

Implant-supported removable partial denture

Prótese parcial removível retida por implante

Ana Rafaela Luz de AQUINO¹

Samira Albuquerque de SOUSA²

Adriana da Fonte Porto CARREIRO³

Adriano Rocha GERMANO³

Steyner Lima MENDONÇA²

Danielle Vanessa Miranda de HOLANDA⁴

ABSTRACT

The absence of lower posterior teeth makes the planning and control of removable partial dentures difficult since support is provided by teeth and mucosa, which present different anatomical characteristics. The planning of removable partial dentures supported on a distal implant renders tooth-implant-supported rather than tooth-mucosa-supported dentures an option in distal extension cases. In the present case report, a patient with a Kennedy class II dental arch was rehabilitated using a distal implant-supported removable partial denture. Fitting of the implant resulted in more stable occlusion, improving the functionality of the denture and providing greater comfort to the patient. This approach might be a suitable treatment alternative because of its low cost compared to implant-retained dentures. However, long-term follow-up of a series of cases is necessary for the routine use of this treatment method.

Indexing terms: Dental esthetics. Dental implants. Removable partial denture.

RESUMO

A ausência de dentes posteriores inferiores representa dificuldades no planejamento e controle de próteses parciais removíveis, pois o suporte é proporcionado por dentes e mucosa, que apresentam características anatômicas diferentes. O planejamento de próteses parciais removíveis apoiadas sobre implantes na região distal torna a prótese dento-implanto-suportada e não dento-muco-suportada sendo, uma opção aos casos de extremidade livre. Por meio deste relato de caso, um paciente portador de arco classe II de Kennedy foi reabilitado com prótese parcial removível apoiada sobre implante na região distal. A colocação do implante resultou em uma oclusão mais estável, o que melhorou a funcionalidade da prótese e proporcionou maior conforto ao paciente. Observou-se que esta resolução pode ser uma alternativa viável de tratamento, pois apresenta custo reduzido em relação à prótese fixa sobre implantes, entretanto, requer um acompanhamento em longo prazo com uma série de casos para tornar-se um método rotineiro de tratamento.

Termos de indexação: Estética dentária. Implantes dentários. Prótese parcial removível.

INTRODUCTION

Patients with missing lower posterior teeth (Kennedy class I and II arches) are frequent visitors to the dental clinic. This fact prompts a constant search for the ideal denture rehabilitation solution for these individuals, bearing in mind the big problem related to the different anatomical characteristics that exist between the supporting structures: tooth and mucous membrane¹.

As early as 1968, Mensor² had already reported that the teeth permit movement of around 0.1 mm while the mucosal tissue is between 0.4 and 2 mm, highlighting the need for a tension direction system in the planning of free-ends, as these differences, when a force is applied at the free end of a saddle, cause a lever-action where the tooth will tend to lean towards the prosthetic space, with the fulcrum situated at the apical limit of its root. This situation will determine the compression of the

periodontal fibers and the stretching of others, tooth mobility, bone loss, periodontal pockets and even the loss of the tooth.

This problem is so relevant that Kuboki et al.³ compared the quality of life of three groups of patients suffering from unilateral free-end saddle: rehabilitated using a fixed denture on top of implants, rehabilitated using tooth-mucosa-supported removable partial dentures and those with no rehabilitation. They found that quality of life was better for patients rehabilitated with the fixed denture on the implants and that the quality of life of patients rehabilitated with removable partial dentures was the same as for those without any rehabilitation.

Misch⁴ described the importance of tooth implants to dentures. He states that the need for additional retention, support and stability are just some of the recommendations for dental implants.

¹ Universidade do Estado do Rio Grande do Norte, Curso de Odontologia. Rua Almino Afonso, 478, Centro, 59610-210, Mossoró, RN, Brasil. Correspondência para / Correspondence to: ARL AQUINO. E-mail: <anarafaella.luz@terra.com.br>.

² Universidade Potiguar, Curso de Odontologia. Natal, RN, Brasil.

³ Universidade Federal do Rio Grande do Norte, Curso de Odontologia. Natal, RN, Brasil.

