the University of Grande Rio (UNIGRANRIO) under CAAE number: 51491221.2.0000.5283.

The clinical case report present in this work is characterized as descriptive and exploratory, with a qualitative approach. The patient signed the Free and Informed Consent Term at the beginning of prosthodontic treatment authorizing to disclose the photos and information of the medical record.

3. Case Report

A female patient, 63 years old, hypertensive, continuous user of Enalapril, Rosuvastatin, Lipanon, ASA, Osteoban, and Calde, sought dental care complaining of mobility and aesthetics of removable partial prostheses superior and inferior. On clinical and physical examination, the evaluation of the dental elements and the upper remaining bone support occurred through panoramic radiography and cone-bean tomography. The installation of seven external hexagons osseointegrated implants, from element 14 to 23, occurring uneventfully (Fig. 1), aimed the anterosuperior rehabilitation. For four months, the patient remained

with the upper partial denture she already had, performing relining and flange wear in some regions to avoid injuring the peri-implant area.

After four months, the installation of provisional acrylic splinted screw-retained crowns reopened the osseointegrated implants; also planned a free gingival grafting surgery to gain lost tissue between implants 21 and 22 due to the identification of a fine periodontal phenotype. After one month with the provisional, the patient underwent a connective tissue graft using the tunneling technique to gain a gingival profile, where the donor area was the left posterior palatal region in the area of implants 21 and 22. In three months, the patient did not gain in the gingival profile and occurred the installation of the final FP2 crowns, unitary and cemented, with adequate contour and aesthetics (Fig. 1).

Figure 1 – Planning of FP2 cemented crowns. (a) the initial condition of the patient; (b) subsequent rehabilitation with implant crowns cemented FP2 by the vestibular face and (c) lingual; (d) the closure of the air passage with chewing gum to eliminate whistling in the region between 23 and 13.

Source: Authors.

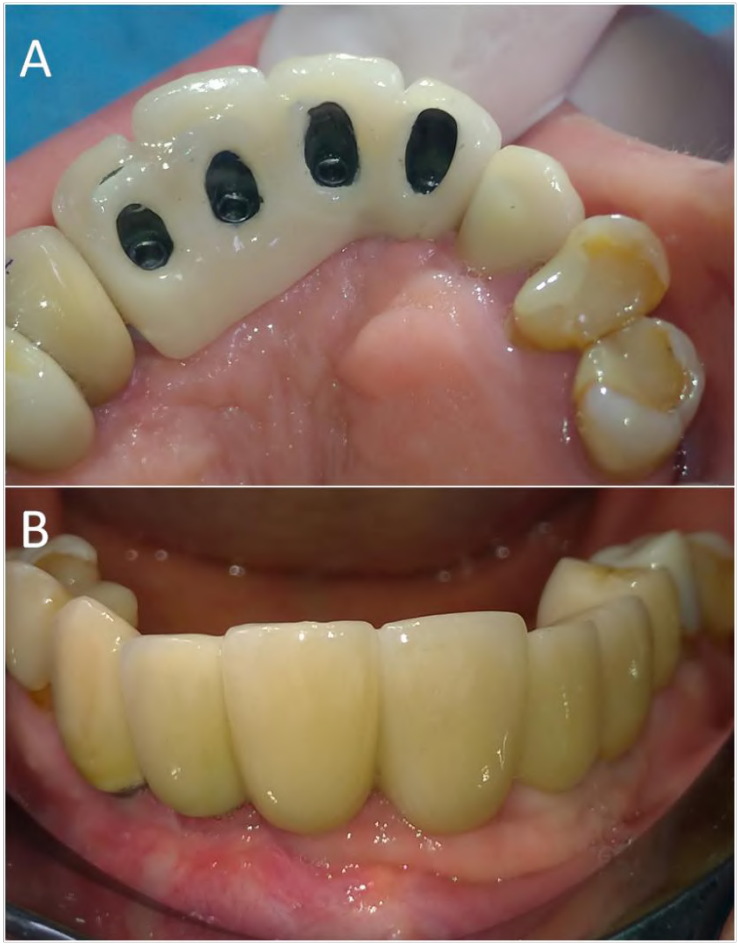
After 30 days of prosthetic installations, the patient complained of phonetic change and wheezing. This change, explained by the patient, was due to the exchange in the phonemes of /s/ and /z/ by the sound of ‘sh’ or ‘c,’ leading to difficulty during speech. Therefore, instead of the correct sound of the letters, the pronunciation was emitted in the form of a whistle, characterizing the phenomena of whistling, which occurs when the space for the tongue is smaller than necessary, and the position of the anterior teeth is unfavorable, causing the tongue to lodge incorrectly (Morais, et al., 2010).

