

Implant O-ring Attachment used for Tooth-borne Overdenture

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ABSTRACT

The lack of retention in complete dentures is a common complaint. The incorporation of the tooth supported overdenture in prosthodontics offers improvements related to patient satisfaction and masticatory capacity compared to the conventional complete denture. Retention of the roots of one or more teeth for overdenture offers the patient a lot of advantages like better stability, proprioception and support among a few. When rehabilitation with a fixed/removable implant-supported prosthesis is not a possible option due to medical contraindication or financial constraints, a tooth supported over denture retained and stabilized with attachment can be proposed as a reliable and cost effective treatment for denture patients. This article presents a clinical report where the O-ring attachment along with bar is used to aid in retention and stability of a maxillary tooth supported overdenture.

Keywords: Abutment, Overdentures, O-ring attachment, Bar.

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INTRODUCTION

The dental profession has expanded the preventive dentistry concepts into prosthodontics to bring about the prescription called 'the overdenture'. An overdenture is defined as a prosthesis that covers and is partially supported by natural teeth, tooth roots, and/or dental implants.¹ Tooth supported overdentures are far superior in many ways to the conventional complete dentures as they enhance denture base stability,² provide positive retention of alveolar bone,² aid in proprioception and mastication,² improves biting force, improves chewing efficiency by 20% as compared to conventional dentures,³ and strongly strengthen the psychology factors of the patient.²

The continuous pattern of alveolar bone loss once the teeth have been removed, has been well documented by researchers such as Olsen,⁴ Tallgren⁵ and Atwood.⁶ Bone resorption is so predictable in most patients that every effort should be made to preserve root and alveolar bone. Few remaining periodontally compromised teeth or edentulous cases, especially with severely resorbed alveolar ridges, require special approach in order to achieve good long-term clinical results.⁷ As the crown-root ratio is improved due to preparation of abutment teeth, prognosis of remaining teeth becomes more favorable due to reduction in the motility of

the abutment teeth under an overdenture.⁸ Also it appears that the presence of a healthy periodontal ligament maintains alveolar ridge morphology, whereas a diseased periodontal ligament, or its absence, is associated with variable but inevitable time-dependent reduction in residual ridge bulk. Minimal bone resorption occurs with the placement of overdenture. The bone under an overdenture may lose as little as 0.6 mm vertical bone over a 5 years period, and long term resorption may remain at 0.1 mm per year.⁹

Use of attachments and adherence to basic principles of complete denture design can improve both retention and stability of overdenture. Many factors such as proper border extensions, adhesion, neuromuscular control, etc. contribute to the retention of overdenture; still overdenture attachments play a chief role.¹⁰ The use of attachments can redirect occlusal forces away from weak supporting abutments and onto soft tissue, or redirect occlusal forces toward stronger abutments and away from soft tissues. The most commonly used attachments are the Bars, studs and magnets.¹⁰ Stud attachment may be intraradicular or extraradicular and connects the prosthesis to the individual tooth whereas the bar attachments connect the prosthesis to the splinted abutment teeth. They may also be classified as resilient and nonresilient attachment. Among the resilient stud attachments, most commonly used attachment system is O-ring attachment system which comprises of a male post, silicone O-rings and a metal housing.¹¹

The web search for overdenture on the PubMed results in listing of majority of articles on implant retained overdenture where different kinds of attachment systems are used. Among them the most commonly used attachments are the stud and the bar attachments.¹² In today's era of aggressive marketing of implant retained overdentures, hardly we find any case reports where bar with O-ring system is used for the tooth-borne overdentures. This article presents a clinical report where the O-ring resilient attachment is used for retaining tooth borne overdenture whereas the bar providing the splinting mechanism for the remaining teeth.

CLINICAL REPORT

A 50-year-old patient reported to the department of Prosthodontics in regard to replacement of missing teeth. The patient revealed no systemic disease, symptoms of temporomandibular dysfunction, dental pain or xerostomia, and presented with satisfactory oral hygiene. The patient

wanted to retain his remaining teeth; his primary complaints were poor retention and esthetics of the existing maxillary prosthesis as well as a general reduced masticatory function. The intraoral findings were that the mandibular arch was completely edentulous and in the maxillary arch, three teeth were remaining, that is the right side canine (13) and first premolar (14) and left side canine (23). These teeth were without caries, mobility, or active periodontal disease at clinical and radiographic examinations.

Primary impressions were made and diagnostic casts were poured. Thoughtful treatment planning was done so as to evaluate the height of the abutment teeth, availability of the inter-arch space and condition of the abutment teeth. This gave an idea for incorporation of O-ring attachments along with the framework. A final treatment plan of overdenture with stud attachment for the maxillary arch and conventional complete denture for the mandibular arch was proposed to the patient and the patient chose to continue with the suggested treatment plan.

