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Use of Attachments in Rehabilitations with Removable Partial Dentures: Case Report

Case Report

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Abstract

Oral rehabilitation for partially edentulous patients offers versatility with various treatment options. Removable partial dentures (RPDs) persist as a viable treatment alternative, particularly for individuals who are not suitable candidates for or choose not to undergo dental implant rehabilitation. A crucial consideration in RPDs, especially when applied in the anterior region, is the debate surrounding the necessity of metal clasps due to potential aesthetic compromises. Attachment systems, as fitting options in RPDs, have emerged as clinically feasible solutions to address the aesthetic and functional limitations associated with traditional RPDs. This study aims to delineate the fitting systems in RPDs, providing insights into their indications, contraindications, advantages, and disadvantages. Drawing from a comprehensive literature review and a case report detailing the rehabilitation with RPDs featuring free-end abutments supported by crowns through attachment systems, the research sheds light on the clinical intricacies. The success of RPDs utilizing attachments hinges on the proficiency and knowledge of dental professionals regarding the potential forces transferred to the teeth and the residual ridge. Factors such as maintenance, ease of insertion and removal, functional comfort, and aesthetic considerations collectively position this device as a viable option in prosthetic rehabilitation. Highlighting the significance of retention, support, and stability, this clinical case underscores that RPDs with attachment systems remain a pertinent alternative in contemporary rehabilitative dentistry.

Keywords: Denture Precision Attachment; Removable Partial Denture; Dental Prosthesis Retention

Introduction

In the rehabilitation with Removable Partial Dentures (RPDs), the appliances are maintained in position, both at rest and during the functional movements of the patient, thanks to the retention provided by clasps. However, these clasps, known as direct retainers, crucial for the fixation and masticatory stability of conventional RPDs, are often deemed unaesthetic, especially when involving the labial surface of anterior teeth [1]. To address the aesthetic limitations of conventional RPDs, precision attachments, also known as attachments, can be utilized not only as retention aids in RPDs and Fixed Partial Dentures (FPDs) but also in complete dentures and in connecting teeth to implants. Attachments offer a new alternative in terms of aesthetics and functionality, providing greater resilience, stability, and retention when compared to conventional retainers [1,2].

The clinical success of RPDs using attachments depends on the practitioner's skills and understanding of the potential forces that a prosthesis can transfer to teeth and the residual ridge [3]. Proper selection of attachments based on retention, space, location, and prosthesis movement is crucial [4,5]. Common causes of failures in attachment systems include bone loss, tooth mobility, root or abutment fracture, all contributing to irreversible loss of retention [6]. Another common issue is the debonding of the metal-ceramic crown containing the attachment. Therefore, success relies on observing indication and contraindication parameters [7]. Attachment types vary in the literature, classified based on fabrication, location, and movement.

Regarding fabrication, precision attachments are prefabricated, while semi-precision attachments are crafted by the dental technician and/or dentist. Precision attachments, available ready-made or in resin and/or wax for laboratory casting, feature metal-to-metal mechanical components with minimal separation during function. Semi-precision attachments, on the other hand, are made of materials like plastic, synthetic fiber, or wax, offering lower precision [8]. Attachments are categorized concerning location as intracoronal and extracoronal. Intracoronal attachments integrate with the supporting tooth as part of a fixed element, while extracoronal attachments reverse this, with the female part becoming part of the RPD, and the male part being part of the fixed element cemented to the supporting tooth [9] They further categorize into intracoronal attachments incorporated into the tooth crown contour and extracoronal attachments located outside the crown contour [8,10].

Regarding movement, attachments can be rigid or semi-rigid. Rigid attachments are suitable for denture-supported partial prostheses, while semi-rigid or resilient attachments are recommended for denture-mucosa-supported prostheses, cases with distal extension, or Kennedy Class IV with a wide span. This is due to their ability to provide "controlled freedom of movement," particularly occluso-gingivally, mitigating lateral forces on abutment teeth by RPDs [10,11]. Despite the improved aesthetic appearance and functional efficiency achieved with these systems, biomechanical factors must be considered to guide therapeutic decisions and treatment plans, preventing damage to soft tissues and food impaction. This study aims to demonstrate, through a clinical case presentation, the feasibility of using RPDs associated with metal-ceramic crowns via attachment systems, restoring aesthetics, protecting abutment teeth, and enhancing the patient's physical and psychological well- being.

Case Report

After conducting anamnesis, intra and extraoral clinical examinations, radiographic assessments, and obtaining study models, the case was planned. The proposed prosthetic rehabilitation included gingivectomy to enhance width-to-height ratio, metal-ceramic unit crowns on teeth 13, 12, 11, 21, 22, 23, followed by the fabrication of RPD with resilient extracoronal attachments as indirect retention for the upper arch, and conventional RPD for the lower arch. The patient already had preparations in the anterior lower elements, with resin on cingula and metal islands on the labial surfaces of teeth 34 and 44 for RPD retention (Figure 1).

