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Multidisciplinary oral rehabilitation with active utilization of roots using a fitting system and removable partial denture – Case report

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Abstract*— Oral rehabilitation consists of dental and esthetic prosthetic treatments that aim to recover or improve the oral health of patient, when it is affected. Currently, partially edentulous patients have a very active social life and thus they should feel safe with their prostheses. Aiming at the correct establishment of balance of the stomatognathic system, restoring function and esthetics, preserving the remaining structures and replacing lost structures, with reversibility and good cost/benefit, the removable partial dentures favorably rehabilitate partially edentulous patients within the context of Brazilian health. In this case report, removable partial dentures in the upper and lower arches were made with retention on spherical retainers (O'rings) in the remaining dental roots, which allowed the active utilization of these roots as abutments of partial dentures, minimizing the torque on teeth that could lead to loss of insertion and consequent mobility. The esthetic gain achieved with the use of these retainers should also be highlighted, due to elimination of extracoronal clamps on anterior teeth. The utilization of dental roots with retention devices proved to be an effective device to increase the retention and stability of prostheses, emphasizing the esthetic benefit in cases of removable partial dentures that involve the anterior region.*

I. INTRODUCTION

Despite the evident progress of Dentistry in the field of oral rehabilitation, especially in relation to endosseous implants, the high rate of individuals with tooth loss, and the harmful impacts on the lives of affected people challenge dentistry to minimize this problem, and conventional

removable partial dentures (RPDs) are the treatment of choice for most individuals. Oral rehabilitation with a removable partial denture (RPD), when well indicated, plays a direct role in reestablishing the oral and systemic health of partially edentulous patients [1-4].

Tooth losses caused by trauma, periodontal disease or caries interfere with the quality of life of patients. Dental prostheses aim at partial or total rehabilitation to restore the esthetics and function, reestablishing the physical and psychological wellbeing of patients, since tooth loss causes functional damage, impairing the masticatory capacity, negatively influencing the speech and esthetics (1,5-8). With a significant advance in preventive dental care and a greater awareness of the population, there was a reduction in the incidence of tooth loss. This, associated with the increase in life expectancy of patients, led to an inversion of the age pyramid with more patients reaching the third age, consequently influencing the increased demand for partial rehabilitation.

Since not all patients have adequate physiological or even financial conditions to receive another type of rehabilitation, RPD becomes a viable option when fixed partial dentures are unfeasible due to the arrangement of remaining teeth and lack of bone support for rehabilitation with endosseous implants [5,9,10]. RPDs replace lost teeth and surrounding tissues, integrating with the stomatognathic system, enabling functional restoration, comfort and esthetics with their limitations, without the need to expose the patient to long and complex surgical and prosthetic treatments [11-17]. These prostheses are widely used due to their fast resolution and affordable costs to most population, some patients fear them due to the unfavorable esthetic aspect [18-20].

The search for correct maxillomandibular relationship is the objective of oral rehabilitation in prosthetic treatments [21]. Tooth loss has a direct influence on the imbalance of the stomatognathic system, since it can cause changes in chewing, speech, esthetics and facial harmony. Besides the esthetic and functional impairment, inadequate dental, skeletal or muscle relationships can also lead to pain and wear of joint structures and teeth and muscle stress [22-25].

Tooth loss worries and impacts several aspects; losing a tooth means not only a damage to esthetics, but also an involution of periodontal tissues, especially the alveolar bone. The alveolar ridge crest loses the functional stimulus and, as a result, bone loss in volume is increased in the region. Besides bone changes, the gingiva also presents alterations: a less keratinized oral mucosa starts to insert into the alveolar bone and, as a result, there is increased predisposition to trauma [26].

Assuming that the surrounding structures change when there is tooth loss, is necessary to reestablish such absence. In the case of partially edentulous patients, specifically, the present anatomical structures (remaining roots) are used as much as possible, always aiming at bone maintenance, as well as any concern to postpone the atrophy of periodontal tissues.

For a long time, remaining dental roots have been maintained and used to promote greater retention and stability of removable dentures [27]. With the advancement of endosseous implants, the use of roots with retention devices has decreased; however, the addition of retainers to natural roots that would be extracted can still be a therapeutic option, especially for patients who cannot or are not willing to undergo surgery for implant placement [28].

