



IMPLANT SUPPORTED OVERDENTURE – A FIRST CHOICE STANDARD CARE FOR THE EDENTULOUS PATIENT

Dentistry

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ABSTRACT

Patients using complete-dentures frequently report problems with oral function, typically caused by retention and stability problems of the mandibular prosthesis. Implant supported overdentures have diminished many of the problems associated with conventional dentures by providing retention, stability, function, esthetics and physical and emotional health. Many articles reported different advantages of implant overdenture and render it as a first-choice standard care for the edentulous patient. This article reviews the different types, indications & contraindications and treatment considerations in the diagnosis and treatment planning of an implant supported overdenture prosthesis.

KEYWORDS

Overdenture; Implant supported overdenture, RISODs

INTRODUCTION -

Use of conventional complete dentures is associated with several problems, such as lack of denture stability, support and retention. These problems lead to discomfort and reduction in chewing ability. Dental implants may provide a solution to this problem. An edentulous jaw may be restored with affixed or removable implant supported complete denture.^[1]

Removable Implant Supported Overdentures (RISOs) result in an aesthetically more pleasing outcome, better accesses for oral hygiene, lower cost and use of fewer implants compared to fixed implant-supported/retained overdentures (FISOs). Phonetics may also be improved and lip support can be enhanced with use of RISOs as the lost tissue can be compensated for by the denture. It is a solution in certain complex situations where the missing teeth are associated with soft tissue and bone loss, and both require replacement.^[1]

An implant retained overdenture is a removable prosthesis supported by the residual oral tissues and retained by dental implants in conjunction with the selected implant attachment/s. Successful to medium long term clinical results have been demonstrated with different types of ISODs based on various rigid/resilient anchorage systems and attachment options involving ball, bar, locator, magnet or telescopic crown attachments with splinted or un-splinted implants.^[2] Implant retained overdentures in the mandible have demonstrated survival rates equivalent to those determined for implant-supported fixed prosthesis. In comparison with edentulous mandible, implant-retained overdenture therapy for maxilla is often compromised by a reduced quantity and quality, which is also subjected to higher mechanical forces.^[3]

According to symposium held at McGill University at Montreal, Quebec, Canada in 2002, strong emphasis was placed on evidence from randomized controlled trials in which Mandibular Two Implant Retained Overdentures as the first choice of treatment for edentulous mandible. In clinical practice, four endosseous implants are considered the minimum number needed for maxillary overdenture treatment, as determined based on survival rate.^[3]

The implant supported overdentures are classified into 3 categories^[4] –

1. Mainly Mucosally Supported : It is attached to 2 implants by means of resilient stud attachments or magnets. This type of

attachment allows for rotation and translation of the overdenture. It is indicated for patients who have a retention problem and when new dentures without implants will not adequately solve the problem.

2. A Combined mucosa- implant supported: Defined as an overdenture retained by 2-4 implants positioned in the anterior region of the mandible and connected with a bar. Retentive clips or retentive sleeves are constructed in such a way that permits rotation around the bar. This overdenture approach is indicated in case of a retention problem resulting from a severely resorbed mandible with relatively short implants.
3. An implant supported overdenture : Depending on the number and location of the implants.

Advantages Of Implant Supported Overdentures^[5]

- As few as two to four implants may be used as support
- Good stability
- Good retention
- Improved function
- Improved esthetics
- Reduced residual ridge resorption
- Simplest implant-supported prosthesis
- Possible incorporation of existing denture into the new prosthesis.

Disadvantages Of Implant Supported Prosthesis^[5]

- Extensive detail required for proper fabrication
- Continued loss of bone
- Does not satisfy the psychologic need of the patients of a fixed prosthesis

Indications Of Implant Supported Prosthesis^[6]

- Severe morphologic compromise of denture supporting area that significantly undermine denture retention.
- Poor oral muscular coordination.
- Low tolerance of mucosal tissues.
- Parafunctional habits leading to soreness and instability of prosthesis.
- Active or hyperactive gag reflexes elicited by removable prosthesis.
- Psychological inability to wear a removable prosthesis.

Contraindications Of Implant Supported Prosthesis^[6]

- Psychological disorders like schizophrenia, dysmorphophobia etc.
- Chemical dependency
- Uncontrolled systemic disorders.
- Generalized osteoporosis
- Chronic and severe alcoholism.
- Radiotherapy
- Hormonal deficiency.
- Heavy smoking habits.

