

AN ECONOMICAL TECHNIQUE TO FABRICATE A TOOTH SUPPORTED STUD ATTACHMENT BY DUPLICATING IMPLANT BALL ATTACHMENT: A CLINICAL REPORT

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Abstract

Although overdenture is an age-old concept it has retained its popularity as a viable treatment option due its superior performance, while still being focused on a preventive approach. Preserving teeth on either side of the arch or placing bilateral implants will help enhance the retention and stability of a denture. Various attachments have been used over the preserved tooth or implant to aid in retention and stability. One of the most widely used attachments today is the stud attachment, but due to its cost patients, often do not opt for it. Therefore, this case report introduces a novel and alternative technique to fabricate the stud attachment without compromising its properties.

Introduction

A completely edentulous patient goes through a series of events following loss of teeth, like, loss of function, esthetic, social and psychological damage to the individual's life, which may have an enormous impact on self-esteem and health of the patient¹⁻². Preservation of tooth or roots can be an effective way to not only reduce bone loss, but to also improve prosthetic outcome³⁻⁵.

An overdenture, which is a removable complete or

partial denture resting on one or more remaining natural teeth, root or/and implant, not only delays the process of resorption but also preserves the bone around retained roots and helps to improve the masticatory efficiency.⁶

One of the reasons for the continued popularity of tooth supported overdenture is the preservation of proprioception which is provided by the periodontal ligament of the tooth. The other advantage of choosing an overdenture over a conventional complete denture is, an increase in stability as well as retention⁷.

To enhance the retention and stability of the overdenture, various attachment systems can also be used. An attachment is defined as "a mechanical device for the fixation, retention, and stabilization of a prosthesis, a retainer consisting of a metal receptacle and a closely fitting part; the former (the female matrix component) is usually contained within the normal or expanded contours of the crown of the abutment tooth and the latter (the male matrix component), is attached to a pontic or the denture framework"⁶. The various attachment systems available to connect the implants to the overdenture are: Stud attachment, Magnet attachments, Bar attachments, Telescopic attachment, etc., stud and bar attachment being the most widely used ones. The key advantages of stud attachments are the feasibility of its use in V-shaped

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arches where a straight connection between the tooth/implants cannot be established.⁸⁻⁹

An O-ring is an elastomeric retentive stud attachment, shaped like the inner surface of a tire and generally made up of silicone and nylon. To aid in their longevity they have metal housings that are incorporated within the denture base resin either chair side or in the laboratory. The O-ring assembly consists of ball head that is attached to a post, with an undercut area or a retentive groove. This assembly is usually fabricated from precious or semi-precious alloys¹⁰. Some of the advantages of an O-ring are - good retention, ease of use, ease of maintenance, simplicity in design, and ease of replacement¹¹. Therefore, the aim of this report was to fabricate an O-ring stud attachment using implant prosthetic component.

Case Report

A, 47-year-old male patient reported to our department with a chief complaint of ill-fitting maxillary dentures.

On examination, patient had existing maxillary overdenture supported by copings on 13 and 23 [Fig.1].

Radiograph was advised to evaluate the condition of the existing abutments. Since interarch space was adequate and to enhance the stability of the prosthesis, stud attachments were planned with respect to 13 and 23.

Informed consent was obtained from the patient.

The post space was modified [Fig. 2], and an indirect method was used for making the impression of the post space using light body polyvinyl siloxane impression material (Aquasil™ UltraLV, Dentsply, Caulk).

A pick-up impression was made using a custom tray and a rubber-based impression material [Fig.3] (Aquasil™ Ultra Monophase. DECA, Regular Set-Dentsply, Germany).

The impression was poured using Type IV Dental Stone (Kalrock, Kalabhai Karson Pvt. Ltd., Mumbai, India).

Border moulding and secondary impression of the lower arch were carried out using the conventional technique

Technique for Duplication of Attachment

1. In order to replicate the ball component of the stud attachment a standard ball abutment mounted on a failed implant [Fig 4] was used.
2. To create a mold, Type IV dental stone (Kalrock: Kalabhai Karson Pvt., Ltd and Pearlstone: Asian Chemicals) was poured into a silicone jar and the implant was placed in the center of the jar [Fig. 5]
3. Once set, the stone is removed for the silicone jar and index notches were made [Fig. 6]
4. Impressions of the stud was made with putty consistency polyvinyl siloxane impression material (Aquasil™ soft putty, Dentsply, DeTrey) with light body polyvinyl siloxane impression material (Aquasil™ UltraLV, Dentsply, caulk) syringed onto the stud.
5. The entire assembly was boxed, petroleum jelly was applied and a counter was poured to stabilize the putty-light body, thereby creating a mold space when removed.
6. Auto polymerizing resin was mixed according to manufactures instruction (DPI RR Cold Cure™; Dental Products of India Ltd.), poured into the mold and allowed to set for 20 minutes. [Fig.7]
7. After which the acrylic studs were retrieved and the O-ring was placed to check the fit [Fig.8].
8. The acrylic studs were sectioned at the neck level [Fig. 9] and incorporated into the wax pattern [Fig.10] (Schuler inlay wax blue; Schuler-Dental GmbH, Ulm, Germany).
9. This assembly was then casted using cobalt

chromium alloy (Wironium Extra-Hard Co-Cr alloy; BEGO, Bremen, Germany).