Tooth loss causes several damages, related to both health and social life. The clinical aspect includes bone resorption, decreased proprioceptive capacity of the masticatory cycle and loss of masticatory capacity. One way to avoid them is to maintain the remaining roots, to support a denture on those roots. The overdenture is described as a removable partial denture (RPD) or full denture supported on one or more remaining teeth, roots and/or dental implants. It has some advantages such as reduced bone absorption, maintenance of the periodontal ligament and proprioception, besides the possibility of using fitting systems (retainers) for the denture, which improve the retention and stability of the prosthesis, providing greater patient satisfaction [29,30].

The rehabilitation treatment using resilient fitting systems is an alternative for the rehabilitation of partially edentulous patients [31,32]. The use of resilient fitting systems provides greater comfort by a more stable and esthetic reconstruction. The roots that will be abutments of this denture must have good periodontal implantation and favorable position for the placement of retainers [33].

The retainer is a mechanical device for fixation, retention and stabilization of dentures [34]. The retainer consists of a male component that is usually located in the region corresponding to the crown of the abutment tooth, and the female component is attached to the structure of the removable denture [35]. The two parts (male and female) of the retainer overlap, so that separation is precluded by the friction generated at the interface between walls [36].

An ideal fitting system should present good retention, biomechanical capacity to aid the distribution of functional loads to the adjacent bone and easy maintenance, if replacement is necessary. In addition, it must present low height, so that it can be used in reduced intermaxillary spaces, favoring the patient's esthetics [37]. The *O'ring* fitting systems have resilience as their main property, which

allows the movement of dentures aiming to distribute the masticatory load between the abutments and mucosa [31]. It is a spherical system, composed of male and female parts, and the male component is usually attached to the implant or root, presenting a projection, in which the rubber ring of the female component is fitted. This rubber ring is the component with higher occurrence of complications; if necessary, it can be easily changed, and this is considered an advantage of the system [37-39].

This system is indicated in cases of overdentures retained by independent roots [40]. This system requires parallelism between retainers, with maximum divergence of 10^0, otherwise, it will present marked wear of the retention rings [35]. According to *Tabata et al.* [37], when the *O'ring* system is used, there should not be a divergence greater than 5^0 between them, since a divergence greater than 5^0 does not allow passive insertion and removal of dentures, which would cause rapid deterioration of the *O'ring*. According to *Telles* [33], it is only contraindicated in roots or implants with more than 20^0 of divergence.

To use this system, the professional should consider the minimum space required for effective use (6-mm height in the average) and, when added to acrylic resin and artificial tooth, it requires at least 15-mm height [37].

This paper reports a clinical case in which remaining roots were actively used for oral rehabilitation of a patient by the fabrication of cased posts associated with a fitting system with removable partial dentures in both dental arches.

II. CASE REPORT

Female patient S.M.S.M., aged 56 years, presented to the Dental Clinic at the University of Marília (UNIMAR) in the Extension Course in Esthetic-Functional Rehabilitation aiming to receive a new prosthesis, so that she could smile, eat and live in society in an effective and safe manner.

The patient had removable partial dentures with severe color changes, with marked wear of artificial teeth, poorly fitting unsuitable and without adequate retention, due to loss of the supporting teeth. Anamnesis, clinical and radiographic examinations of the patient were performed, which revealed the presence of tooth 11 with composite resin restoration on the mesial and distal surfaces, involving the incisal edge, both unsatisfactory and requiring replacement; tooth 13 presented fracture in the cervical third, good bone implantation and satisfactory endodontic treatment. Tooth 16 presented satisfactory amalgam restoration (mesio-occlusal-distal) and tooth 21 presented an unsatisfactory composite resin restoration on the distal surface. Tooth 23 had an unsatisfactory cast metal post, not covered by any type of crown; also, the remaining dental structure around the post was carious. In the mandibular arch there was presence of teeth 31, 32, 33, 41, 42, 43 all healthy, besides tooth 44 with great coronal destruction and satisfactory endodontic treatment.

Initially, the decayed tissue in tooth 23 was removed, which also resulted in removal of the cast metal post in this tooth. It was observed that the dental remnant presented satisfactory conditions to be used as support for a future denture. Initial study models were obtained by simple alginate impression using metallic trays (Fig. 1 A).

