ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 7, Issue – 3, June - 2024, Page No. : 122 – 130

Tooth supported overdenture: A review

[1]Dr. Dangar Shyam Maganbhai**,** Resident**,** Department of Prosthodontics and Crown & Bridge, Army Dental Centre R and R, New Delhi, India

[2]Dr. Joshua Nirmalkumar L, Resident, Department of Prosthodontics and Crown & Bridge, Army Dental Centre R and R, New Delhi, India

[3]Dr. Guruprasada, Assistant Professor, Department of Prosthodontics and Crown & Bridge, Army Dental Centre R and R, New Delhi, India

[4]Dr. Deepak Kalia, Assistant Professor, Department of Prosthodontics and Crown & Bridge, Army Dental Centre R and R, New Delhi, India

[5]Dr. Sahil Verma, Resident, Department of Prosthodontics and Crown & Bridge, Army Dental Centre R and R, New Delhi, India

Corresponding Author: Dr. Dangar Shyam Maganbhai, Resident**,** Department of Prosthodontics and Crown & Bridge, Army Dental Centre R and R, New Delhi, India

How to citation this article: Dr. Dangar Shyam Maganbhai, Dr. Joshua Nirmalkumar L, Dr. Guruprasada, Dr. Deepak Kalia, Dr. Sahil Verma,"Tooth supported overdenture: A review", IJMACR- June - 2024, Volume – 7, Issue - 3, P. No. 85 – 93.

Type of Publication: Review Article

Conflicts of Interest: Nil

Abstract

Preventive prosthodontics, a branch of dentistry, focuses on delaying or preventing future prosthodontic issues. Overdentures, a key procedure, utilize remaining teeth for support, preventing alveolar ridge resorption. They have evolved since Ledger's initial use of natural teeth in 1856. Tooth-supported overdentures can be classified as non-coping abutments, abutments with coping, and abutments with attachments. Abutment selection considers periodontal health, tooth location, path of insertion, and periapical tissue status. Advantages of overdentures include maintaining ridge integrity, improving retention and stability, tactile discrimination, enhanced neuromuscular control, positive psychological impact, and potential use as conventional complete dentures if abutment fails. However, disadvantages include caries susceptibility, bony undercuts, an overcontoured denture base, interocclusal distance issues, compromised aesthetics, and periodontal breakdown. This review also includes an abutment tooth preparation for the bare root face approach, dome-

shaped copings, and thimble-shaped copings. Attachment systems, including stud attachments, bar attachments, and magnets, play a vital role. Stud attachments like Gerber and Dalbo offer different retention mechanisms. Bar attachments like Header, Dolder, and Baker clips provide stabilization, while magnets offer resilient retention. The in-depth summary focuses on how important overdentures are in preventive prosthodontics and describes their different types, pros and cons, and attachment options.

Keywords: Tooth Supported Overdenture, Abutment Teeth Selection, Attachments in Overdenture

Introduction

Preventive prosthodontics is a branch of dentistry that focuses on procedures to delay or prevent future problems related to future prosthodontic complications. One such procedure is the use of overdentures which are designed to maintain teeth as part of the residual alveolar ridges to prevent their resorption.[1]

Unlike conventional dentures that rest on the soft and movable tissue of the mouth, overdentures are supported by teeth, thus enabling them to withstand greater force without any movement. Overdentures have been used for over a century and are now considered a viable alternative to many other prostheses for patients with some remaining teeth.[2]

An overdenture is a removable dental prosthesis that covers and rests on one or more natural teeth, the roots of natural teeth, or dental implants.[3] This type of treatment has been described using various names, including overlay dentures, telescoped dentures, tooth-supported dentures, hybrid prostheses, crown and sleeve prostheses, and superimposing dentures.[4,5]

In this literature review, we have tried to compile the topic of tooth-supported overdenture.

Evolution of Overdenture

In 1856, Ledger became the first person to utilize natural teeth as a means of anchoring removable denture and assisting in their stability.[6] In 1888, Evans described the use of roots to preserve restorations. Essig introduced the use of telescopic coping in 1896. Hunter's "focal sepsis" theory in 1906 dealt a blow to overdenture treatment. In 1958, Miller explained the retention of unusable teeth in overdenture treatment.