⁴ Academia Norte-Rio-Grandense de Odontologia. Natal, RN, Brasil.

Longitudinal clinical studies have shown that the osseointegrated implants work successfully as anchors in prosthetic restorations with fixed dentures and full dentures (overdentures)⁵.

Budtz-Jørgensen⁶ and Keltjens⁷ mooted the possibility of combining implant planning with removable partial dentures, especially in Kennedy class I and II arches. The planning of free-ends with removable partial dentures resting on implants in the distal region renders the denture tooth-implant-supported instead of tooth-mucosa-supported, promoting greater retention, stability and comfort.

According to Mifiritsky et al.⁸, the removable denture on the implant has advantages over the conventional removable partial dentures, such as increased retention and stability and the improvement in patient satisfaction with the denture. The preservation and maintenance of the hard and soft tissue surrounding the implants are reported with bone neoformation. This suggests that the removable partial dentures enveloping teeth and implants should be considered as a treatment option in the rehabilitation of partially edentulous arches, providing esthetics and function and overcoming the difficulties of extensive edentulism. Various authors have reported success in cases where the removable partial dentures are combined with implants⁹⁻¹⁵.

Therefore, this study aims to show, by way of the description and discussion of a clinical case, a treatment alternative for partially toothless patients unsatisfied with their conventional removable dentures.

CASE REPORT

Healthy female patient aged 41, with complete maxillary arch in contrast to the partially edentulous mandibular arch, classified as Kennedy class II, whose main complaint was denture movement when chewing, by virtue of the lack of retention and stability of her conventional removable partial dentures. She was subjected to the fitting of an osseointegrated implant 3.75 mm in diameter by 7 mm long (Master Poruos®, Conexão Sistemas de Prótese, São Paulo, Brazil) in the right posterior mandibular region at the level of the second molar. After the period of osseointegration (Figures 1 and 2), the prosthetic procedures could begin.

In the bottom study mold, an analysis was performed on the delineator in order to determine the insertion trajectory, pillar preparation planning (guide planes, retentive areas, adjustment of the prosthetic equator and recesses) and fabrication of the respective

transfer guides in accordance with the pre-planning. Next, the preparations of the pillars and the molding were carried out to obtain the master mold for the fabrication of the metal frame. Once the CoCr metal frame was obtained (Figure 3), the next step was to produce the working mold via the bipartite mold technique. After obtaining the top mold and the altered bottom mold with the metal frame and the guide plan in the edentulate area, the recording of the maxillo-mandibular ratios was performed and the fitting into a semi-adjustable articulator with the assistance of the facial arch, allowing the fitting of the artificial teeth, the clinical test with wax and the acrylization.

After the processing of the denture, this was installed and subsequently checked after 24 hours and then at 7 days after installation of the denture, the moment for capturing the ball-type retention system (Conexão Sistema de Prótese, São Paulo, Brazil).

The ball-type insert was placed on to the implant (the male part), at a torque of 20 N/cm, calibrated by means of a manual torque wrench (Ratchet Head with Conexão® torque reference, Conexão Sistemas de Prótese, São Paulo, Brazil) to guarantee proper seating and resistance to movement (Figure 4). A rubber sheet between the female and male was used to prevent the acrylic resin for chemical polymerization penetrating the retentive areas during the locking of the female on to the denture base. For the locking procedure it is important to wait for the complete polymerization of the resin, holding the denture in the position of maximum intercuspation. Next a check was performed on the position of the female component on the base of the denture (Figure 5), the length of the edges and the adjustments. The denture was then positioned and the patient was instructed about the importance of oral hygiene to maintenance of health and about the methods for cleaning the insert and denture system, emphasizing the need for periodic return visits for preservation and check-up. In Figure 6, the final appearance of the denture in position can be observed. The patient authorized the publication of this case by way of a free and informed consent form.



Figure 1. Clinical appearance of the implant.



Figure 2. Implant situated in the posterior region of the lower jaw.



Figure 5. Female component incorporated into the base of the removable partial dentures.



Figure 3. Metal frame in position in the mold, made out of CoCr.



Figure 6. Completed denture after final adjustment.