Preoperative endodontic therapy was done on the abutment teeth 13, 14 and 23. Abutment teeth were prepared in a dome-shaped contour and hemispherically rounded

in all dimensions. The height of the abutment teeth was 3 to 4 mm projecting just above the gingiva (Fig. 1). The exposed dentin of the abutment was polished and treated with fluoride varnish. A rubber base impression was made and a cast was prepared for the wax pattern fabrication of framework for the stud attachments (Fig. 2). The O-ring system was procured from the trade dealer. It consisted of different colored silicone rings; metal housing and brass laboratory analog (Fig. 3). These components are basically used for implant prosthetic work. The brass lab analog was duplicated in putty index and a resin pattern lab analog post was fabricated. The metal housing with the silicone O-ring fitted well to the duplicated pattern resin lab analog post (Fig. 4). Then the duplicated pattern resin lab analog posts were attached on the runner bar connecting the wax copings for the abutment teeth using connector (Figs 5A and B).

Four stud attachments were placed. One of the studs was attached to the distal aspect of tooth 13 and another to the distal aspect of tooth 23, remaining two studs were placed in between teeth 13 and 23 above the bar. The placement of attachments was done with proper care making them parallel

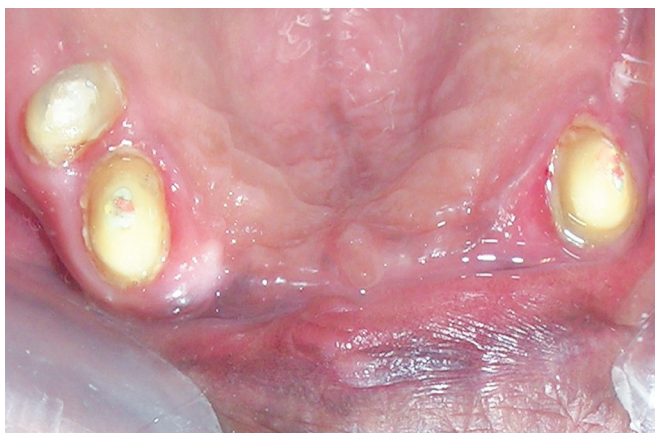


Fig. 1: Tooth preparation of the abutment teeth

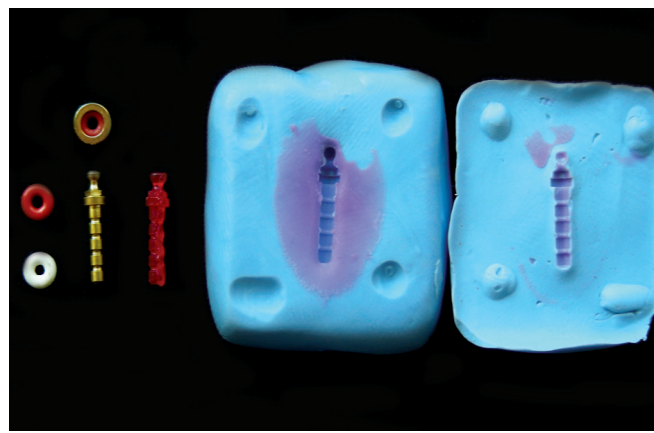


Fig. 3: O-ring attachment system



Fig. 2: Cast showing the preparation of the abutment teeth

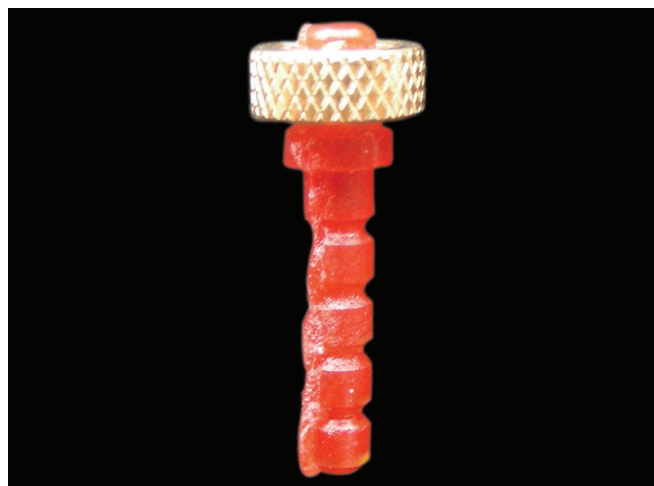


Fig. 4: Metal housing with the silicone O-ring tried on duplicated analog post

to each other and perpendicular to the occlusal plane and this was done using surveyor. The casting procedure was carried out using standard technique and the metal framework was initially tried on the cast and later in the patient's mouth. The fit was found to be satisfactory. The stud attachment framework was luted to the abutment teeth using resin cement (Figs 6A and B).

