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Implant Supported Metal Reinforced Overdenture with Ball Attachments: A Case Report

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Prosthetic management of mandibular edentulous arch has always been a challenge. Implant-supported overdentures have been a common treatment modality for edentulous patients and have shown good clinical results. Implant supported overdentures offer many advantages over conventional complete dentures. These include decreased bone resorption, reduced prosthesis movement, better esthetics, improved tooth position, better occlusion, increased occlusal function and maintenance of the occlusal vertical dimension. The present article illustrates design and fabrication technique of the implant-retained mandibular overdenture using ball attacments.

Keywords: Implant retained overdenture; ball attachment.

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1. INTRODUCTION

"Implant-supported overdenture is a treatment modality that is commonly used, cost effective, and possible treatment for the edentulous mandible to increase patient satisfaction" [1]. "Mandibular implant-supported overdenture is often indicated when there are problems found with mandibular dentures, such as lack of retention or stability, decrease in function, difficulty in speech, tissue sensitivity, and soft tissue abrasion" [2]. "However, acrylic resin denture base fracture can be a problem encountered with implant supported prosthesis. Occlusal disharmony, excessive occlusal forces, flexure and fatigue of the denture base as a result of alveolar resorption, thin spots in denture base, and impact as a result of dropping the denture can be the possible causes of fracture of denture" [3]. "Metal reinforcement of the mandibular implant-supported overdenture has been suggested as a method that can increase resistance to fracture and improve the denture's dimensional stability. Many patients are satisfied with a stable implant-supported overdenture that requires limited clinical time and financial expense" [4].

"The attachments used to retain implant overdenture include stud, bar, magnets, and telescopic attachments" [5]. "The selection of the attachments for an implant retained overdenture depend on cost effectiveness, retention required, oral hygiene, amount of bone available, patient's economic status, patient's expectation, maxillomandibular relationship, inter-implant distance and status of the opposing jaw" [6].

The present article reports prosthodontic rehabilitation of edentulous mandibular arch with implant supported metal reinforced overdenture.

2. CASE REPORT

A male patient aged 60 years reported to department of Prosthodontics with chief complaint of broken mandibular denture. On intraoral examination, it was found that maxillary and mandibular arch were completely edentulous (Fig. 1) and a decision to place two implants in interforaminal region in mandibular arch was made. Under antibiotic prophylaxis and standard aseptic protocol, two adin implants (3.75 x 10 mm) were placed. Post-operatively after 3 months, osseointegration was evaluated clinically and radiographically, second stage surgery was performed in which cover screws were removed and healing abutment were inserted into the implants. After a time period of two weeks, peri-implant soft tissue healing was examined, the healing abutments were removed and selected ball abutment were placed onto each implant (Fig. 2). The following procedure was carried out for fabrication of implant supported overdenture:

1. Maxillary arch primary impression was made with impression compound and mandibular arch primary impression was made with alginate (Fig. 3). Casts were poured in dental plaster. Custom trays were fabricated with self cure acrylic resin (DPI, India). Border moulding was done with green stick compound followed by wash impression with zinc oxide eugenol impression paste (DPI, India)for maxillary arch and light body polyvinylsiloxane material (Coltene Affinis) for mandibular arch (Fig. 4). After beading and boxing of the impressions, definitive casts were poured with dental stone (Fig. 5).
2. Fabrication of the metal denture base was done prior to jaw relations. It included relieving the master cast using a wax spacer followed by duplicating the cast using agar, pouring and preparation of the refractory cast. After that die hardener was applied all over the refractory cast. Meshwork pattern wax was used for the design of the metal framework which was then sealed to the refractory cast. Sprues were attached, ring liner and casting ring was placed and then invested. The metal framework was then finished and polished (Fig. 6).
3. Customized record base and occlusal rim was then fabricated over the metal framework. Facebow record and jaw relation of the patient was made. Casts were articulated onto semi-adjustable articulator followed by teeth arrangement. Evaluation of esthetics and phonetics was done, and the patient's acceptance was obtained at the try in appointment (Fig. 7).
4. On the day of denture placement an index was made using alginate for ball attachment locations on the intaglio surface of mandibular denture, and a recess was created in the intaglio surface of denture to receive female housings. A rubber dam was cut and placed around the ball attachment on the tissue to prevent tissue injury during acrylic polymerization.