Figure 4. Ball-type insert attached to the implant.

DISCUSSION

The distal extension removable partial denture creates problems due to the absence of a dental path in the posterior region, using as simultaneous support the mucosal fiber and tooth. Due to the difference in the behavior of these two load transmission paths to the bone tissue, even when the removable partial denture is properly planned, a leverage force is always present and could result in the inclination of the pillar tooth in the direction of the prosthetic space when a force is applied to the free end of the saddle¹. This situation could result in compression and stretching of the periodontal fibers, tooth movement, bone loss, periodontal pockets and even the loss of the tooth.

Besides the problems mentioned above, the main complaints associated with free-end removable partial prostheses are stability defects, minimal retention, unfavorable esthetics on account of the appearance of clips and discomfort when chewing^{14,16}.

At the present time, dental implants are being used to support distal extension removable partial dentures and offer many advantages over tooth-mucosa-supported removable dentures as not only do they serve as anchorage for the denture, but they also preserve and maintain the alveolar bone⁴.

The use of implants as an element to support and retain removable dentures is already widely employed with full dentures¹⁷. Timmerman et al.¹⁶ evaluated implant-supported overdentures as a treatment strategy to resolve the main complaints such as poor retention and stability of the full mandibular denture and, as a result, obtained a high level of patient satisfaction with the dentures, and functionally a better retention and stability of the denture. The author also suggested that the overdenture supported by 2 implants connected by a bar is the best treatment strategy for providing stability over a longer period.

As for the overdenture connection system, Naert et al.¹⁸ studied the use of magnets, ball-type inserts and straight bars with clips. The results did not indicate any differences between them, despite the bar-retained overdentures being functionally better, it did not have an impact on the level of patient satisfaction.

As far as the combined implant and RPD planning is concerned, there have been few studies reported in the literature, with the majority being reports of clinical cases related to this treatment option.

According to Verri¹, the principal objective in the planning of distal extension removable partial dentures is to balance the distribution of forces to maintain the alveolar rim and the remaining healthy teeth and provide comfort and better function for the patient. Implants have been incorporated into removable partial dentures to better distribute these forces, preserving the integrity of the support structures and providing greater retention, stability and support to the denture.

Keltjens et al.⁷ also stated that the fitting of implants under the distal extension of the base of the removable partial dentures results in better occlusal stability. Two clinical cases were reported combining the use of implants with removable partial dentures providing occlusal stability and comfort to the patient. Moreover, for cases similar to the one reported, as for the most part they deal with type II bone quality, which affords relatively good initial stability

and good bone-implant contact and optimized through the use of a treated surface, short implants may be used.

According to Kuzmanovic et al.¹⁰, the implant fitted in the posterior region could convert a distal extension removable partial denture from a tooth-mucosa-supported to a tooth-implant-supported denture, thereby modifying the Kennedy classification from class I to class II and providing stability.

Removable partial dentures supported by a combination of implants and the remaining teeth contribute to the preservation of the soft tissue¹⁵ and the remaining hard tissue, increase patient satisfaction, there is a minimum of wear and tear on components, bone loss within normal limits and stability of peri-implant soft tissue¹⁴.

Moreover, this treatment combination could be a good option in cases where it is not possible to perform conventional implant insertion due to the proximity of the alveolar nerve or when the fitting of short implants in the area will have an adverse effect on longevity due to the insufficient crown-to-implant ratio.

According to Mijiritski et al.⁸, the removable partial denture on top of the implant has advantages over the conventional removable partial denture, such as the increased retention and stability and the improvement in patient satisfaction, preservation and maintenance of the hard and soft tissue and it provides esthetics and function, overcoming the difficulties of extensive edentulism.

As for the biomechanics of the removable partial denture supported on the implant in the distal region and the abutments, Lacerda¹¹ stated that the greater the area of contact between the mucosal fiber and the removable partial denture, the greater the demands on the mucosal fiber and lower tensions will be transmitted to all the remaining support structures and that the presence of a metal frame inside the plastic saddle causes this to undergo less deflection and compresses the mucosal fiber to a lesser degree, demanding more of the following supports: tooth support and implant.