10. The casting was retrieved. Finishing and polishing was carried out using tungsten carbide burs (Gebr Brasseler GmbH, Lemgo, Germany) and rubber polishers (green and brown polishers for Co-Cr alloys; Dentaureum, Ispringen, Germany) [Fig.11].

Clinical Procedure

After the stud attachment was fabricated, they were luted onto the abutment teeth using resin cement (RelyX U200/3M ESPE-U200; Maxcem Elite/Kerr-MAX; Clearfil SA Cement/Kuraray-CSA).

A primary impression of the lower arch was made with alginate and a special tray was fabricated on

the primary cast after block out. Record rims were made and the jaw relation was recorded. Teeth arrangement was done and after a satisfactory try-in, the denture was processed using heat cure acrylic resin. After finishing and polishing of the denture, vent holes were created in the maxillary denture to create space for the O-ring. The O-ring were picked up using auto-polymerizing resin [Fig. 15] while maintaining upper and lower dentures in occlusion. Excess acrylic from the vent holes was trimmed and the denture was finished and polished and insertion was carried out [Fig.16]. Periodic follow-up was carried out

Discussion

It is well acknowledged fact that retaining natural teeth, even with doubtful prognosis, or roots can



Figure 1. Pre-treatment intra oral photograph



Figure 2. Preparation of post space



Figure 3. Pick-up impression



Figure 4. Standard ball abutment mounted on a failed implant



Figure 5. Implant placed in Type IV Dental stone

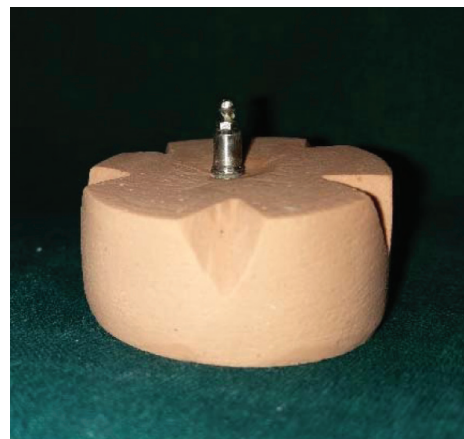


Figure 6. Index notches made for reorientation

reduce the rate of bone resorption¹². Teeth showing mobility can be retained and used as abutments for overdentures. Preparation of abutment for overdentures has the most dramatic effect on the crown root ratio (CRR). It can alter the CRR from 1:1 to 1:2 or in some cases 1:3. Decreasing the crown height shortens the length of the lever arm, subsequently, exerting less lateral force onto the attachments.

Which results in reduction of the horizontal mobility shown by the abutment¹³. Various studies have concluded that Abutment mobility can be associated with periodontal health, as well as to the improved biomechanical CRR. When the teeth are preserved, the proprioception through the periodontal ligament is also preserved, this

provides the patient with better occlusal awareness, good neuromuscular control and biting force¹⁴.

The physiologic advantages of overdentures are:

1. An increased stability of the prosthesis, which reduces trauma to the supporting soft tissues of the basal seat.
2. The maintenance of periodontal proprioception, giving the patient an increased awareness about food bolus and chewing patterns.
3. The preservation of the alveolar process adjacent to the teeth retained under the prosthesis, thereby reducing the rate of resorption of the basal bone used for denture support.

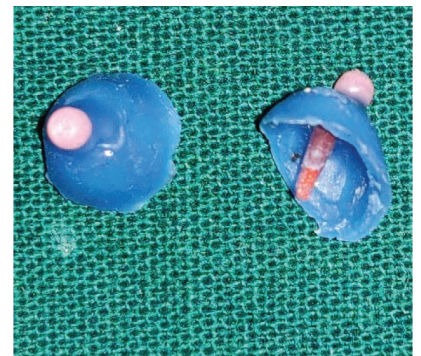


Figure 7. Stud assembly duplicated with auto polymerizing resin using putty and light body impression

Figure 8. O-Ring placed on a acrylic stud to verify the fit

Figure 9. Acrylic stud Figure 10. Wax pattern of the sectioned at neck level stud attachment



Figure 11. Finished stud attachment



Figure 12 & 13. A surveyor used to ensure parallelism between the studs.



Figure 14.