The immediate solution for the patient was to involuntarily tamponade the region responsible for air tunneling with chewing gum, between elements 13 and 23 (Fig. 1). Also, due to the short period of adaptation of the definitive crowns, which was 30 days, and the long period of use of upper partial prosthesis associated with the pattern of an ogival palate, the patient underwent a speech-language pathologist evaluation. The professional claimed that postural reeducation of the tongue was not necessary.

Evaluating the areas responsible for the air escape corridor, we decided to change the definitive crowns of elements 11, 21, 12, and 22, maintaining the area with splinted provisional crowns to test the hypothesis that this area is responsible for whistling by adding an acrylic palatal flange.

After the normalization of phonetics of the patient with the use of the provisional prosthesis, with a palatal flange delimiting the necessary extension of the prosthetic planning, a FP3 was screwed and splinted from 12 to 22 elements, with a prosthetic flange in the palatal portion of teeth 11, 21, 12 and 22, replacing the cemented FP2 prosthesis for elements 11, 21, 12, and 22, characterized by the replacement of the crown and part of the root portion, hypercontoured in the gingival half (Fig. 2). The substitution replaced the lost palatal gingival portion and obliterating the air passage in this region, returning the patient to phonetic normality.

Figure 2 – FP3 prosthesis screwed and splined. (a) Photomicrography of the palatal flange eliminates the cecum of the patient and (b) the vestibular face of FP-3.



Source: Authors

4. Discussion

In view of the reported case, the importance of prosthetic planning in choosing the type of prosthesis to be used, whether single or splinted, is notorious. Therefore, it is necessary to respect prerequisites such as good occlusion, aesthetics, phonetics, and preservation of adjacent tooth structures (Bornstein, et al., 2009). Surgical treatment and prosthetic planning must respect the implant position, obtaining the best prosthetic positioning in order to avoid negative consequences for the patient (Misch, 2015; Dario, 1996). Thus, the system of choice for the prosthesis must be planned before the surgical procedure, whether cemented or screwed, according to the demand and prosthetic objective that the patient wants to achieve (Morais, et al., 2010). The use of single FP in multiple studies becomes a superior aesthetic alternative to cases in which the components need to be

joined, making the prosthesis splinted. However, cases of lisping require an extension of the coronary contours that are best achieved when the FP is splinted.

On the other hand, over contours require redoubled the hygiene of the ISP to prevent possible inflammation around the implant. In addition, ogival palates require greater attention regarding the frequency of hygiene, as they may hinder the hygiene of these prostheses (Lewgoy, *et al*., 2012; Bannwart, *et al*., 2012). Therefore, the association of these conditions requires advising the patient on the maintenance of ISP to ensure prosthetic longevity.

To produce vowels, the air must pass freely through the mouth. At the same time, posterior interruption is necessary for consonants, so the palatine roughness and the presence of the incisive papilla guide the tongue to the sound production (Carvalho, *et al*., 2013). In the reported clinical case, the patient has an ogival palate, with narrow and high-arched palate results in a phonetic alteration that does not allow the tongue to reach a comfortable position (Nakamara, *et al*., 2020). Therefore, in cases of ogival palates, a phonetic impairment factor influences the whistling phenomenon (Zarb, *et al*., 1998). Whistling is characterized by the deviation of the speech articulation and occurs mainly in ogival palates, as the patient mentioned in this work. It is the consequence of decreased prosthetic space, so the large-scale wheezing sounds present this whistling defect (Morais, *et al.*,2010; Weir, 2008). Unlike muco-supported prostheses, which allow the correction of the palatal region by filling it in, the ISP does not have the same characteristic, making the use of gingival flange necessary to obliterate the spare space, justifying the need to reverse the crowns to a FP3 with palatal flange, to rehabilitate this area with a splined prosthesis providing support to anchor the flange.