Figure 1:

A. Initial frontal intraoral photograph of the patient

B. Frontal intraoral photograph of the patient following the gingivectomy procedure

C. Fabrication of provisional restorations in the laboratory according to the pre- established plan

D. Intraoral placement of the provisional restorations

Source: Personal collection of Prof. Dr. Antônio Alves.

In the rehabilitation proposal for the upper Removable Partial Denture (RPD), resilient extracoronal Co-Cr attachments (CNG®; São Paulo, Brazil) were employed. This system consists of three parts: related to the abutment tooth, there is a resin male component, which is soldered to the prosthetic crown before casting; as part of the RPD, at the base of the saddle, there is the female component with an attached spiral spring system on its lateral portion. This spring was designed to be activated in case of retention loss, allowing the system a fail-safe condition. After a certain period of use, this spring must be replaced due to the potential for metal fatigue (Figure 2).

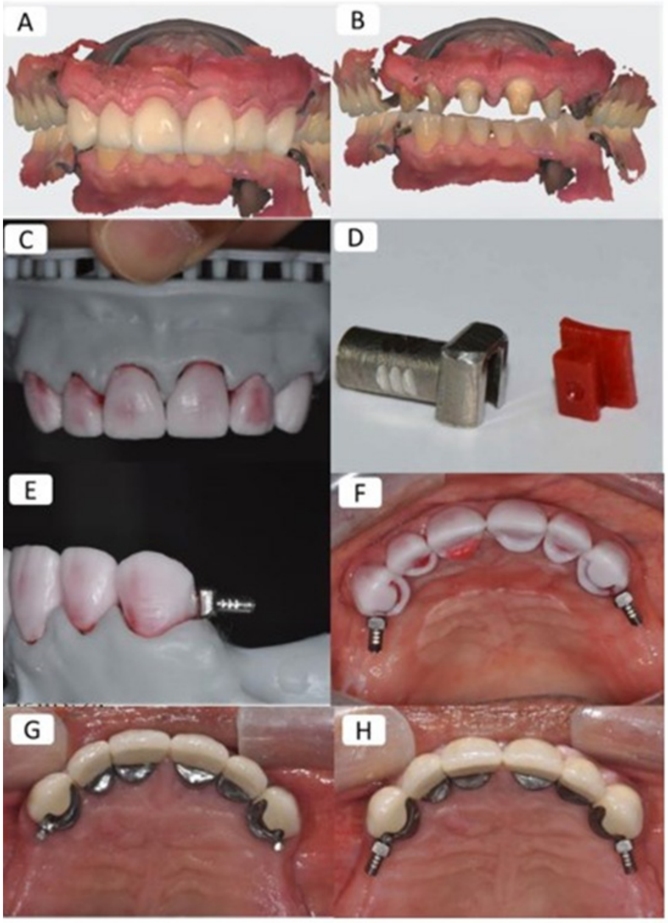

Figure 2:

A. In-mouth scanning of provisional crowns to serve as a reference for the final porcelain restorations

B. Intraoral scanning of teeth 13, 12, 11, 21, 22, 23 after preparation with old removable prostheses in place for occlusal registration

C. Copings in acrylic resin and ceroplasty on the working model

D. Metallic female attachment and resin male attachment

E. Side view of the coupled male and female attachments in position on the printed model, demonstrating the compatible distance to the alveolar ridge for RPD fabrication

F. In-mouth trial of copings and attachments in position

G. Metal-ceramic crowns installed in the mouth with the male attached to teeth 13 and 23

H. Placement of female attachments over male attachments in the mouth for transfer molding

Source: Personal collection of Prof. Dr. Antônio Alves.

For the fabrication of the upper crowns, following gingivectomy, necessary preparations and provisional restorations were performed, followed by 3D scanning using the intraoral scanner TRIOS 3 (3shape; Copenhagen, Denmark). In the laboratory, on the printed 3D model, copings in acrylic resin with wax coverage were made, simulating dental anatomies of the case for intraoral try-in. They were tested to verify adaptation, insertion direction for the RPD, and occlusion. After some adjustments, it was returned to the laboratory for coping casting and ceramic application. During the trial, the male components of the extracoronal attachments were still resin-bonded to the distals of teeth 13 and 23, undergoing simultaneous casting with the crowns (Figure 2). After cementing the metal-ceramic crowns to the preparations, with the female components in place, the work impressions followed, using Hydrogum 5 Type I Alginate (Zhermack; Badia - Italy) in the lower and upper arches. This impression with the transfer of the female part aims only to provide space on the working model for these components. After obtaining the mold, the devices were removed. Subsequently, the working models were produced in special Type IV gypsum FUJIROCK EP (GC; USA), to be used in the fabrication of the metal frameworks for the upper and lower RPDs.

The frameworks of the RPDs, already with orientation planes and trial bases, were properly fabricated in the laboratory. They were tried in the mouth, checking the seating of the upper RPD with the male elements of the retention system, and interocclusal registration was performed. After tooth color selection, the material returned to the laboratory for assembly.