Another treatment alternative to solve free-end problems is the planning with conventional cantilever fixed dentures, however this option produces a highly unfavorable biomechanical behavior and requires preparation for the total crown of pillars adjacent to the free-end, thereby limiting its application.

The option also exists for a fixed denture on the implants, however, according to Misch⁴, the removable denture on top of the implant has advantages over the fixed denture, such as the lower risk of caries in the pillar

teeth and tooth pulp, ease of cleaning of the surfaces and maintenance of the bone in the edentulous region.

For Uludag & Çelik¹⁷, the advantages of the overdenture over fixed dentures on the implant are that fewer implants are needed, cleaning is performed more easily and the esthetics due to bone loss are more easily reproduced. He also mentions that atrophied mandibles are treated better with RPD because the fixed denture requires a more favorable crown-to-root ratio.

For Asvanud & Morgano¹⁹, the fixed denture screwed on to the implant improves the esthetic results as it incorporates the labial flange, but it has an adverse impact on oral hygiene. He adds that implant-supported overdentures could restore reabsorbed edges and, as they are removable, it helps with cleaning.

However Bassi et al.²⁰ pointed out the advantages of the fixed denture on the implants versus the removable partial dentures, such as not needing to prepare natural teeth, lower induction of forces on the pillar elements and the frequent biomechanical problems and, as it is fixed, it tends to be more acceptable to the patient.

Pellechia et al.¹² quote another treatment option which is the implant-supported fixed denture with bilateral distal cantilevers that offer the advantage of being fixed in relation to the overdenture, but which could present functional and biomechanical disadvantages. Another option would be the removable partial denture anchored to a fixed denture supported by implants with stress directors close to the connection with the fixed denture, whose advantages consist of lower compression on the rim during function and development of stability during chewing, permitting a functional activity similar to that of an overdenture.

Considering the planning of the oral rehabilitation of partially edentulate arches with free ends, it is noted that, compared with the other treatment options with the removable partial dentures supported and retained by

distal implants, this provides adequate retention, stability and support which provides comfort, allowing the patient to perform the functions of the stomatognathic system. It is also found that, when compared with the denture fixed on top of implants, the removable partial denture and implant combination is less expensive, with shorter treatment time and the possibility of fitting shorter implants, since there will be no lever arm in the crown portion¹⁹.

In spite of all the advantages of prosthetic rehabilitation with implants, more long-term, controlled studies are required to evaluate the durability of implants in combination with the removable partial denture and thereby enable the validation of this technique with broad indication⁷. Watson²¹ reports that a severe occlusal load in the cases of implant-supported dentures, mainly at the free-end, could induce mechanical failure or bone reabsorption around the implant.

CONCLUSION

The fabrication of the removable partial denture retained via implant gave the patient better retention, stability, support and better occlusal stability when compared to the conventional removable partial denture.

Collaborators

ARL AQUINO, SA SOUSA and AFP CARREIRO took part in the fabrication of the denture on the implant and in the composition of the article. AR GERMANO was the surgeon responsible for the dental implant and took part in the composition of the article. SL MENDONÇA took part in the surgical stage of the dental implant and composition of the article. DVM HOLANDA was responsible for the revision and composition of the article

REFERENCES

1. Verri FR, Pellizzer EP, Rocha EP, Pereira JA. Influence of length and diameter of implants associated with distal extension removable partial dentures. *Implant Dent.* 2007;16(3):270-9. doi: 10.1097/ID.0b013e31805007aa.
2. Mensor Mc Jr. The rationale of resilient hinge-action stressbreakers. *J Prosthet Dent.* 1968;1968;20(3):204-15. doi:10.1016/j.prosdent.2004.04.010.
3. Kuboki T, Okamoto S, Suzuki H, Kanyama M, Arakawa H, Sonoyama W, et al. Quality of life assessment of bone-anchored fixed partial denture patients unilateral mandibular distal-extension edentulism. *J Prosthet Dent.* 1999;82(2):182-7. doi: doi.org/10.1016/S0022-3913(99)70154-X.
4. Misch CE. The importance of dental implants. *Gen Dent.* 2001;49(1):38-45.