Diagnosis And Treatment Planning^[7,8]

Establishing and arriving at a diagnosis is the key to treatment planning. The sequential process of clinical examination, laboratory tests, radiographic analysis, diagnostic protocols of casts, wax ups, along with the treatment needs and desires have to be factored in for the overall diagnosis and prognosis of implant therapy. Special attention should be given to examine the following structure apart from the routine examination –

- Edentulous ridge defects (vertical, horizontal, combined)
- Crown to bone relationship (distance between the ideal position of the future crowns and the underlying bone.) defect compensation with soft and/or hard tissue feasible or prosthesis basis required.
- Quality and quantity of the mucosa
- Existing prosthesis if present must be examined for inter/intramaxillary relationships, size, form, position and colour of denture teeth and their occlusal status.
- Denture space – dictated by the degree of vertical resorption. In some patients, the space available allows only the placement of teeth, the fixed prosthesis being the most appropriate treatment. In other cases, the residual space between the crest and the opposing arch will be increased, indicating the need for a prosthesis to replace both hard and soft tissues.
- Lip Support – The degree of resorption is analyzed horizontally by making two baseplates, one with denture flange and one without denture flange. This procedure is done to evaluate proper lip support necessary and to prevent improper angulation of implants that could interfere with oral hygiene. If the patient does not need lip support, a fixed prosthesis is indicated; however, if the lip support is necessary, an overdenture is the best option.
- Smile line – If the patient has a low smile line that does not allow visibility of the ridge, the transition from prosthesis to the residual soft tissue does not imply esthetic risk. If, however, the smile line is high and the residual ridge visible, the esthetic compromise will be high. In this situation, a hybrid prosthesis could be a challenge if the smile line is too high. In cases where the smile line is higher an overdenture can avoid the problem.

Selecting An Adequate Retention System^[9]

The loads that are applied during function of overdenture generate stress that is dissipated from the attachment system to implants and the supporting tissue. A favorable prognosis requires a correct selection of the attachment system based not only on retention or cost aspects but also in the biomechanics aspect.

Factors involved in choosing the type of attachment include available space, maintenance necessity, spare part availability and ease of change, force distribution to the soft tissue or implant and the level of retention. Because the stress distribution is an important factor for bone resorption during implant rehabilitation, the attachment system should present an adequate stress transfer to avoid bone resorption and improve treatment prognosis. Other factors such as time of use, distance between the implants and angulation between the implants should also be taken into consideration.

Depending on upper or lower jaw :

In mandible it will be easier to place parallel implants, thus, ball or locator attachments would be indicated. In maxilla, implants divergent emergency, worse bone quality and use of short implants due to sinus proximity, will mandate the use of bar attachments.

Depending on the arch form :

Bar attachments will be indicated in wide arches. On the other hand, in narrow arches ball or locator attachment would be indicated.

Depending on bone reabsorption rate and implant length :

If the implant is at least 10mm long, it can be used as an un-splinted, but if it is less than 10mm long, it may be indicated that the implant be splinted with bar attachments.

Depending on implant location :

If implants are placed quite far from each other, it will not be indicated to use bar attachments due to increase of bone stress.

Space Requirements^[10]

Functional aspects of oral structures that bound the restorative space must be carefully considered during the planning phase of dental implant therapy. Overdenture construction necessitate the existence of sufficient room for the accommodation of the attachments. Lack of space can result in esthetic problems, fracture of the acrylic resin or other technical problems.

Besides the necessary vertical space for the housing of the attachment, sufficient horizontal space is also critical for the structural integrity of the prosthesis. The use of attaching mechanisms such as the HADER bar clip and other similar elements requires a distance of about 10-12mm between the implants. If this space between the implants cannot be guaranteed, then an individually milled bar that fits the specific dimensions should be considered.

In this design, the retention is derived from the frictional fit of the overcast implant supported superstructure. However, placement of additional retentive elements (CEKA, ERA, etc.) should be considered.

In the vertical axis, a minimum distance of 12mm from the implant platform to the incisal edges of the incisors should be established, when an average of 3mm of soft tissue is present above the implant platform. Bars are more difficult to accommodate than other attachments, such as balls or magnets. According to Biez et al, the bar length should be limited to the 12-16mm range if the placement of 2 small vertical O-ring attachments is planned for retention.