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The other advantage of Overdenture is that can easily converted to complete denture, in the event of abutment failure, since they follow the principle of complete denture construction¹².

Rooney and Crum¹⁵ in their study with a 5 year follow up established, through cephalometric radiographs, an average loss of 0.6 mm of bone height in the anterior part of the mandible in overdenture patients when compared to a loss of 5.2 mm in complete denture patients.

Literatures states that the strategically selected teeth in tactical positions can significantly enhance the stability and retention of the overdenture prosthesis^{16,17}. Canines are most often retained, due to their position at the corner of the dental arch and also due to the shape, size and length of their root⁷. Their relatively large root surface provides greater periodontal and epithelial attachment, making them the most important proprioceptive organ in the oral cavity¹⁸. When the canines are absent or lost, first premolars are used as alternative because they are single rooted and because of their favorable position in the dental arch¹⁹.

Foremost reports of the use of attachments for overdentures date back to the beginning of this century^{20,21}. Integrating attachment retained

overdentures into present dental practice will open up a new dimension in everyday dental treatment and enhance patient satisfaction¹³. Teeth, that are planned for extraction because of their questionable prognosis, can be considered as long-term or short-term alternatives to implant or total edentulousness. For the success of an overdenture, patient selection is crucial. The attitude of the patient towards the treatment should be evaluated and only those who can comprehend, both, the benefits and the limitations of attachments ought to be treated with attachment retained overdentures¹⁷. The other significant prerequisite for the success of overdentures is patient's awareness of oral hygiene and maintenance which includes exceptional oral care at home with professional aid in order to prevent failures^{22,23}.

It is impossible to overemphasize the necessity for simple attachments for overdenture fixation. Snap fasteners or stud-type attachments, are simple in idea and use. Some stud attachments are resilient and have a spring return (Gerber). Others are tissue resilient (Dalbo); the few others are non-resilient (Introfix). Resilient attachments can either be unidirectional or multidirectional. Resilient attachments have a compensating mechanism where they allow the tissues to



Figure 15. Clinical pick up of O-ring using auto-polymerizing resin



Figure 16. Insertion of finished prosthesis

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support the denture base, rather than the tooth; this feature act as a safety regulator in the event of an overload²⁴. Therefore, In the present report a ball type of resilient stud attachment system was used. A resilient attachment was chosen in-order to enhance the retention, as the patient initially reported to us with a complain of ill-fitting denture and an O-ring does not transfer load onto the tooth/root, rather it acts as a retentive device. The O-ring system is thought to be the best attachment as it acts passively on the abutment teeth²⁵. They provide satisfactory retention, are easy to use in terms of insertion and removal and comfortable for the patient¹⁷. To evaluate the retention of an O-ring attachment system at different degrees of inclinations, Rodrigues et al²⁶ conducted a study. According to them O-ring stud placed perpendicular to the occlusal plane demonstrated satisfactory retention during the course of first year; they also found that the retentive capacity of the O-ring was affected by inclination of the stud, O-ring stud perpendicular to the occlusal plane were show to have highest retention. Hence, in-order to achieve parallelism between the studs a surveyor was used, in the present report, to position the studs without any inclinations [Fig.12 & 13].

According to literature, impaired dental status causes dietary restrictions due to difficulty of inability to chew, thus resulting in diminished nutritional status²⁷⁻²⁹. Of those who are over 65 years of age, 60% are totally edentulous, and on the average, they experience a 70% loss in chewing efficiency when compared to patients with natural teeth. This reduction in chewing ability has a significant effect on the dietary preferences of these patients and it has been reported that patients over the age of 70 have a consistently inadequate nutritional intake³⁰. Rissin and co-workers, in their study compared the masticatory efficiency in patients with natural dentition, complete denture and over denture. They concluded that patients wearing overdenture had a chewing efficiency one-third greater than the complete denture patients³¹.

Although overdenture has numerous advantages, some of their disadvantages are that the prosthesis tends to be bulky and over contoured. Patient selection is very important as maintenance of oral hygiene is of utmost importance in order to prevent caries, periodontal disease, and failure of abutment teeth. The other drawbacks are that, they cannot be used in patients with bony undercuts. Overdenture tends to encroach on the inter-occlusal space¹² which can cause reduction in freeway space if not planned properly. This treatment modality will require frequent recall check-ups and relining procedure as resorption in the posterior part of the arch will continue.

Conclusion

With time, lack of retention can be a common grievance in complete denture patients. Although in recent years implant supported overdentures have gained popularity, they may not be affordable to all patients. In such case, tooth borne overdenture can be advised. Incorporation of attachments in overdentures elevates modest overdenture to another level by adding mechanical retentive properties. The O-ring is one such stud attachment. Various materials such as waxes, resins, acrylic can be used for casting. Our technique offers a simple and alternative technique, to the current method, for the fabrication of stud attachment.

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