5. Female housings were incorporated over male ball attachments, which were held parallel to each other in the parallel path of the axis. The self-cure acrylic resin was mixed and injected into the hollow space created on the tissue surface for mandibular denture. Both dentures were positioned inside the patient's mouth, and the patient was asked to bite in centric occlusion. The material was allowed to set for some time and was removed from the mouth. Excess materials were trimmed and finished before being reoriented in the same position intraorally (Figs. 8 and 9). Patient was highly satisfied with the final prosthesis.
6. A follow up of 3 months was given to the patient. On radiographic examination the marginal bone loss was foundto be minimal.

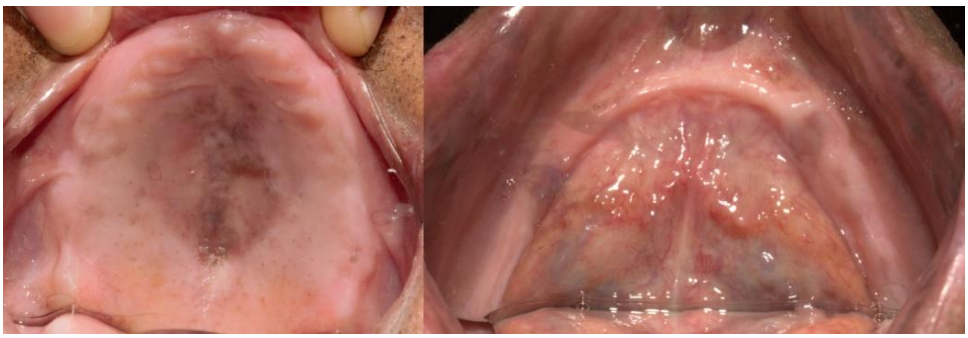

Fig. 1. Intraoral view of maxillary and mandibular arch

Fig. 2. Intraoral and radiogrpaphic view of mandibular arch after implant placement

Fig. 3. Primary Impression of Maxillary and mandibular arch

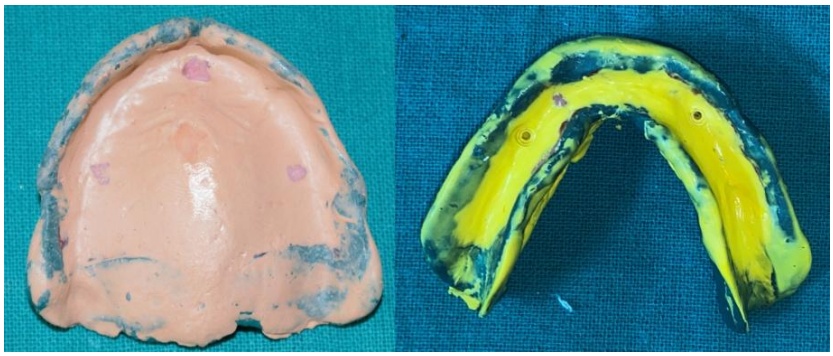

Fig. 4. Final Impression of Maxillary and mandibular arch

Fig. 5. Master cast of Maxillary and mandibular arch

Fig. 6. Refractory cast with wax pattern and sprue attachmentand finished metal framework

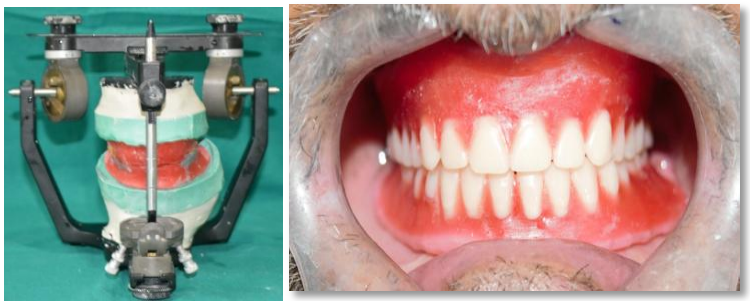

Fig. 7. Jaw relation mounted on facebow and Denture trial

Fig. 8. Intaglio surface of denture after pick up of female attachments and insertion of denture

