

**Clinical experience with implant retained overdenture treatment option having ball attachments -A 8 years follow up**

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**Abstract**

**Aim:** The aim of this study was to evaluate the clinical success rate and long-term prognosis of overdentures retained by 2 implants in the mandible using 2 single ball attachment systems.

**Material and Methods:** A prospective 8 years longitudinal study was carried out for evaluating clinical and radiographic findings in a series of 15 patients ( 8 male and 7 female) who had received a total of 30 implants. The success and failure cases were evaluated and studied. The data was analyzed using descriptive statistics

**Results:** All the implants except one fulfilled Albrektsson et al criteria for success. The mean marginal bone loss recorded over 8 years shows, with decrease in marginal bone levels up to 8 years. The maximum bone loss recorded was 4.2 mm. The most frequent prosthetic complication was O ring replacement because of loss of retentiveness.

**Conclusions:** The study reaffirmed the fact that implant overdenture is a successful treatment option in edentulous patients

**Keywords:** Implant overdenture, marginal bone loss, ball attachment

**Introduction**

The average incidence of edentulism around the world is 20% of the adult population by age 65 years<sup>1</sup>. Complete edentulism is functionally and emotionally disruptive to the patient<sup>2</sup>. The majority of completely edentulous patients are treated with complete dentures. The dentists and the public are more aware of the problems allied with a complete mandibular denture than any other dental prosthesis. The mean decrease in anterior mandibular ridge height is 4 times greater than that of maxilla<sup>3</sup> leading to decreased foundation area for mandibular denture. Treatment modalities for the restoration of the edentulous mandible include: a mandibular complete denture, pre-prosthetic surgery with a mandibular complete denture,

implant retained (RP-4) and or supported (RP-5) mandibular overdenture and implant supported fixed prosthesis (FP-1, 2, 3). Pre-prosthetic surgery, including vestibuloplasty and ridge augmentation has been advised in certain circumstances. However, there are mixed long term success rate associated with this treatment modality<sup>6</sup>. The placement of implants enhances the support, retention, and stability of an overdenture. As a result, edentulous patients are very keen to accept a treatment plan for a mandibular implant overdenture (MIOD).<sup>1, 3</sup>The choice of prosthetic design and material in completely edentulous patients depends on the amount of interarch space available in a particular arch<sup>12</sup>. With interarch space of more than 18 mm, the most preferred restorative option is implant overdenture because of the unfavourable biomechanics of fixed prosthesis in this case.<sup>12</sup>

An overdenture is defined as “a removable partial or complete denture that covers and rests on one or more remaining natural teeth, roots, and/or dental implants.”<sup>13</sup> Implant retained overdenture provides many advantages over conventional complete dentures. These include decreased bone resorption, reduced or eliminated prosthesis movement, better aesthetics, improved tooth position, better occlusion, increased masticatory efficiency and maintenance of occlusal vertical dimension, thereby providing psychological and functional benefit to the patient. MIOD uses different precision attachment with varying prosthesis movement (PM). The motion may occur in zero (rigid) to six directions or planes: occlusal, gingival, facial, lingual, mesial, and distal<sup>18</sup>. The aim of this study was to evaluate the clinical success rate and long-term prognosis of implant overdentures (RP-5 prosthesis) retained by two implants anterior to the mental foramina and soft tissue support in the posterior regions which is OD 1 treatment option according to Misch<sup>1</sup>. Ball abutments were used in all the patients with independent

O rings (PM-6). Clinical and radiographic findings were observed during the 8 year interval.

### Materials and Methods

Research protocol of the study was approved by the ethical committee held at Govt. College of Dentistry. A total 15 patients who fulfilled the inclusion criteria were included in this study. Inclusion criteria were: Patients (1) between the age of 60 and 80 (mean age of 65 years), (2) compliant with oral health-care instructions, (3) sufficient bone to accommodate the placement of two implants and (4) keratinized tissue present around the proposed implant site (5) Patients having interarch space of more than 15 mm.

Exclusion criteria were: (1) a history of alcohol abuse, smoking, bruxism, irradiation or chemotherapy, (2) poor health, or any other medical, physical, or psychological factor that might affect the surgical procedure or the subsequent Prosthodontic treatment and required follow-up examinations; and (3) the inability to achieve primary implant stability following implant placement.

All patients signed a written informed consent form before the surgery and were informed that their clinical data would be used for the present study. Panoramic radiographs were taken preoperatively to determine availability of bone at the site for implant placement and postoperatively to determine the bone level in relation to the implants placed in all patients using a constant calibration and magnification of 25%.