Dolder bars for overdentures were introduced in 1961.[7] Commercially available overdenture attachments were described by Prieskal in 1968.[8] Crum and Rooney's 1978 study showed less bone reduction with mandibular overdentures. They demonstrated in a 5-year study that overdenture patients experienced an average loss of 0.6mm of vertical bone in the anterior part of the mandible, as compared to a 5.2mm loss in complete denture patients.[9]

Miller's study concluded that alveolar bone resorption is dependent on three variables: the character of the bone, the health of the individual, and the amount of trauma to which the structures are subjected.Overdenture helps reduce the shrinkage of surrounding bone.[10,11]

In the case of overdenture prosthesis, proprioception is maintained, which includes directional sensitivity, dimensional discrimination, canine response, and tactile sensitivity. The average threshold of sensitivity to a load was found to be 10 times greater in denture wearers than in dentulous patients.[12–14]

A comparison of masticatory performance among patients with natural dentition, complete dentures, and overdentures was conducted by Rissin et al. in 1978. They found that over-denture patients had a chewing efficiency one-third higher than complete denture patients.[15]

Types of overdentures

The classification given By Heartwell is based on support derived.[16] He classified overdentures as

Tooth Supported dentures

a. Non coping abutments
b. Abutments with coping
c. Abutments with attachments

Brewer and Morrow classified overdentures as

1. Transitional overdenture
2. Immediate overdenture
3. Remote overdentures

The other classification by Preiskel. He classified overdentures as

1. Transitional overdenture
2. Training overdenture
3. Immediate replacement overdenture
4. Definitive prosthesis

Abutment selection for tooth supported overdenture:[10,12,17,18]

Periodontal considerations: An abutment tooth that is suitable for an overdenture must exhibit minimal mobility, a manageable depth of the sulcus, and a sufficient band of attached gingiva. The periodontal elements are the main concern, and only teeth having the potential for this architecture should be considered as supports for overdentures. The fundamental determinant in the choice of teeth is the quantity of alveolar bone that supports the root. Adequate bone is required to provide support to the tooth against vertical pressure following the establishment of a favourable crown-to-root ratio. Whenever possible, it is advisable to utilize a tooth that has a manageable sulcus depth and sufficient attached gingiva. In the absence of these conditions, pocket depth may typically be decreased, and attached gingiva can be obtained by changing the surgical process during tooth extraction and denture placement.

Tooth location

Teeth should be retained where the stress exerted on the residual alveolar ridges has the highest capacity to undergo resorption. An example would be the retention of maxillary canines when the mandibular dental arch has either complete natural dentition or natural anterior teeth with a distal extension removable partial denture. The maxillary anterior ridge is thereby shielded from severe stress, even in cases where the mandibular removable partial denture is not regularly worn. Edentulous patients commonly experience significant resorption in the anterior region of both dental arches. Hence, it is beneficial to keep canines or premolars in these areas. The mandibular teeth are of greater significance because of the challenges associated with maintaining the overdenture and the extent of resorption of the mandibular ridge. Mandibular canines are frequently retained due to their tendency to be the last teeth to be lost, as well as their advantageous placement in the dental arch, which provides support and stability for an overdenture. If there is a lack of teeth on both sides of the dental arch, a single tooth can serve as a suitable support for an overdenture. Preserving teeth in both dental arches will help in maintaining the vertical dimension of the occlusion provided by the dentures. By maintaining the canine and second premolar instead of the canine and first premolar, the teeth are positioned at a greater distance from each other, resulting in wider support. This further assistance is particularly advantageous when the overdenture is opposed by natural teeth.

Path of insertion

Frequently, when a tooth is kept in place, it creates an undercut area in the outer portion of the ridge that would not exist if the tooth were extracted. The labial angulation of the tooth might complicate the insertion process, particularly when there are additional lingual undercuts. Retaining premolars or an incisor can offer a straightforward insertion route while also safeguarding the front region of the dental arch against excessive stress.

Periapical tissue

The periapical tissue of an overdenture abutment is assessed using the same method as natural teeth. Periapical radiographs should display an intact lamina dura. Periapical pathosis, if present, should resolve following the completion of root canal therapy.

Indications and contraindications of overdenture: [8,12]

This treatment option may be appropriate for patients with compromised dental arches or congenital anomalies, denture patients with maxillofacial trauma, worn-out dentition cases, and patients with abnormal jaw size or position.

Overdentures are not recommended in cases of poor oral hygiene, inadequate inter-arch distance, and when abutments exhibit mobility.

Advantages of Overdentures[1,8,12,16,17]

1. Maintains ridge integrity.
2. Improves denture retention and stability.
3. Tactile discrimination.
4. Enhances neuromuscular control and biting force regulation.
5. Positive psychological impact as extraction can be avoided.
6. Can be used as a conventional complete denture if the abutment fails.

Disadvantages of Overdentures[1,8,12,16,17]

1. Caries susceptibility of abutment tooth.
2. Bony undercuts found adjacent to the abutment tooth.
3. Overcontoured denture base to cover the prepared abutment tooth .
4. Under extended denture flanges due to limited path of insertion and bondy undercuts.
5. Encroachment of the interocclusal distance
6. Overcontoured prosthesis may disturbs natural contour of lips which leads to compromised esthetics
7. Periodontal breakdown of abutment tooth/teeth.

Abutment Preparation: [8,16,19]

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 Approach:

The occlusal part of an immediate insertion prosthesis can be filled with silver amalgam or glass ionomer. As the treatment goes on, reduce the crown to a height of two to three mm and install coping. To reduce lateral occlusal stress, smooth and polish the occlusal surface of the endodontically treated abutment tooth.