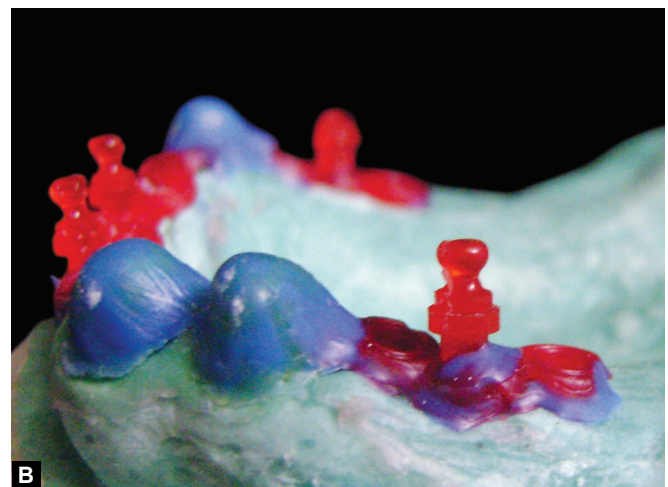
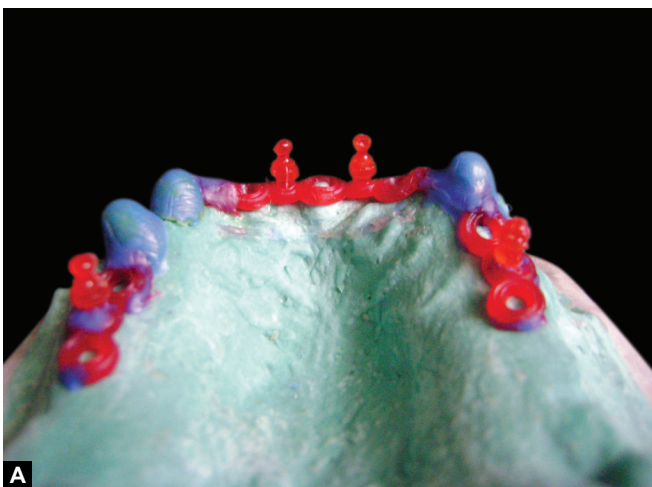
Special tray was fabricated on the previous cast using two wax spacer thickness for allowing the space to incorporate the studs. The final impression was made with medium body rubber base impression material. Care was taken to block the undercuts below the bar with soft wax at the time of impression making. Brass lab analogs which were supplied along with the O-ring system were placed in the impression and the cast was poured. On the casts, metal housings with the silicone O-ring were placed on the laboratory analog. Necessary block out was done and temporary record base and occlusal rims were fabricated. Jaw relations were recorded using standard techniques. A satisfactory trial of the dentures was done. Now, before during the laboratory processing, after the dewaxing step, the metal housing with the silicone

O-ring were retrieved from the temporary denture base and placed back on to the laboratory analogs on the master cast.

Then the heat polymerized acrylic resin was packed and polymerized. Relief was provided in the abutment area in the intaglio surface of the dentures as to reduce the forces transmitted to the abutment teeth and thereby giving a freedom of movement for the O-ring attachment (Fig. 7). The palatal portion of the denture was cut since the denture had good support and retention and it also enhanced the gustatory function as well (Figs 8 and 9). The patient was instructed regarding removal and insertion, hygiene routine and maintenance regimen. The follow-up evaluation was done once in 3 months for 1 year, and postoperative radiographs made (Fig. 10). The outcome of the treatment was positive.

DISCUSSION

The use of teeth as overdenture abutments is beneficial to patients. Tooth-retained overdenture technique helps reduce the impact of some of complete denture wearing consequences: residual ridge resorption, loss of occlusal stability, undermined esthetic appearance and compromised



Figs 5A and B: Wax pattern copings for the abutment teeth with duplicated lab analog attached



Figs 6A and B: Metal framework showing male studs attached to the copings and cemented on abutment

masticatory function.¹³ The psychological aspect of patients losing teeth should not be underestimated and this has been well documented.¹⁴ Careful selection of strategic abutment is important to provide optimal stabilization and retention to the prosthesis to avoid the rotation of the denture base around the theoretical fulcrum line determined by the most distal rests.¹⁵ If these factors are not achieved then this rotation can negatively affect patient comfort and mastication.