### Treatment protocol

Two stage surgery was planned for all the patients. Stage I surgery, patients received 675 mg of amoxicillin/clavulanic acid (1 B.D) 1 day before the surgery and 3 days post surgery. Under local anaesthesia, a crestal incision was made leaving the median tissue bridge intact. This served to reduce the risk of dehiscence and provided a reference point of the patient's midline. With

the aid of a surgical stent, two interforaminal sites were prepared using a 2-mm diameter pilot drill. Direction and depth were checked with parallel gauges. Following the sequence of instrumentation prescribed by the ADIN implant system, two implants ranging between 3.3- 4.2mm in diameter and 10-16 mm in length were placed sub-crestal and coverscrews were placed. The surgical site was sutured. An Orthopantomograph (OPG) was taken after the implants placement in all the patients. Postoperative medication and instructions were given to allow uneventful healing. After 1 week, the patient's existing lower denture was relieved and relined with a tissue conditioner. 3 months later, a stage II surgery was performed to access the gingival platform of implant and placement of healing cap. Once the gingival collar is formed after 2 weeks, patients were recalled and ball abutments were placed over both the implants. The intaglio surface of the lower denture was relieved in the region of retentive anchors. The denture was tried in the patient's mouth to ensure a passive fit. The retentive ball caps with O ring were then "picked up" in the mouth using self cure acrylic.

An 8 year follow up was done for all patients. Following criteria was used for assessment of clinical success rate of implant retained overdentures.

**Implant Survival-** Albrektsson et al criteria for success and failure

**Success Criteria Report:** (1) an individual, unattached implant is immobile when tested clinically, (2) a radiograph does not demonstrate any evidence of periimplant radiolucencies, (3) vertical bone loss is less than 0.2mm annually after an implant's first year of service, and(4) individual implant performance is characterized by an absence of signs and symptoms such as pain, infections, neuropathies, paraesthesia, or violation of the mandibular canal <sup>16</sup>

**Marginal Bone Loss:** Standardized radiographs of the implants were taken. The mean marginal bone loss was measured on the radiographs at the mesial and distal sides of the implants. The implant abutment connection line served as the reference point. At sites where two different bone levels could be seen, the most apical level was used in the measurement. Mean marginal bone loss for each patient was recorded at an interval of 2, 5 and 8 years.

**Periodontal status evaluation:** Marginal probing was performed by the observer and judged for any signs of bleeding on probing, plaque and calculus index was evaluated and probing depth was calculated with the help of Marquis colour coded probe.<sup>14</sup>

**Evaluation of the Prostheses:** All prosthetic complications during 8 year were recorded and definitive measures were taken to optimize the function with implant overdenture

**Subjective evaluation :** The patients' own appreciation of the overdenture therapy was evaluated in a five-point questionnaire<sup>5</sup>: How do you find your overdenture on the whole? How does it stay in place? How does it function when chewing? How does it function when talking? How does it look? The possible answers were good, rather good, rather bad, and bad.

**Implant performance:** The categories in the clinical implant scale (the CIP scale) by Delphi were used to ensure implant overdenture treatment success.<sup>15</sup>

Category	Scores
-No complication or need for treatment.	0
-Minor complications that do not need intervention or are easily treated.	1
-Complication or treatment procedure with reasonable chance of recovery or stabilization of the situation.	2
-Serious complication or treatment procedure that may lead to failure of The implant system.	3
-Complete failure of the implant system.	4

**Ref-** . Marinus A. J. Construction of a Clinical Implant Performance Scale for Implant Systems with Overdentures with the Delphi Method Journal of Prosthetic Dentistry May 1997

## Results

The following results were obtained in the study

1. All the implants except one fulfilled Albrektsson et al criteria for success.
2. The mean marginal bone loss recorded over 8 years shows, with decrease in marginal bone levels up to 8 years. The maximum bone loss recorded was 4.2 mm.
3. Although plaque seems to accumulate more quickly under overdenture, results of an 8-year longitudinal study indicate that over the time little changes were found with regard to the peri-implant parameters. When proper recall and maintenance are provided for implant patients, favourable results are seen. It has been observed that a high level of compliance is found among patients with implants
4. The most frequent prosthetic complication was O ring replacement because of loss of retentiveness.
5. The patients satisfaction scores were very high with implant overdenture
6. In Clinical implant scale – Delphi: Score 3 was assigned to one patient whose implant was not in correct position, all the other patients had a mean score of 1

