Restoring Facial Aesthetics and Function with Implant Overdentures

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Abstract:

Since the discovery of Osseointegration and introduction of implants in the dental field, replacement of missing teeth has become a successful option and proved to be a therapeutic breakthrough for edentulous people. Implant supported overdentures are fast becoming the choice of treatment for edentulous patients as they provide various advantages over the conventional dentures; most importantly they are a reliable and simple solution to denture retention and stability problems. This article discusses aesthetics and function provided with implant borne Overdentures in Maxillary and Mandibular arches.

Introduction:

For centuries dentists have been trying to modify conventional dentures to solve the occurring problem of retention and stability, also masticatory function is quite poor in comparison with that of healthy dentate subjects[1]. Complete-denture wearers need up to 7 times more chewing strokes than subjects with a complete natural dentition to reduce the food to half of the original particle size[1]. But with implant supported Overdentures problems related to retention and stability were solved, patients feel more secure, their chewing ability improves and thus their nutrition. Besides in severely resorped Mandibular ridge implant supported overdenture remains the only choice.

Apart from difficulties in chewing, complete dentures present with various problems such as deficiency of denture-bearing tissues, reduced salivary flow, vulnerable tissue and severe ridge resorption. Also with increasing age patient's motor skills start to decrease[2]. Extensive detailing for proper fit is required and patient is always socially concerned about denture's slippage and unnatural appearance[3]. Implant supported Overdentures have many advantages over complete dentures such as improved function due to good retention and stability, 2-4 implants are used, improved esthetics, reduced ridge resorption and possible incorporation of existing denture into new prosthesis[3].

In principle implants must be vertically loaded[4]. Horizontal forces or horizontal components of the vertically directed forces should be avoided, as they lead to bending moment stresses and causative factor of bone resorption around implant[5]. The overdenure design can be mucosally supported, a combined mucosa-implant supported, or an implant supported, depending upon the number and location of the implants[6].

Mandibular Overdentures

There is a high success rate of Mandibular Overdentures, many authors have concluded over 97% success rate. Van Steenberghe et al reported 98% success rate, Mericske-Stern et al of 97%, Jemt et al and Naert et al of 100% success rate[7].

Mandibular anterior portion, between the mental foraminae, presents with maximum height of the alveolar ridge and maximum bone density, optimally required for implant support. When the prosthesis has poor anterior support and good posterior support, it rocks back and forth, applying torque on the abutments and increased stress on the overdenture components and bone implant interface. Therefore anterior forces should be restricted with the help of various attachments available. Depending upon this concept there are various variations in designs available for long-lasting prognosis of the treatment.

For overdentures anterior mandible (from first premolar to first premolar) is divided into 5 positions, mentioning as A, B, C, D & E. implants are placed in these positions depending upon the criteria available. Table 1 gives a tabular description of designs and their description. Overdenture should be designed resulting in RP-4 prosthesis. Retention and stability depends upon number of implants placed.

Table 1:

Option	Description	Removable Prosthesis Type 5
OD - 1	Implant in B and D position independent of each other.	• Ideal denture. • Ideal anterior and posterior ridge form. • Cost is a major factor. • Retention only PM 6. • Type of attachment o-ring.
OD - 2	Implants in the B and D position rigidly joined by a bar, without distal cantilever.	• Ideal posterior ridge form. • Ideal denture. • Cost is a major factor. • Retention and minor stability PM-3 to PM-6.
OD - 3A	Implants in A, C and E positions, rigidly joined by a bar if posterior ridge form is good.	• Ideal posterior ridge form. • Ideal denture. • Retention and moderate stability PM-2 to PM-6 (two-legged chair)
OD - 3B	Implants in B, C and D positions, joined by a rigid bar when posterior ridge form is poor.	• Division C-h anterior bone volume. • Poor posterior ridge form. • Retention and minor stability PM-3 to PM-6.
OD - 4	Implants in A, B, D and E positions rigidly joined by a bar cantilevered distally about 10 mm.	• Patient desire greater retention, major stability and support. • PM-2 to PM-6 (three-legged chair)
OD - 5	Implants in A, B, C, D and E positions rigidly joined by a bar cantilevered distally about 15 mm.	• Patient has high demands or desire. • Retention, stability and support PM-0 (four-legged chair).

Maxillary Overdentures

Maxillary and Mandibular designs vary because of the differences in anatomy, dependence of retention and dependence on palatal coverage. The degree of prosthetic retention and stability is based on attachment type, design, alignment and position[8]. According to Jaffin and Berman[9] Maxilla's bone quality should be evaluated, as less dense maxilla requires more no. of implants. Although 92% maxillary survival rate over a period of 15 years has been reported, but complications are notable, like speech and hygiene[10]. Maxillary implant Overdentures have also been documented with a high implant loss relative to other implant treatment modalities due to reduced bone quality/quantity, higher biomechanical forces, and anterior and inferior teeth arrangement on facially angled implants[11].

