

Over-Dentures and Attachments: A Review of Literature

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Abstract

Tooth-retained overdentures are a simple and cost-effective treatment than the implant-supported overdentures. When few teeth are present which are periodontally strong can be used as abutments for overdenture fabrication. This helps in the retention and stability of the final prosthesis. The extraction of teeth results in bone resorption, so preserving them as an abutment can not only provide retention and stability to the denture but also prevents bone loss and provide proprioception. Above all, “it gives the patient the satisfaction of having prosthesis with his natural teeth still present”.

Keywords: *Tooth Supported Denture, Implant Retained Denture, Overlay Prosthesis.*

Introduction

An Overdenture is a “dental prosthesis that covers the natural tooth and or is partially supported by natural teeth, natural tooth roots or dental implants”. According to GPT 10, “overdenture is a partial or complete denture that covers and rests on one or more remaining natural teeth, roots and/or dental implants; a dental prosthesis that covers and is partially supported by natural teeth, tooth roots, and/or dental implants”. It is also called as “overlay denture, overlay prosthesis and superimposed prosthesis.”¹⁶

Preventive prosthodontics “emphasizes the importance of any procedure that can delay or eliminate future prosthodontic problems and overdenture is an important part of the preventive treatment modality”. De-Van’s golden statement: “Perpetual preservation of what remains is more important than the meticulous replacement of what is missing” still rings true⁷.

Tooth supported overdentures have various advantages over conventional complete dentures such as maintenance of alveolar bone maintenance, periodontal proprioception is preserved, improves retention, stability and support, enhances psychological comfort and increased mastication efficacy.⁴

Chen et al. “observed that the patients treated with tooth-supported overdentures had significantly more comparative masticatory efficiency than those with

conventional complete dentures, while there was an insignificant difference in comparative masticatory efficiency between tooth-supported overdentures and implant-supported overdentures”².

Crown and Rooney 1975 in their study found that “retention of mandibular canine for overdenture led to preservation of alveolar bone”².

Indications for Overdentures:¹

1. For better support in morphologically compromised dental arches.
2. Cleft palate cases and congenital anomaly cases like microdontia, amelogenesis imperfecta, dentinogenesis imperfecta, and partial anodontia.
3. Dentures patients with maxillofacial trauma.
4. Patients with worn-out dentition.
5. Patients with abnormal jaw size and position where orthognathic surgery is contraindicated.

General Considerations during Diagnosis and Treatment Planning for an Over-Denture^{1,2,4}:

1. Maintenance of Periodontal Health: Once an overdenture is planned and constructed, the patient must maintain his teeth free from plaque. The dentist should check for pocket formation around the abutments periodically and failing may lead to the loss of abutment tooth.

2. Reduction in Crown-root Ratio: Reduction in crown size during preparation can be beneficial for the tooth, as it “reduces the crown-root ratio” and “decreases the leverage forces acting on the tooth”.
3. Success of Endodontic Therapy: Endodontic therapy may be necessary for most abutment teeth because they need extensive crown reduction. A two-to-four week interval should be provided after completion of root canal therapy to determine the success.
4. Number of overdenture abutment teeth: “Two Abutments On Opposing Sides Of The Arch Particularly In The Canine Regions Will Provide Excellent Results”. Four Widely separated Abutments Are Even Better.
5. Adaptation and Coverage of Denture-Bearing Area: The denture base should be well adapted to the soft tissues to prevent accumulation of food debris and to evenly distribute the force acting on the denture.
6. Design of the Denture: As the denture base for overdentures are thin, they have to be reinforced with metal. At the same time they should be easy to fabricate and maintain.
7. Ease of Use: The patient should be able to easily insert and remove the denture without any harm to the denture base or the abutment tooth.

Advantages of Overdentures:³

1. Maintains the integrity of the ridge.
2. Improves the “retention and stability” of the denture.
3. Improved proprioception leads to better neuromuscular control. This helps in regulating the biting force over the denture.
4. The psychological effect on the patient as extraction can be avoided.
5. If there is abutment failure, the abutments can be extracted and the overdenture can be relined and used as a conventional complete denture.

Disadvantages of Overdentures:²

1. Nutritional counseling, oral hygiene measures, and fluoride application should be carried out periodically.
2. “High incidence of caries and periodontal disease around the overdenture abutments”.
3. Frequent reviews are needed to verify the health of

the supporting tissues of the overdenture abutments and Improper maintenance of the overdenture may lead to periodontal breakdown of the overdenture abutments and the patient may lose all his remaining teeth.

4. More costly than conventional dentures because:
 - (a) Root canal therapy and coronal restorations may be needed for certain overdenture abutments.
 - (b) Most cases need a cast metal denture base, as acrylic is weaker.
5. Additional designing and laboratory work is needed.
6. Cannot be used in cases with reduced interarch space, bony undercuts adjacent to the abutments, etc.