## Discussion

The present prospective study was conducted to determine the clinical success rate and long term prognosis of implant overdenture retained with 2 single ball attachments. Implant overdentures borrow several principles from tooth supported overdentures<sup>1</sup>. It is like placing the abutment in desired position. Though the use of conventional complete denture has long offered benefit to edentulous patients by improvement in function and

aesthetics but for many patients, wearing mandibular complete denture can be challenging. Problems with adaptation to complete dentures are observed with a higher incidence for mandibular dentures than for maxillary dentures. The mandibular overdenture retained by implants in the interforaminal region maintains bone in the anterior mandible, improves masticatory performance, reduces size of prosthesis (flanges), improves or regain oral proprioception and increases retention and stability of the prosthesis. The implant retained overdenture is known to be associated with greater posterior bone loss in the mandible; on the contrary there is gain in bone levels in posterior region when the prosthesis is completely implant supported even when the implants are not even placed in the posterior region<sup>19</sup>. The clinical experience of 15 patients demonstrated posterior bone loss, but its effects were not unfavourable for the prosthesis.

The implant which failed in the study was tilted buccally, it was removed and replaced with a new implant. Two independent implants should be positioned parallel to each other and at the same occlusal height. If one implant is higher than the other, the prosthesis will disengage from the lower implant during function and rotate primarily on the higher implant. Also the implants should be equal distance off the midline. If one implant is more distal (farther from the midline), it will serve as the primary rotation point or fulcrum when the patient occludes in the posterior segments, the medial implant attachment will wear faster, and the more distal implant will receive a greater occlusal load. When the patient bites in the anterior region, the anterior implant will act as the fulcrum, and the posterior attachment wears rapidly<sup>1</sup>

O ring replacement was the most frequent prosthetic complication; it can be minimized by using correct O-ring size, proper laboratory technique and preventing installation damage during final component assembly.

Amount of prosthesis movement (PM) is another important clinical issue. Overdenture which does not move is designated as PM-0, hinge motion is PM-2, apical and hinge motion is PM3, movement in four directions is PM-4 and PM-6 has multiple ranges of movement. Ball and socket design has multidirectional movements and therefore is in PM-6 group. Designs like 'O-rings' which resemble ball and socket joint has also PM-6 type movements, while Hader bar or Dolder bar has only limited hinge movement. There are studies in which no significant difference in the marginal bone loss and health of the periimplant tissue has been found between ball and socket and bar attachment<sup>20</sup>, which validates the contemporary practice of former over latter

One patient with opposing fixed prosthesis demonstrated greater marginal bone loss and required frequent prosthesis repairs; this can be attributed to heavy masticatory forces. The maximum bone loss in this patient was 4.8mm. Thus for a natural opposing arch RP-4 or FP-1, 2, 3 mandibular treatment option should be a preferable than RP-5. The bite forces are reduced when the patient is completely edentulous before treatment. The maxillary denture has some movement during function and acts as a stress reliever. The instability of the maxillary denture and mandibular OD-1 overdenture is shared. The support requirements of the posterior regions of the mandible are reduced when opposing a complete denture. Hence, the opposing arch should be a complete denture when OD-1 is the treatment option.

One patient demonstrated moderate inflammation after 2<sup>nd</sup> stage surgery. Investigation revealed incidental finding of Diabetes mellitus, the inflammation subsided after glycaemic control. Eventually then patient was successfully rehabilitated with the implant retained prosthesis.

Limitations such as severely resorbed jaws, unfavourable jaw relations, and financial restrictions sometimes prevent the placement of a sufficient number of implants to accommodate a fixed prosthesis. These patients are benefited with ball attachment overdenture treatment option.

From the evidence presented in this paper it can be summarized that the edentulous patient restored with an implant retained mandibular overdenture with 2 single ball attachments can provide patient satisfaction, improved masticatory efficiency, increased stability and retention with no significant bone loss. Because each clinical situation is unique, all the parameters described in this study need to be discussed carefully to establish results by prospective randomized studies with longer follow-up periods.

**Conclusion:** Within the limitations of the present study following conclusions can be drawn

1. Mandibular overdenture shows high success rate over the years, with minimal bone and soft tissue loss, when proper hygiene measures are performed
2. The patient satisfaction was high except in one case where the implant failed and the prosthesis was repeated
3. Whenever interarch space is less than 12 mm locator attachments should be used instead of ball attachment.
4. The presence of opposing natural dentition or fixed prosthesis results in higher forces so implant overdenture should be carefully used in such patients

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