Usually there are no specific guidelines for number of implants required to support the overdenture but minimum of 4 implants in the anterior region are adviced[11,12]. Eckert and Carr[13] have advised use of 6 implants to ensure better support or incase of an implant failure. According to carl misch there are only 2 types of designs for maxillary Overdentures due to biomechanical disadvantages of maxilla[14].

1. **Option 1- Maxillary RP-5 Implant overdenture.**

The advantage of this type is the maintance of anterior bone and less expensive treatment option. In this at least 4-6 implants are placed splinted together out of which 3 are placed in the premaxilla. There is no distal cantilever, and the bar desing should follow the arch form but slightly lingual to the maxillary anterior teeth.

2. **Option 2- Maxillary RP-4 Implant overdenture.**

In this type of prosthesis 7-10 implants are used. Advantages include rigid fixation, maintains greater bone volume, provides improved security and confidence to the patient. Disadvantages are expensive treatment option, requires skilled Implantologist to perform the surgery.

Attachments in Overdentures

Several attachment systems are available, such as bars, clips, balls and o-ring attachments and magnets. All attachments are designed to prevent vertical movement of dentures and no literature states the use of one attachment system over the other but Magnets, so far are the most common type of attachment system providing PM-4.

There are various movements provided by these attachments, such as:

Vertical Movement: The prosthesis is allowed to move toward the tissue. This movement allows even loading and support from the entire anterior-posterior length of the residual ridge. The movement is stopped by the supporting structure.

Hinge Movement: Hinge movement is that in which the prosthesis revolves around an axis that has been formed by the most posterior attachments on each side of the arch.

Rotation Movement: Rotation movement allows the prosthesis to rotate around an axis that runs anterior-posteriorly.

Translation and Spinning or Fishtailing: In this type of movement, the prosthesis moves in an anterior-posterior movement,or a bucco-lingual direction, without any rotation.

These attachments are provided depending upon the prosthetic movement. Table 2 shows the classification of prosthetic movement given by Carl E. Misch in 1985.

For mucous retained Overdentures attachments like o-rings, locator and round bars with Hader clips can be used. Such attachments are resilient anchorage systems and allow vertical and rotatory movements[15]. For implant supported overdentures milled bars are used. This is a rigid attachment system and evenly distributes the stress along the implant complex. It also minimizes overdenture movement along the path of its insertion[15]. If the arch form is square, implants can be spread and connecting bar can be used, with tapered arch form, single attachment systems should be used like studs/magnets[16].

Table 2: Classification of prosthetic movement

Type of prosthetic movement	Description
PM-0	Prosthesis does not move during function. Implant support similar to fixed prosthesis.
PM-2	A prosthesis with hinge motion. Allows movement in two planes.
PM-3	A prosthesis with apical and hinge movement.
PM-4	A prosthesis allows movement in four directions.
PM-6	A prosthesis having all ranges of movement.

Case presentation

A 56 year old female presented with the complaint of difficulty masticating and desiring an opinion on her options. The patient's dental history revealed extraction of all remaining teeth due to advanced periodontal disease one year prior to presentation and had been wearing a full maxillary and mandibular removable prosthesis. Examination noted a decrease in the vertical dimension of occlusion (VDO) with an associated rolling of the vermillion border of the upper and lower lips inward to completely hide their appearance. (Figure 1, 2)

A panoramic radiograph was taken and it was noted that minimal bone was available for implant placement in the maxilla and mandible. (Figure 3) Sinus enlargement had resulted in thin residual crestal bone in the posterior maxilla and extensive grafting would be required for implant placement in these areas. Available bone was present in the premolar-canine region with sufficient height and width for

Figure 1 — Patient prior to treatment showing collapsed VDO with the current full dentures.

Figure 2 — Lateral view demonstrating decreased VDO and rolling of the lips inward to yield a more aged appearance.

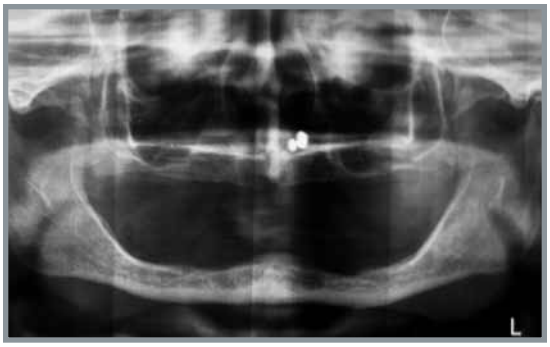

Figure 3 — Panoramic radiograph demonstrating minimal amount of bone present in the maxilla and mandible for support of conventional dentures.