Abutment Preparation¹: The preparation of abutment teeth is one of the keys to the construction of overdenture. Assuming the periodontal status to be good, the operator has three choices:-

1. Preparation just above the mucosal level.
 - The bare root face approach.
 - The dome-shaped gold coping.
2. The use of attachments.
3. The thimble-shaped coping.

The Bare Root Face Approach¹: The occlusal section is obturated with glass ionomer or silver amalgam. It is normally employed for immediate insertion prosthesis. On later stages coping can be given the crown of abutment is reduced to a height of 2-3 mm. the abutment tooth is endodontically treated the occlusal surface is to be contoured to smooth or polished dome-shaped surface. This will minimize lateral occlusal stress. It offers following advantages-

1. “It is the simplest,cheapest and least space-consuming”.
2. “It is ideal during maturation of edentulous ridge”of a recently extracted case.
3. It should be replaced by an coping with precious or semi-precious metal otherwise there is a chance of vertical longitudinal root fracture.
4. Contraindications:
5. It should not be used for a long period where a natural tooth is opposing the overdenture.

6. Leaving it as such may lead to longitudinal root fracture.

The Dome Shaped Copings¹: The Abutment Tooth Is root canal Treated And Reduced To A Height Of 2-3mm and Post Space Is Created. Dome Shaped Cast Metal Copings 2-3 Mm In Height With Chamfer Finish Line And Post Are Fabricated And Cemented. Coping Should Be Atleast 1 Mm Thick To Withstand Occlusal Forces.

Thimble shaped coping¹: These are 5-8mm in height and need considerable space. These copings can be used to support the telescopic crown to enhance retention. The chamfer finish line is given in the prepared abutment.

Basic Principles to be followed¹⁻⁵: The abutment teeth must be surrounded with healthy periodontal tissue.

1. Maximum reduction of the crown to attain a better crown-root ratio and avoid interference during the placement of artificial teeth. Endodontic therapy may be done if needed. A simple tooth preparation without any internal attachments can be done in a single visit. This can be done for elderly patients and medically compromised patients. It is less expensive than copings.
2. Gold copings or crowns and sleeve coping retainers can be given for grossly destructed abutments after assessing the patient's susceptibility to caries. Gold or metal coping can be prepared with posts and retentive pins after evaluating the amount of tooth structure above the gingival attachment.
3. Attachments are added to the cast copings for additional retention. These attachments may be resilient or non-resilient types.
4. Regular reviews and periodontal evaluation of abutment teeth should be done.

Types of Overdenture:¹

Two types:

Tooth supported overdenture

Implant-supported overdenture

Heartwell's classification for tooth-supported overdenture

Based on the method of abutment preparation:

1. Coping
2. Noncoping – with simple tooth modification
3. Attachments
4. Submerged vital roots: Effective in preserving alveolar bone

Based on length of coping:

1. "Short coping – 23 mm long and normally require endodontic therapy".
2. "Long coping – 58 mm long, an attempt is made to circumvent endodontic therapy by conservative reduction".

Abutment with attachment—"Most of the attachments are secured to the abutment by a cast coping. The objective of attachment is to improve the retention of denture".

Attachments Used In tooth/root/Implant supported Overdenture:

Definition: "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".¹⁶

The attachments used for overdenture can be classified as^{1,9}:

Stud attachment

Bar attachments

Magnetic attachments

Requirements of Attachments:

- Patients should have a low caries index.
- Sound periodontal health.
- The vertical space should be sufficient enough to accommodate the attachment and denture teeth.

Disadvantages of Attachments:

- Time-consuming and expensive.
- Difficulty in construction as well as repair is difficult.

- Require careful use by the Patient. So not recommended for mentally and physically handicapped patients.

Stud attachment^{1,9,15}:

It is the simplest of all types of attachments.

Stud attachments can be divided into two groups:

1. **The Extra Radicular:** “The Stud” (Male part) usually attached to metal coping cemented over the prepared abutment and it projects from the root surface of the preparation. The female part is attached to the denture. Attachment of male component to female component provides retention. The male parts are available as:

- a. Prefabricated Metal Posts-Cemented Directly To The Root.
- b. Prefabricated Resin Patterns- Which Is Cast And Cemented To The Root.

The female component is also termed as retentive anchor and made in metal or plastic and is in the form of an o ring or matrix. Eg-CEKA, ORS-OD, DALBOS, SERIES, GERBER, LOCATOR ATTACHMENT AND ROTHERMAN.

Ceka Attachment:

The male part is round and composed of titanium.

The female part is replaceable plastic part that is flexible And compressible.

O Ring Series System: O-rings are “doughnut-shaped, synthetic polymer gaskets that possess the ability to bend with resistance and then return to their approximate original shape”.

Parts of an O-Ring Attachment-metal encapsulator,o ring post, and o ring which is available in 3 different sizes.

Dalbos Series Attachment System:

- It is the most popular stud attachment with a long life.
- It is available in two designs- ball and socket dalbo & rigid dalbo.
- It is available in spherical and cylindrical forms.
- The ball and socket dalbo is the smallest of 4mm height and easy to clean and maintain.