5. Albrektsson T, Jansson T, Lekholm U. Osseointegrated dental implants. *Dent Clin North Am.* 1986;30(1):151-74.
6. Budtz-Jørgensen E. Restoration of the partially edentulous mouth: a comparison of overdentures, removable partial dentures, fixed partial dentures and implant treatment. *J Oral Dent.* 1996;24(4):237-44.
7. Keltjens HM, Kayser AF, Hertel R, Battistuzzi PG. Distal extension removable partial dentures supported by implants and residual teeth: considerations and case reports. *Int J Oral Maxillofac Implants.* 1993;8(2):208-13.
8. Mifiritsky E, Karas S. Removable partial denture design involving teeth and implants as an alternative to unsuccessful fixed implant therapy: a case report. *Implant Dent.* 2004;13(3):218-22.
9. Giffin KM. Solving the distal extension removable partial denture base movement dilemma: a clinical report. *J Prosthet Dent.* 1996;76(4):347-9. doi: 10.1016/S0022-3913(96)90536-3.
10. Kuzmanovic DV, Payne AGT, Purton DG. Distal implants to modify the Kennedy classification of a removable partial denture: a clinical report. *J Prosthet Dent.* 2004;92(1):8-11. doi: 10.1016/j.prosdent.2004.04.010.
11. Lacerda TS, Laguna DC, Gozález-Lima R, Zanetti AL. Contribution to the planning of implant-supported RPD in the distal region. *RPG Rev Post-Grad.* 2005;12(3):293-300
12. Pellecchia M, Pellecchia R, Emtiaz S. Distal extension mandibular removable partial denture connected to an anterior fixed implant-supported prosthesis: a clinical report. *J Prosthet Dent.* 2000;83(6):607-12.
13. Cunha VPP, Marchini L, Ribeiro NR, Santos JFF, Cunha MOPP. Prótese parcial removível retida por implantes: relato de caso clínico. *BCI.* 2001;8(31):236-8.
14. Mitrani R, Brudvik JS. Posterior implants for distal extension removable prostheses: A retrospective study. *Int J Periodontics Restorative Dent.* 2003;23(4):353-9.
15. Halterman SM, Rivers JA, Keith JD, Nelson DR. Implant support for removable partial overdentures: a case report. *Implant Dent.* 1999;8(1):74-8.
16. Timmerman R, Stoker GT, Wismeijer D, Oosterveld P, Vermeeren JJ, van Waas MA. An eight-year follow-up to a randomized clinical trial of participant satisfaction with three types of mandibular implant-retained overdentures. *J Dent Res.* 2004;83(8):630-3. doi: 10.1177/154405910408300809.
17. Uludag B, Celik G. Fabrication of a maxillary implant-supported removable partial denture: a clinical report. *J Prosthet Dent.* 2006;95(1):19-21. doi: 10.1016/j.prosdent.2005.10.021.
18. Naert I, Quirynen M, Hooghe M, van Steenberghe D. A comparative prospective study of splinted and unsplinted Branemark implants in mandibular overdenture therapy: a preliminary report. *J Prosthet Dent.* 1994;71(5):486-92. doi: 10.1016/0022-3913(94)90188-0.
19. Asvanud C, Morgano SM. Restoration of unfavorably positioned implants for a partially edentulous patient by using an overdenture retained with a milled bar and attachments: a clinical report. *J Prosthet Dent.* 2004;91(1):6-10. doi: 10.1016/j.prosdent.2003.09.009.
20. Bassi F, Schierano G, Lorenzetti M, Preti G. Oral conditions and aptitude to receive implants with removable partial denture: a cross-sectional study. Part II. Aptitude. *J Oral Rehabil.* 1996;23(3):175-8. doi: 10.1111/j.1365-2842.1996.tb01230.x.
21. Watson RM. The role of removable prostheses and implants in the restoration of the worn dentition. *Eur J Prosthodont Restor Dent.* 1997;5(4):181-6.

Received on: 27/6/2008

Final version resubmitted on: 24/9/2009

Approved on: 21/10/2009