Due to the clinical situation, in which the patient had three dental remnants (13, 23 and 44) requiring needing prosthetic reconstructions using them as abutments of a future removable partial denture, The treatment planning proposed included cast metal posts associated with a fitting system on them, which would act as retainers for the new removable partial denture.

The option to fabricate a removable partial denture using with the *O'ring* fitting system, using teeth 13 and 23 as abutments in the anterior region, with active utilization of these roots, would benefit the patient's esthetics because there is no need to use extracoronal retainers (clamps) in this region of the arch. The *O'ring* fitting system (CNG) is a mechanical system known for its passivity, due to the cushioning effect provided by the rubber ring. Regardless of the direction of forces applied to the female component, the rubber ring will always be present undergoing deformation, relieving the efforts transmitted to the male component of the system and consequently to the anchorage in the remaining roots.

The first session comprised the necessary intraradicular preparations of the root canals of teeth 13, 23 and 44, including adequate removal of root canal filling using Rhein tips and Gates Glidden drills, respecting the ideal principles of length, taper and diameter of these canals (Fig. 1 B-C).

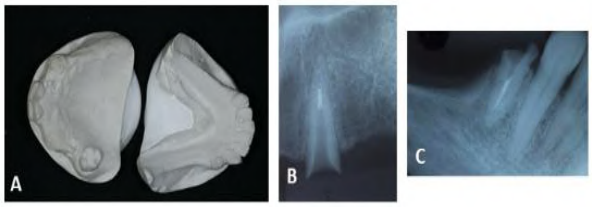

Fig. 1 – (A) Initial study models of the partially edentulous patient; (B-C) Root canals properly prepared for molding the posts.

Following, the root ducts were molded using Pincanal™ and acrylic resin with better dimensional precision (*Duralay*™) by the direct technique (Fig. 2 A-F).

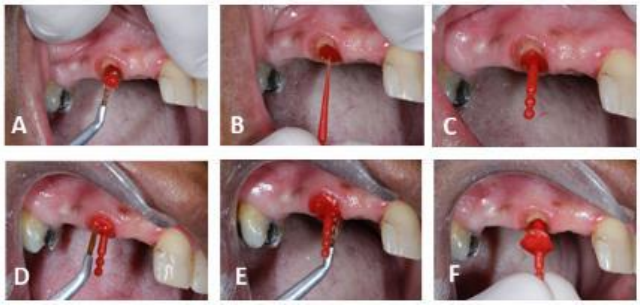

Fig. 2 – (A-F) Molding of the root canal for fabrication of cased cast metal post, using Pincanal™ and Duralay™ acrylic resin.

In the coronal portion, finishing was performed with burs and sandpaper discs. At completion of finishing, these posts presented full coverage of the remaining coronal structure with acrylic resin, a characteristic of cased posts (Fig. 3 A-D).

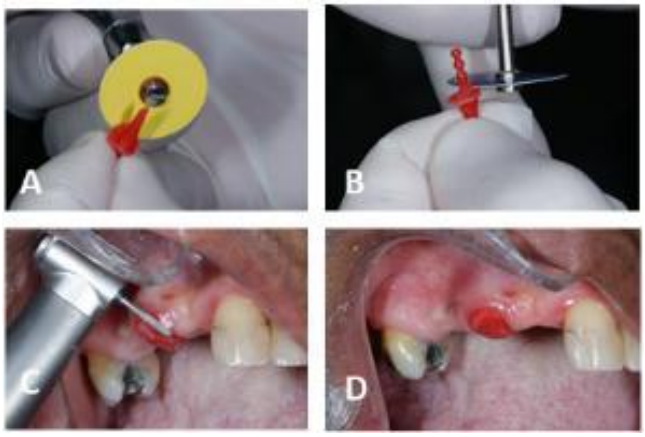

Fig. 3 – (A-D) Finishing of the coronal portion of cased posts.

Thereafter, the components of the *O'ring* fitting system were fixed with acrylic resin to the coronal portion of posts for later casting in the laboratory (Fig. 4 A-C); the posts were removed from their position by simple impression with alginate using a metallic tray (Fig. 4 D-E).