Figure 4 — Maxillary arch demonstrating shallow buccal vestibule and palatal vault.

Figure 5 — The mandibular arch demonstrating a lack of buccal vestibule and shallow floor of mouth.

fixture placement. A complicating factor to utilization of a standard denture was due to the lack of vestibular depth making extension of denture flanges difficult to aid in denture stability and retention. (Figure 4)

The mandible presented challenges with severe resorption in the posterior distal to the mental foramen bilaterally. Close proximity of the inferior alveolar nerve to the crest precluded implant placement distal to the mental foramen without extensive grafting and the possibility of the need for nerve repositioning. Sufficient bone was present in the symphysis for implant placement. The severe resorption had resulted in virtual elimination of the buccal vestibule and loss of the depth of the floor of the mouth. (Figure 5)

Financial constraints precluded grafting to allow implant placement in the posterior of either the maxilla or mandible. Based on these constraints it was decided to place four fixtures in the maxilla with two fixtures in the premolar-canine area bilaterally and restoration of the arch with a overdenture with "ball" attachments on the fixtures and full palatal coverage for improved stability. The mandible due to narrow space between the mental foramina would allow placement of three fixtures. Restoration of the lower arch would be with a "ball" attachment retained overdenture.

At the surgical appointment following administration of local anesthetic, a crestal incision was made from the first molar to the first molar on the maxilla. A vertical releasing incision was places at the mid buccal and a full thickness flap was elevated. (Figure 6) Osteotomy site preparation was performed and Laser-Lok implants (BioHorizons, Birmingham, AL, USA) fixtures with an internal hex connector and a diameter of 3.0 and length of 12mm were placed in the 2nd premolar and canine sites bilaterally. (Figure 7) Cover screws were placed and the incision closed with 4-0 PGA sutures in a simple interrupted fashion. The mandibular arch was treated in a similar manner with a crestal incision and releasing incision at the facial midline with a full thickness flap reflection. Site preparation was performed and three Laser-Lok implant fixtures with an internal hex connector and a diameter of 3.0 and length of 12mm were placed between the mental foramina. (Figure 8) Cover screws were placed in the fixtures and the incision closed with 4-0 PGA sutures in a simple interrupted fashion.

Impressions were taken of both arches followed by fabrication of record bases and wax rims. The wax rims on

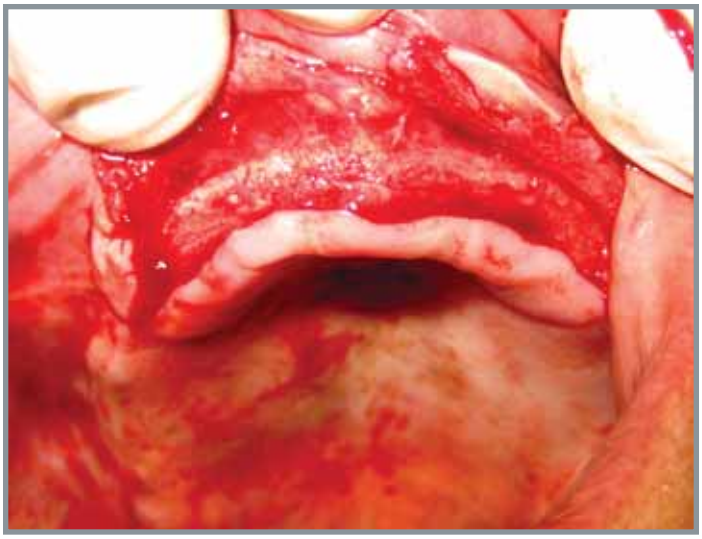

Figure 6 — Crestal incision with a buccal vertical releasing incision at the midline with elevation of a full thickness flap.