A classification system of available vertical restorative space (from the crest of the soft tissue edentulous ridge to the proposed occlusal plane) for edentulous arches to be restored with implant overdentures was put forward by Swathi Ahuja and David R Cagna in 2011. According to this classification –

Class I:

Describes the clinical condition where available vertical restorative space is equal to or greater than 15mm. This condition may correlate with long term edentulism, characterized by considerable alveolar bone resorption. The full range of implant overdenture attachment systems (bar and clip attachments and stud attachment) can be considered.

Class II:

Restorative space exists when vertical space is between 12mm and 14mm. Most overdenture attachments can be used, but bar and clip systems must be carefully designed to fit optimally within a denture base of physiologically acceptable contour.

Class III:

When vertical restorative space is between 9mm and 11mm, the arch is designated as class III. Due to the decreased vertical dimension, selection of an appropriate overdenture attachment system becomes more critical, particularly at the lower end of this dimensional range. It has been recommended that a minimum of approximately 12mm of vertical restorative space is necessary to accomplish a mandibular implant assisted overdenture.

Class IV:

When vertical space is less than 9mm, a class IV condition exists. In these patients a substantial amount of alveolar process remains intact as often seen immediately after extraction. This condition is considered least favorable for the fabrication of an overdenture.

Attachments

An attachment is a mechanical device used for the fixation, retention and stabilization of a dental prosthesis. One part of the attachment system is usually connected to the implant and the other incorporated within the undersurface of the overdenture.

Different attachment types have been proposed for the retention and stabilization of overdentures with different longevity, biomechanics, functionality and patient comfort. Each attachment system has inherent attributes and drawbacks and must be chosen with the particular patient profile in mind.^[11]

1. Bar and Clip Systems^[1,12] :

The implants are connected with a bar, which represents the anchor that retains the denture and gives it support. An element that fits on the bar is usually in the form of a clip (sleeve/channel) that is attached to the fitting surface of the overdenture. The major bar types come with matching clips. These are incorporated into the prosthesis, either at the time of processing or afterwards as a pick-up procedure. The bar may have cross-sections like reverse U shape (rigid joint) or egg-shaped or circle (resilient joint). The bar may be milled, pre milled plastic patterns (castable), prefabricated from gold (Dolder bar) or produced from CAD/CAM technology.

2. Studs^[1,12] :

When stud attachments are used, all stud attachments should be parallel to each other, and the attachments should not interfere with the path of insertion of the overdenture. The different types of stud attachments are

a) O-Rings attachment –

It comprises of a titanium male unit and a rubber-ring female unit. It transfers the amount of stress to the abutments and offers an excellent shock absorbing effect during function. Rodrigues et al in 2009 evaluated the retention force of an O-ring attachment system inclined differently to the ideal path of insertion and concluded that, the retention was adequate for a longer time.

b) ERA attachment –

It is an extra radicular attachment that has two design systems. The first is a partial denture attachment, which is placed on the proximal aspects of artificial crowns, while the second is an axial (or overdenture) attachment, which is placed either inside the prepared roots or the ERA abutment for the overdentures. It is available as a straight one piece type or a two piece angulated type. Each ERA retentive system is available in four color codes (white, orange, blue and gray) that offer different degrees of retention.

c) Ball Attachments –

This system consists of a retentive patrx, which is part of the abutment screwed into the implant. The patrx has the shape of small ball with different diameters. Matrix is attached to the fitting surface of the denture into which the patrx fits. The matrix consists of 3 parts : the O-ring, a metal part and a spherical metal anchor.

d) The LOCATOR Overdenture Stud attachment (Zest Dental Solutions)^[10] -

Was designed for easy insertion and removal, dual retention, a low vertical profile and its pivoting ability, so it was resilient and tolerant for implant divergence. It was designed to be self-aligning.

3. Magnets^[1,12] :

The magnet is attached to the fitting surface of the acrylic resin base of the overdenture, usually cylindrical or dome shaped, is a neodymium-iron-boron alloy. The magnetic keeper cast to a metal coping is screwed over the implant fixture. Magnets provide the least retention.

4. Telescopic Copings (rigid and non-rigid) Treatment Considerations

The treatment considerations considerably differ for the maxillary and mandibular overdenture treatment due to the difference in the quality and quantity of bone and the tissue support considerations.