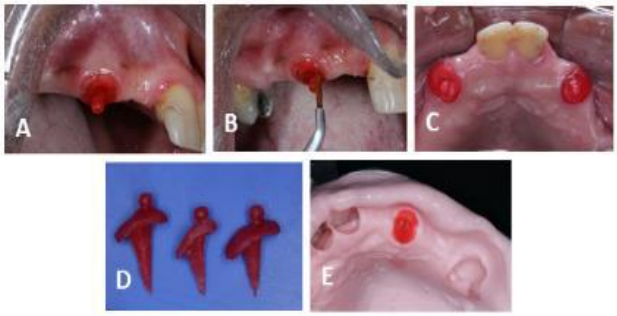

Fig. 4 – (A-B) Fixation of the fitting system component with acrylic resin; (C-D) Cased posts with the fitting system component properly fixed; (E) Removal of the posts from their position inside the alginate impression.

Then, the acrylic resin posts were cast in metallic alloy and, after adjustments to achieve perfect adaptation to the root remnants, they were definitively cemented inside the root canals using zinc phosphate cement, according to the cementation protocol recommended for indirect posts (Fig. 5 A-F).

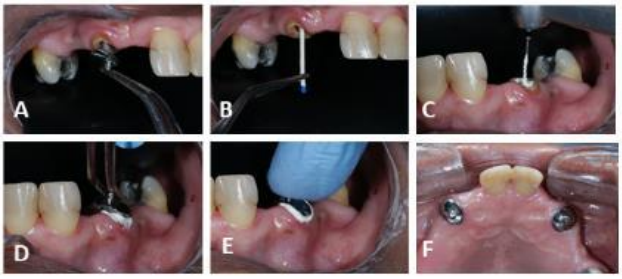

Fig. 5 – (A-F) Sequence of definitive cementation of cased posts inside the root canal.

The upper removable partial denture of the patient was provisionally adapted over these posts. In the upper arch, an occlusal niche was made in tooth 16 and palatal niches in teeth 11 and 21. In the lower arch, the niches were made in teeth 33 and 43. After specific preparations, functional impression of the dental arches were achieved to fabricate the metallic frameworks of removable partial dentures. The metallic frameworks were then properly tested and adjusted in the mouth for subsequent intermaxillary registration. In this session, a reduced intermaxillary space was observed and thus it was necessary to keep the cased posts of tooth 44 only as a simple metal coping, without the fitting system on it. In the following session, with the teeth mounted in wax, the functional test of dentures was performed, assessing all fundamental aspects as occlusion, esthetics and speech. Re-impression of the edentulous area was achieved using a light impression material (condensation silicone), for better adaptation of the denture base (Fig. 6 A-E).

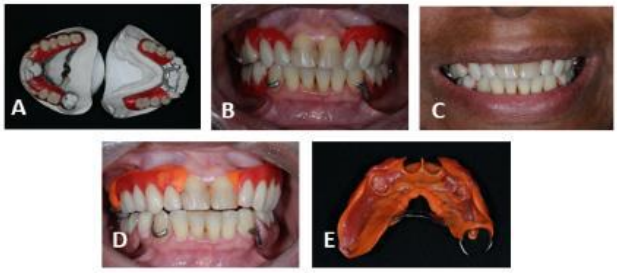

Fig. 6 – (A-C) Functional test of removable partial dentures in both arches; (D-E) Re-impression of the upper arch with light condensation silicone.

After denture polymerization in the laboratory, they were placed in the patient's mouth. In this case, capture of the retention capsules with the rubber rings of the *O'ring* system was performed directly in the patient's mouth with chemically cured acrylic resin. With the finished denture, with open spaces to accommodate the capsules, they were captured directly in the mouth, with the patient keeping the mouth closed in light occlusion until direct resin polymerization. If, during this period, there was interference with seating, there might be movement leading to an incorrect capture. A spherical or similar drill is used to further grind the acrylic internally until correct opening of the capsule space, and then self-curing resin is placed in the plastic phase inside the denture. After curing, only an internal finishing is performed around the capsule. Although it is possible to fabricate the denture acrylics with the capsules in place, this is technique more subjected to error, since there may be a difference in the movement of capsules during the process, and correct adaptation on the abutments may not occur (Fig. 7 A-F).