Rotherman System-

- The male part consists of a groove.
- The female part is c shaped ring that fits in the deeper part of retaining groove.
- The attachment looks like a press button with a groove.
- The female unit is clip with open end.

Locator attachment-

- The locator attachment system is an attachment system with a self-aligning feature and has dual retention (inner and outer).
- Locator attachments come in different colors (white, pink and blue)
- “Extended range attachments, which can be used to correct implant angulation up to 20 degrees they are offered in green, which has standard retention, and red, which has extra-light retention”.

Gerber Attachment: Readily replaced male or female attachment Which can be replaced if they are worn out.

The spring-clip of the female part engages in the peripheral groove in the male.

Other extraarticular attachment systems used are:

- (a) The Ancro fix attachment
- (b) The Introfix attachment
- (c) Quinlivan attachment
- (d) Schubiger Attachment

2. **The Intra Radicular Attachment:** “The Stud”(Male element) forms part of the denture base and engages a specially produced depression(housing or female part) within the root contour. This attachment is indicated in situations with reduced interocclusal space.

Eg-Logic,Zest attachment,ERA attachment

Zest Anchor System:

The female sleeve is cemented in the post space.

Male portion consists of nylon.

ERA system: Resilient attachment system with

color-coding resin unit providing various degrees of retention.

Universal hinge with vertical movement.

Metal jacket which holds the male attachments.

Bar Attachment: It consists of a bar spanning an edentulous area joining copings on the roots of the abutment teeth on either side of the arch.

Sleeves and clips placed in the denture attach to the bar when the denture is inserted, providing retention.

The bar splints the abutment teeth and thus distributes the forces.

This type of bar attachment requires vertical and buccolingual space.

Oral hygiene maintenance is very much essential otherwise may lead to abutment loss.

It can be a bar joint or bar unit.

Depending on the number it can be a single bar or multiple bars.

Depending on movement it can be a bar unit that provides no movement and is made up of solid rigid material or bar joint which permits rotational movement between bar and sleeve and thus made up of resilient material.

Hader Bar:

It is named after the swiss tool and die technician "Helmut hader".

It is a rigid bar connecting two or more attachments.

When viewed from the cross-section it appears a keyhole consisting of a rectangular bar with a rounded superior ridge that creates a retentive undercut for the female clip within the removable prosthesis.

The bar provides mechanical retention and the round part makes the bar resilient type and thus some amount of movement is seen in this attachment.

The sleeves which are available commercially in plastic form can be cast and converted to metal if extra retention is required.

Dolder Bar:

It is named after swiss prosthodontist Eugene j dolder.

The bar is straight and is rounded at the top. The sleeves that fit over the bargain retention by friction only.

The bar is available in various sizes and when cross-sectionally viewed appears to be pear-shaped. The clip which is fitted in the denture base allows some rotational movement.

It is available in sizes in diameter of 1.6 and 2.2 mm.

Ackermann and CM bar

These bars are round when viewed in cross-section.

As they are round they offer some resiliency and can be bent in all directions.

A short extension of 5 mm is carried behind the most distal root and the sleeve is positioned on this section.

Sleeves or clips are made up of gold.

Available in 1.8 mm diameter in plastic and gold.

The CM bar is available in a 1.9 mm diameter and used in long-span cases.

Magnetic Attachments^{1,3,8}

Magnetic attachment consists of keeper and denture retention element.

The keeper is made up of stainless steel and is cemented to the abutment teeth.

The "denture retention element" consists of "paired, cylindrical magnets" made of cobalt-samarium with opposite poles placed adjacent to each other.

One end in the denture with knurled housing which fits into the denture and other ends which is smooth fits on the keeper.

The retention principle is due to the mutual attraction of unlike poles. During dislodging forces, the magnetic forces reseal the denture.

Advantages of magnetic attachment: No path of insertion, No specialized casting or instruments required, No paralleling of abutment.

Automatic reseating, Ease of repair and relining, Minimum forces are transmitted to roots.

Disadvantages: Alloy and corrode and fracture leading to loss of magnetism with loss of retention and thus need for constant replacement.

Discussion

Tooth & implant-supported over-dentures are a “step in the direction of preventive prosthodontics”. They Preserve the residual ridge, provide support and stabilization to the denture base, and thus gives the patient a sense of security in knowing that teeth aid in support of their prosthesis. The maxillary overlay denture is of great value when it opposes remaining mandibular anterior teeth because it aids in conserving the ridge against resorption from “masticatory stress”⁴. The greatest difficulty is the use of attachments because of their “complex design”. A thorough understanding of the case and knowledge about the various attachments and its applications and limitations is a must to apply clinically.

Conclusion

Overdenture helps reduce shrinkage of surrounding bone and reduces pressure on the alveolar ridge. In the case of an overdenture prosthesis, “proprioception is maintained” there is the presence of “directional sensitivity; dimensional discrimination; canine response and tactile sensitivity”^{1,14}.

Funding Statement: None

Conflict of Interest: None

Ethical Permission: Approved

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