Cases of previous rehabilitation have high aesthetic demand, even in regions with large alveolar atrophy, leading to the need for high surgical and prosthetic planning so, consequently, the desire and comfort of the patient at the end of the treatment are prioritized, mainly by phonetic and masticatory changes (Bornstein, *et al*.,2009). Thus, prostheses making is a challenge but becomes less complex if it respects the limits imposed by the patient and with the correct planning.

Cemented ISP do not provide space between the crown and abutment, creating a juxtaposed metal connection with a non-ideal and poorly adhered cement line (Bornstein, *et al.*, 2009); this may account for the fact that spaces allow whistling in ogival palates. Hebel (1997), on the other hand, names the cemented prostheses as a great potential for the dimensional discrepancy in prosthetic adaptation, increasing passivity (Hebel & Gajjar, 1997). According to Bezerra and Rocha (1999), screw-retained prostheses are more beneficial for the reversibility characteristic, which means being able to remove for cleaning, repairs, implant evaluation, and peri-implant tissue, increasing the prosthetic longevity; however, Kallus and Bessing (1996) and Lemos *et al*. (2016) indicates that screw-retained prostheses can receive cyclic overloads in parafunctional cases, which may lead to greater risks of fractures or failure to remaining in the oral cavity for the long term (Kallus & Bessing, 1996; Lemos, *et al*., 2016). Finally, et al., (2007) identified that the irreversibility of cemented ISP is associated with the poor hygiene of patients in most cases. In the reported case, the absence of reversibility correlated to the ogival palate contributed to the failure of the first treatment. Thus, the cementation of the screw-retained anterior crowns allowed the removal of the prosthetic set, enabling patients with an ogival palate to retain less food, preventing the installation of inflammation, and allowing the addition of incremental layers in the palatal flange to avoid the passage of air, achieving success in the treatment.

There are still controversies regarding the best fixation system. Some authors suggest using cemented prostheses, while others recommend using screw-retained prostheses (Bornstein, *et al*., 2009; Wittneben, *et al*., 2017). However, clinical complications may be determinant of the choice of the system, overlapping the function over aesthetics. After planning the case, we concluded that in the reported case, the best aesthetic and functional option was making a prosthesis on a screwed implant, allowing the patient to recover her correct phonetics and preventing air from exiting through the prosthesis spaces.

Therefore, multiple anterior prostheses may present additional limitations when associated with a thin gingival profile, such as inadequate space between the supracristal crest and the prosthetic crown, allowing phonetic changes in these regions. The second limitation correlates with the palatal format: an ogival palate can cause a lingual interposition, causing difficulty in phonetics and swallowing. The preparation of the pre-prosthetic planning did not consider the presence of the ogival palate, resulting in the main problem addressed in the clinical case and limiting the patient to obtain a good result in the prosthetic treatment.

Thus, the last limitation is correlated with the lack of research on the influence of the ogival palate on the phonetics of prostheses users. This condition consequently generates the limited possibilities of professional analysis for the best treatment solution to be satisfactory; as the reported case discussed, adaptations of different existing techniques, such as making a gingival flange and changing the type of cementation technique.

The research responds to a solution of the negative consequences in the manufacture of prostheses on implants that caused phonetic alteration. This case study correlated to cross-sectional studies, with the objective of appropriate treatment for the patient in question and to solve the problem of the unexpected sound after the implant-supported prostheses through prosthetic planning by observing anatomical changes of the patient, such as the ogival palate. The researchers expect a satisfactory result, with the adequate treatment of the patient to improve the approach of other professionals.

5. Conclusion

Several factors may result in phonetic alterations. In the case presented, the multiple anterosuperior prosthetic rehabilitation associated with an ogival palate and a thin gingival profile resulted in the development of whistling. The prosthetic conversion of FP2 to FP3 crowns with palatal flange ensuring air blocking between the cervical region of the FP proved to be satisfactory in resolving the condition of phonetic alteration, rehabilitating the lost phonemes.

Therefore, choosing the appropriate type of prosthesis for fixation is necessary. A good case study is essential, with careful planning and differentiation to choose the best prosthesis according to the needs of each patient. In addition, the limited literature reporting these changes had not yet reported the conduct taken in this clinical report, which emphasizes the need for further studies on the topic addressed.

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