With teeth in position, functional molding was performed using zinc-eugenol paste (Lysanda; São Paulo - Brazil) on the free ends, followed by gum color selection. After acrylicization, a trial of the RPDs was performed in the mouth to capture the female parts of the attachments, using Dencor Lay Acrylic Resin (Clássico; São Paulo - Brazil). After the installation of both prostheses and hygiene instruction, clinical follow- up occurred after seven days and after one month (Figure 3).

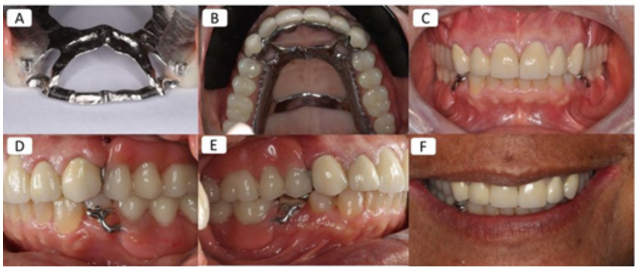

Figure 3:

A. Females captured after the acrylicization of the RPD

B. Occlusal view of the upper rehabilitation

C. Frontal intraoral photograph of the patient with completed treatment without the presence of clasps in the upper anterior region

D. Lateral view of the left arch in occlusion, single crowns in the upper anterior, with attachment on teeth 23, upper RPD with attachments, and conventional RPD in the lower arch with clasps retained on metal islands on tooth 34

E. Lateral view of the left arch in occlusion, single crowns in the upper anterior, with attachment on teeth 13, upper RPD with attachments, and conventional RPD in the lower arch with clasps retained on metal islands on tooth 44

F. Patient's smile after the completion of the treatment

Source: Personal collection of Prof. Dr. Antônio Alves.

Discussion

Guilherme et al. (2004) [12] and Martins et al. (2009) [13] reported that when the arch is classified as Kennedy Class I or II, attachments are indicated. According to Freitas Junior, Silva, and Verde (2005) [14], resilient extracoronal attachments are employed to reduce stress on the abutment tooth and transfer it to areas of prosthesis support. While all precision attachments provide a primary retention function, they do not have a role in lateral force transmission (embracement) or occlusal force transmission (support). According to the same authors [14], extracoronal attachments have part or all of their mechanism outside the normal contour of the abutment tooth and are primarily used for free-end removable partial dentures when a fail-safe mechanism is desired, as demonstrated in this case. Corroborating with these authors, this clinical case opted for resilient attachments, an effective treatment option for bilateral free-end situations. This type of retention was chosen as a means of protecting the abutment tooth while achieving a more satisfactory aesthetic outcome for the patient.

Despite the improved aesthetic appearance and functional efficiency achieved with these systems, biomechanical factors must be considered to guide therapeutic decisions and treatment plans to avoid damage to soft tissues and food impaction. Additionally, it is essential for the abutment tooth to have a crown height of 4 to 6 millimeters, necessary for proper fixation and retention, and in some cases of teeth with unfavorable positions, endodontic treatment may be necessary.7 In the present case, all upper anterior teeth had undergone endodontic treatment, with old restorations and facets replaced to improve adaptation and mechanical resistance. Clinical crown lengthening procedures were performed to contribute to the success of the proposed treatment.

According to Waltz (1973) [15], the use of resilient extracoronal attachments is safer when dealing with a well-defined residual ridge. This was also observed in the conducted case, where the prosthesis saddle base, related to the ridge, played a fundamental role in the stabilization of the RPD. However, it is crucial to note that if positioned outside the normal contour of the supporting crown, destructive torque may occur on the abutment tooth due to non-directed forces along its long axis. Therefore, correct selection should be made from the beginning of the planning 3,7 especially when the abutment supports a free-end RPD.

A negative aspect of extracoronal attachments is the difficulty for patients to maintain good oral hygiene because, being located outside the normal contour of the crown, they can lead to plaque and food accumulation, causing inflammation of the gingival tissue, and consequently, periodontal disease.8 According to Guilherme et al. (2004) [12], intracoronal attachments reduce food impaction, plaque quantity, and caries lesions, improving contour and masticatory efficacy. However, the extracoronal system is easier for the patient to insert and remove their prosthesis than the conventional and intracoronal systems. This clinical case opted for extracoronal attachments, as their preparations were carried out respecting contour and dental structure limits, consequently maintaining greater biological integrity. The patient was guided and encouraged to maintain good oral hygiene habits and visit the dentist regularly for dental check-ups.

The use of precision attachments in dentistry was conceptualized in 1906 by Herman Chayes.1 As a well-established methodology in the literature, it is worth emphasizing that a deeper understanding of their indications and advantages brings excellent prospects in rehabilitation treatments, considering not only aesthetic factors but also functional ones, providing excellent stability and retention compared to RPDs with clasps.

Conclusion

Many attachments are available for use with RPDs associated with single crowns. The extracoronal attachment system described in this article is a good option for cases involving free-end situations and intact ridges. Its maintenance, ease of insertion and removal, functional comfort, along with the aesthetic factor, make this type of device a viable option in RPDs supported by single crowns. This clinical case prioritized retention, support, and stability, reinforcing that such a device remains a good alternative for contemporary rehabilitative dentistry.

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