In the present report, a bar and O-ring retained maxillary denture was fabricated. A bar attachment was used to stabilize and strengthen the abutment teeth by providing a splinting mechanism and dissipate the occlusal forces evenly to the underlying abutment teeth and residual ridge. The metal bar had adequate flexural and torsion strength to prevent the lateral force transmission to the abutment teeth and also provided cross arch stabilization. The placement of 4 O-ring studs on the metal bar provided additional anterior and posterior retention and provided benefits of improved biomechanics and esthetics in a partially edentulous patient presenting with only 2 canines and one remaining premolar in the maxilla. This placement of metal studs provided partial

overload relief on abutment teeth, which could improve the periodontal health and long-term prognosis of the treatment.

The use of a conventional rehabilitation with a partial removable denture in this patient would represent an adverse mechanical situation due to high lever force on the abutment teeth, mainly due to the presence of an unsatisfactory metal clasp on the abutment teeth. Therefore, the metal studs placed at the regions of the left first premolar and right first molar provide relief of lever effect on the abutment teeth by the reduction of the free-end condition.

The attachment system must provide appropriate retention, satisfactory durability and easy maintenance. Also, the height of the attachment system is an important factor to be considered during treatment planning. It should be as short as possible to minimize the oblique forces which may cause failure of the attachment system.¹⁶ In this case, O-ring attachment system was used due to its lower height and the resilience provided by the rubber retainer. The main advantage of O-ring is that it provides superior retention and easy insertion/removal and patient comfort, it is recommended to exchange the rubber retainers every



Fig. 7: Maxillary overdenture with O-rings



Fig. 9: Denture in occlusion



Fig. 8: Palateless maxillary denture

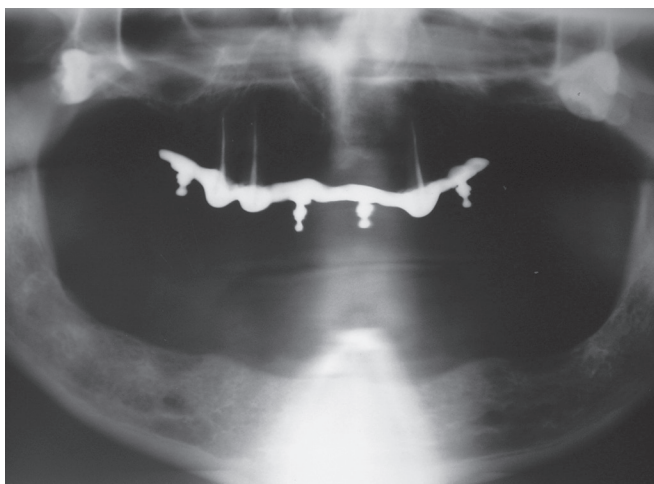


Fig. 10: Postoperative radiograph

6 months or when the patient perceives the lack of retention.¹⁷ The useful life of the retainers may be prolonged if the direction of insertion of prosthesis remains unique, with all the attachment retainers parallel to each other and in the same insertion direction as the metal framework.¹⁶ The use of resilient attachments on metal studs, allows little vertical and horizontal movement which facilitates the dissipation of occlusal force to the abutment teeth.¹⁸

The advantages of technique used in this case include preservation of alveolar bone, prevention of overload on the abutment teeth, improvement of proprioception, and removal of visible metal clasps. The advantages of overdenture rehabilitation include lower cost, maintenance of labial support, simplified oral hygiene, psychological advantages for patients who do not want to see themselves as totally edentulous, the future option to easily convert to fixed implant-supported complete dentures or overdentures, and relatively simple clinical and laboratory procedures.¹⁹

The tooth supported overdenture has been shown to be a reasonable treatment with satisfactory esthetics and re-establishment of physiologic function in a more economical and less invasive manner, suggesting that in certain cases the temptation to use fixed implant-supported restorations may result in overtreatment. That is, the surgical procedures to which the patient will be submitted will not necessarily result in greater patient satisfaction, in terms of cost/benefit, than the tooth supported overdenture rehabilitation. However, there are some disadvantages such as the gradual loss of retention due to the wear of O-rings and need for periodic replacements. A study was conducted by Rodrigues et al¹⁸ to evaluate the retention force of an O-ring attachment system in different stud inclination to the ideal path of insertion; they concluded that O-ring stud perpendicular to the occlusal plane was adequately retentive over the 1st year and that the retentive capacity of O-ring was affected by nonparallel studs. Further, adequate oral hygiene and maintenance recall protocol are mandatory for the long-term success of the above treatment.²⁰

CONCLUSION

The lack of retention in complete dentures is a common complaint. With the inception of the osseointegrated implants, the concept of overdenture has become popular but not all the patients can afford it. Tooth borne overdenture may be advised whenever few good teeth are remaining in the jaw. This technique presented here increases the cost effectiveness besides increasing the retention and support for the tooth borne overdenture. Additional clinical data are needed to verify the clinical predictability of this treatment for specific situations.

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