Fig. 9. Pre and Post operative view

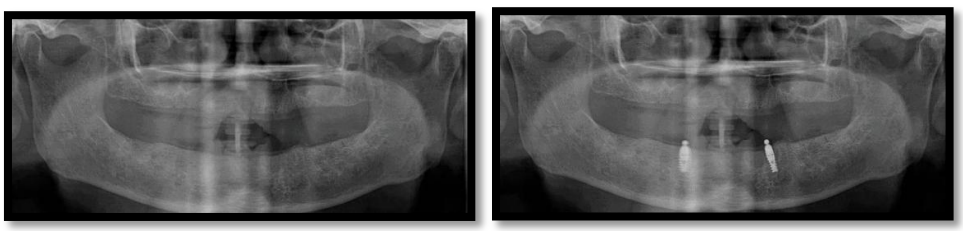

Fig. 10. Pre and Post operative OPG

3. DISCUSSION

"The complete denture patients frequently report problems with oral function, typically caused by retention and stability problems of the mandibular prosthesis. An alternative to the conventional denture would be implant supported fixed bridges, hybrid prosthetic dentures and removable overdenture prosthesis. In the present case report implant supported overdenture was planned as it not only enhances overall satisfaction and nutritional status, but also eases the fabrication and cost effectiveness over conventional removable prosthesis. The implant-supported overdenture allows the tongue and perioral musculature to resume a more normal function as they remain in place during mandibular movements" [7].

In the present case, ball attachments were used owing to sufficient space availability of 10 mm. Also the implants were parallel to each other. This is in accordance with the documented literature which states that the minimum space required for ball attachments is 10-12 mm. "Attempts to fabricate prostheses with inadequate restorative space can result in physiologically inappropriate contours, structurally weak prostheses, compromised esthetics, encroachment into interocclusal rest space, and/or compromised retention and stability of the treated result" [8,9]. Moreover ball attachments are less costly, less technique sensitive and easier to clean than bars. Tokuhisa et al. [10] stated that "the use of the ball/O-ring attachment could be advantageous for implant-supported overdenture with regard to optimizing stress and minimizing denture

movements". "A photoelastic analysis done by Kenney and Richards indicated that less stress was transferred with the ball/O-ring attachment to the implants. It appears that the O-ring provide retention against dislodging forces toward occlusal surface, allowing the overdenture to rotate around the ball connected to the implant body. As rotation occurs, stress is transferred to the posterior edentulous area providing optimal broad stress distribution to the ridge and minimal stress to the implants" [11].

"Ball attachment can be a simple attachment that is washed with horizontal brushing movements that are easy to abutment . This is advantageous in comparison to use of cylinder locator attachments which are not easy to wash. Cleaning using a palatal, buccal, mesial and distal toothbrush, including areas close to the gingival margin, could be of concern for the patient to rotate the toothbrush section in such a way that the wall around the buffer is washed. Also, a research by Carine states that retention for ball support is better at each implant position proportionally to the locator support" [12].

"Retentive element and the denture connection can be achieved by two methods i.e. indirect or direct method. The indirect technique includes recording of denture's soft tissue support and implant position in relation to the denture, so that the connection of the matrix and the relining procedure can be completed in the laboratory. This method reduces chair time. Recording and transfer of implant positions with analogues may include errors. The direct technique includes locating a ball attachment intraorally. This technique was used in the article as this technique is simple, economic, quick, and allows the patient to retain the prosthesis" [12].

"The technique presented describes the reinforcement of the denture base with a metal framework and also the inclusion of the metal housing in the framework design to prevent fractures that could occur at the sites close to the implant abutments. Metal bases and frameworks when incorporated into complete denture bases especially mandibular denture improve fracture resistance, dimensional stability, accuracy, weight, and retention" [13].

4. CONCLUSION

Prosthetic rehabilitation of edentulous mandible with implant supported overdenture is one of the most beneficial treatment option that can be rendered to the patient. Despite being widely accepted as treatment, some controversies still exist with regard to the design of the overdenture, selection of the appropriate attachment system, and the optimal techniques for the overdenture fabrication. Clinicians and dental technicians have to adhere to sound design principles such as simplicity in fabrication, ease of maintenance, repair and cost control.

CONSENT

As per international standard or university standard, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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