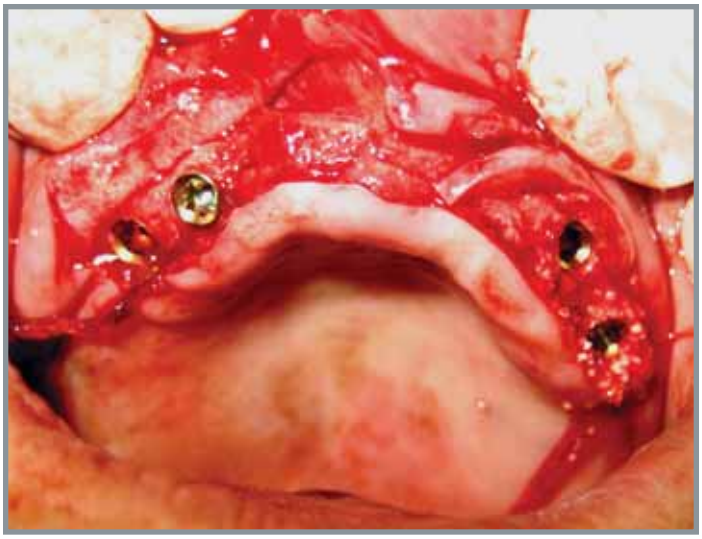

Figure 7 — Placement of Laser-Lok 3.0 (BioHorizons, Birmingham, AL, USA) implants in the premolar and cuspid locations bilaterally.

Figure 8 — Placement of Laser-Lok 3.0 fixtures (BioHorizons, Birmingham, AL, USA) in the symphysis after reflection of a full thickness flap.

the records bases were adjusted intraorally until an ideal VDO was established. Following this the master models were mounted and teeth set in wax for try-in by the laboratory. The wax try-in was inserted intraorally and evaluated for VDO, lip support, phonetics and esthetics. Upon approval by the patient the dentures were returned to the laboratory for processing and finishing.

Following four months of healing to allow integration of the implant fixtures a panoramic radiograph was taken to verify bone levels around the fixtures. (Figure 9) An incision was made at the crest over each fixture and the cover screw removed. "Ball" attachment heads were placed into each fixture and torqued to 25 Ncm per the manufacturer. (Figure 10, 11) Holes were punched in a piece of rubber dam and slipped over the "ball" heads and the female portion of the attachment (rubber ring) in a metal housing was placed on each implant attachment. (Figure 12) The

Figure 9 — Panoramic radiograph demonstrating implants in the maxilla and mandible placed in the available bone following healing. Note nasal cosmetic stud on the left.

Figure 10 — Uncovery of the maxillary implants and placement of impression heads after 4 months.

Figure 11 — Uncovery of the mandibular implants after 4 months of healing.

Figure 12 — Rubber dam placed over the "Ball" attachments seated on the implants in the mandible with the females in metal housings awaiting luting in the new lower overdenture.

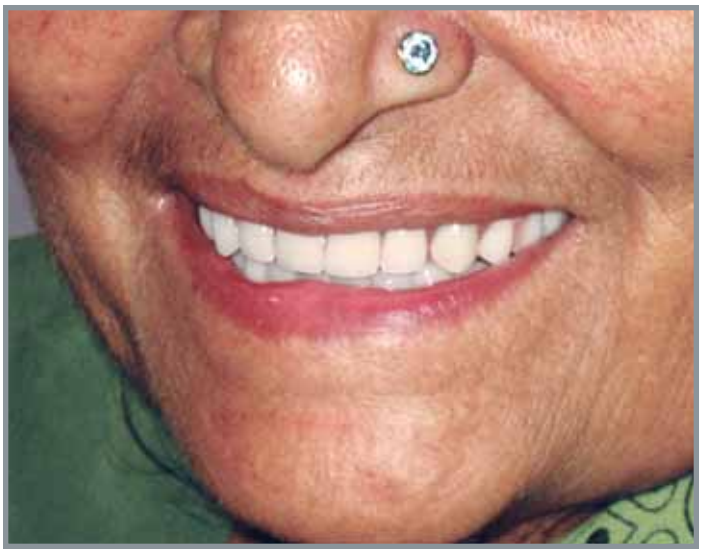

Figure 13 — The patient upon completion wearing new upper and lower overdentures.

Figure 14 — Lateral view demonstrating proper VDO with good soft tissue support resulting in a more youthful appearance.

dentures were relieved over the attachments to allow passive seating of the denture without contact on the metal housing but full contact with the ridge circumferentially. The metal housings were picked up utilizing denture repair methyl methacrylate resin mixed from powder/liquid to a doughy consistency and inserted into the receiving wells in the dentures. The dentures were inserted and the patient guided into occlusion and instructed to lightly occlude. Following setting of the resin the dentures were removed and excess resin was removed with an acrylic bur and polished.

Stability has been increased for the patient allowing her to masticate and improve the quality of her life. Lip support has been achieved with proper positioning of the denture teeth along with an increase in the VDO to provide a natural appearance to the face and eliminate the aged appearance to the patients face with the prior set of dentures. (Figure 13, 14)

Conclusion

Implant supported overdentures provide better function and esthetics then standard dentures especially when resorption of the residual ridges has resulted in decreases in the vestibular depth. An improvement in the patient's quality of life results, providing them with greater confidence and with an improved ability to masticate better general health. ■

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