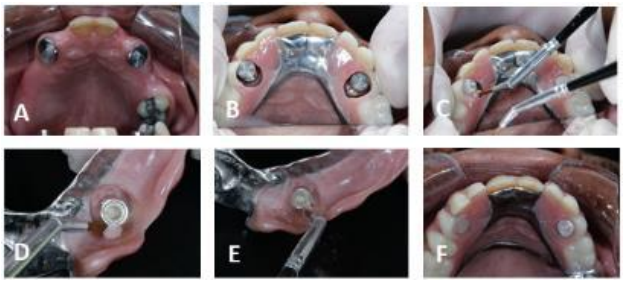

Fig. 7 – (A-F) Capture of the retention system capsules.

After capture was completed, the upper removable partial denture presented excellent final adaptation and retention, thus the patient was extremely satisfied (Fig. 8 A-B). The patient was instructed on placement and removal, as well as about denture cleaning. Occlusal adjustments and replacement of composite resin restorations on teeth 11 and 21 were performed, which were unsatisfactory and, in subsequent controls, some adjustments (reliefs) in the acrylic base region were performed due to small areas of trauma.

Fig. 8 – (A-B) Final clinical situation, with the denture adapted in the patient's mouth.

III. DISCUSSION

Increased denture stability and masticatory efficiency, better dissipation of occlusal loads, prevention of height and volume of the adjacent alveolar ridge, maintenance of the sensory functions of teeth and better psychological acceptance by the patient are some advantages of *overdenture* removable prostheses [41-43].

The use of *O'ring* fitting system provides retention with cushioning of axial forces on the supporting teeth, due to the rubber ring present in the female component of the system. Also, it reduces the lever arm in relation to the rotation axis of the root, thus allowing better distribution of masticatory forces on the roots and alveolar ridge [40]. An *in vitro* study by *Freitas et al*. [44] reported that the retention of the *O'ring* fitting system decreased over time, yet without total loss of retention.

According to *Cunha &Marchini* [45], if possible, the remaining teeth should always be maintained, since after extraction there will be bone remodeling due to the gradual process of alveolar ridge resorption. This resorption is delayed when the roots are maintained, by biological stimulation of the periodontal ligament, and maintenance of these roots aids the retention and stability, helping to restore the function and prognosis of dentures. The maintenance of roots is considered beneficial, since it reduces bone resorption, maintaining a more favorable bone level, allowing the future implant placement if necessary [45].

When the roots are maintained, the proprioception of the tooth is kept, since even endodontically treated teeth have periodontal fibers that transmit the load to the alveolar bone, thus gaining masticatory efficiency [46]. Maintaining teeth, even in small numbers, contributes to maintenance of the sensory response. This provides to the patient the benefit of differentiating the intensity of loads, food thickness and texture, which are important factors for the control of forces during mastication [45]. Also, the maintenance of roots has a psychological benefit, since tooth loss is usually seen by the patient as a synonym of aging [28]

In this case report, esthetics was an extremely important factor, being one of the aspects considered when choosing to use the fitting system; without this, the esthetics would be impaired, since it would be necessary to use clamps on the anterior direct abutments, namely the incisors in this case. The use of retainers compared to clamps often responds to an esthetic need [47]. The partial denture with clamp is always behind, especially in terms of esthetics, since the clamps may constitute obstacles that preclude the acceptance of the proposed treatment.

Removable dentures fabricated with fitting systems for increased retention ensure greater longevity to abutment teeth, especially those without a good crown/root ratio, since their components do not generate oblique forces that

could impair the uniform distribution of these forces [27]. The esthetic gain obtained with the use of these retainers in removable partial dentures should also be highlighted, which allows the elimination of extracoronal clamps on anterior teeth [39]. The use of dental roots is an option to increase the retention and stability of removable dentures, especially in patients who cannot receive endosseous implants, besides presenting a good cost-benefit relationship [28].

IV. CONCLUSION

The oral rehabilitation with removable dentures associated with the *O'ring* fitting system on roots is a good option for patients who cannot receive implants. As observed in this case, when well planned and performed, the denture provides rehabilitation but also harmony and balance of the stomatognathic system, providing comfort, favoring the esthetics, with good predictability, and meeting the patient's expectations.

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