Mandibular Overdenture Considerations -

The resorption of the residual ridge area in the mandible often allows the use of implants anteriorly due to substantial basal bone in terms of width and depth in that area. Sadowsky^[1] (2001) summarized the following treatment concepts :

- The mandibular overdenture retained by implants in the area between the foramina maintains bone in the anterior mandible. Bone undergoes remodelling in the anterior mandible as a result of more functional loading with implants.
- Implants should be parallel, perpendicular to the occlusal plane, and be situated at the same height to avoid faster wear in the highest or more leaning implant. According to Al-Ghafi et al., implant angulation affects negatively the attachment retention longevity.
- Implants should be placed equidistant to the midline to avoid instability, retainer wear or abutment loosening. Another option would be to use a splinted three-implant supported overdenture that will limit denture rotation dislodgement.

- If there are severe or moderate anatomical conditions, with great posterior alveolar ridge resorptions and retention, support and stability loss, as well as high patients demand, it will be indicated to use a splinted or un-splinted four implant supported overdenture.
- If the mandibular arch is U shaped, and a straight bar can be ideally positioned above the alveolar ridge, a two-implant bar-clip reconstruction is indicated. A minimum distance of 15mm from implant center to center is required to ensure sufficient prosthesis retention with an adequate clip length and an efficient axis of rotation.^[13]
- In a V shaped arch, a bar construction would cause lingual over-contouring and encroach on the tongue space. The form and contour of the hinging prosthesis retained on two implant abutments are similar to those of a conventional complete denture. An optimal extension and fit of the denture base, as well as a posterior support on the retromolar pads, are prerequisites for functional success.^[13]

Maxillary Overdenture Considerations-

The main advantages of a maxillary implant supported overdentures are an increase of prosthesis retention and a reduction in palatal coverage, resulting in higher patient satisfaction and chewing ability. The literature to date has suggested that although there is consensus about the number of implants necessary to support a mandibular overdenture, this consideration is not valid when the maxilla is analyzed.^[14]

- Maxillary implant overdentures have a higher rate of implant loss than any other implant procedures as a result of relatively poor bone quality and quantity, increased implant to abutment ratios and non-axial loading.^[15]
- The distribution of implants in the maxillary arch may be compromised by various anatomical structures and issues like pneumatization of the maxillary sinus, alveolar orientation and the shape of the ridge.^[15]
- As there is limited space in the maxilla, flexible bar designs may increase bending movements. Thin buccal bone of the rigid maxilla may not tolerate the applied forces as well as the mandible. Un-splinted anchorage designs may require less space within the prosthesis, facilitate hygiene, be more cost-effective, less technique sensitive and easier to manage than splinted designs.^[15]
- There are no specific recommendations for the number of implants needed to support a maxillary overdenture. If the design of the denture is such that there is no palatal coverage, then a minimum of four implants is considered necessary.^[15]
- Mucosal inflammation and mechanical problems occur more often in the maxilla than the mandible. This may be due to bigger stresses in the maxilla from the opposing dentition or fixed restorations. The most common complication occurs as there is a change in the retention system due to loosening or fracture.^[15]

Maintenance Of Implant Supported Overdenture^[16]

When an implant supported overdenture is utilized, it must be supported by an adequate number of implants in ideal position. It has been shown that these prosthesis have fewer post-operative visits for adjustments and unscheduled appointments.

- Any retention system selected will retain plaque to varying degrees. Bars/splinted attachments, due to their design, are more challenging for patients to clean and maintain and have been shown to be prone to mucosal hyperplasia around the implants.
- For some patients a free-standing attachment system can be easier to clean and maintain and this should be considered during treatment planning.
- The different attachment systems allow different movements of the prosthesis, this movement can be vertical, horizontal or rotational. If the prosthesis has not been designed to move freely about an axis, then premature replacement of the attachments will be required or breakage of components will ensue.

CONCLUSION

Rehabilitation of the edentulous state with mild to severe ridge resorption has been improved greatly due to the introduction of implant overdenture procedure. Implant overdenture is superior to conventional complete denture in terms of stability and retention, improved function, esthetics and phonetics of the patients and also reduces the residual ridge resorption. Implant supported overdentures provide a good treatment alternative to fully edentulous patient who often present with substantial bone and soft tissue deficiencies, which

lead to prognathism, deficient facial support, speech disruption, and general esthetic problems that compromise the ubication of smile line and the length of the upper lip; thus preventing the use of a fixed implant-supported prosthesis.^[17]

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