The Dome Shaped Copings:

The abutment tooth is prepared in such a way that only 2-3mm of tooth will remain above the marginal gingiva. There is now a post space. The next stage is to create 2-3mm tall case metal copings in the form of a dome. These copings may have a post and a chamfer finish

line. To guarantee that the coping can sustain occlusal forces, it should have a minimum thickness of 1mm. The copings will be fixed into place when they are ready.

Thimble shaped coping:

These copings are tall (5-8 mm), take up a lot of room, and help keep the telescoping crown in place. The prepared abutment has a finish line that is chamfer.

Basic Principles to be followed[1,8,10]**:**

Maximal crown reduction, the use of copings, and the addition of attachments to cast copings are the three techniques for preparing teeth for the overdenture. It's critical to routinely assess the abutment teeth's periodontal health.

Attachments in Overdentures

While there are other types of attachment methods available, the three most typically utilized are

1. Stud attachment
2. Bar attachment
3. Magnets

Wismeijer et al. (1999) and Epstein et al.[12] reported on the precise retentive capability of overdenture attachments. The attachments can be categorized into four types based on their retention:

1) Frictional,

2) Mechanical,

3) Frictional-Mechanical, and

4) Magnetic Attachments.

Stud Attachments

Stud attachments have a long history as one of the earliest attachments employed in overdentures. It has a male stud type that is attached to the base, which is coping over an endodontically treated tooth stump or an implant abutment.[1]

They can be divided into two groups: Extraradicular, where the male component projects from the root stump or implant. Intrardicular, where the male component is a part of the denture base. Gerber, Dalbo, Zest, ERA, Prosnap, and Profix are different stud attachments. Gerber is the largest stud unit.[6,7]

The Gerber attachment

The Gerber attachment is of two types in which the one allows the vertical movement while other rigid attachment doesn't allow any movement of bone. The retention is achieved through the engagement of a groove in the male part by the spring clip in the female housing. It is readily interchangeable.

Dalbo Attachment

Dalbo's attachment can be rigid, resilient, and stress-broken. The resilient is the most commonly used. The female component is capable of both vertical and rotational movement around a male component that has a sphere-like shape.

Rotherman Eccentric Attachment

This attachment requires very less space, therefore it is an excellent choice for the cases and which where interocclusal space is very less. As the attachment system has very less space requirement parallism between the attachments are not necessary. It consists of two parts i.e.Patrix – eccentric cylinder with undercut or groove and Matrix – Clip or clasp arm.Activation can be done by Bending the clasp arm toward the centre.

Ceka attachments

Ceka attachments consist of a male component that is securely attached to the tooth. The male component has rounded shape which is wider at top and split vertically into four. The female component is fixed over the housing or ring.

Zest Anchor Attachment

Zest Anchor was first presented to the dental profession in 1972. Originally employed as a component for

affixing overdentures to existing natural teeth. Later modified as ZAAG (Zest Anchor Advanced Generation). It allows up to 15 degrees of divergence in female orientation

Components - Polythene nylon stud and Funnel shaped tube.

Advantages: Reduce vertical space requirement, Loads are transferred more apically.

The zest anchor attachments obtain fixation by engaging post space which is prepared inside the root surface, and the female component is securely bonded in position. They possess the advantage of resolving the spatial constraint associated with the attachment being located within the root structure. Furthermore, the force applied to the abutment tooth is minimal due to the attachment point being positioned well below the level of the alveolar bone. Additionally, the attachment method is straightforward and does not involve any casting. Parallelism may not be required if multiple teeth are present due to the nylon male component's elasticity. They are prone to dental decay and breakage.

Introfix attachments

Introfix attachments are stud attachments that are oriented vertically and provide frictional retention. It possesses the dual qualities of being adjustable and replaceable. Due to their high height, they are prone to torque and should only be used in tooth-supported overdentures. A paralleling mandrel is required when more than one attachments are used.

The Schubiger attachment

The Schubiger attachment employs a screw system for a durable method of fixation. In addition, these devices necessitate the use of a parallel mandrel and are particularly suitable for teeth with divergent roots. If one or more abutment teeth are lost, the Gerber attachments can be altered and interchanged.

Bar Attachments

The primary objective of bar attachment is to stabilize and immobilize the abutment teeth, while also providing secure retention and structural support for the prosthetic appliance. Bar units are characterized by their rigidity, while bar joints are known for their lack of rigidity. The first one is supported by the teeth, while the second one relies on the support provided by the remaining ridge of the jaw.

The Header bar system

The Header bar system comprises prefabricated plastic bars and plastic/metal clips. The plastic bar is attached to coping and casted with the coping; if additional retention is required plastic clip can also be casted and transformed into metal clip.

The Dolder bar system

The Dolder bar system comes in bar unit and joint configurations. The bar has a frictional fit and it can only achieve a near-perfect fit to the ridge contour. The larger size of the bar makes achieving aesthetic appeal challenging. The male portion is rigid and egg-shaped while the female portion is a thin, flexible metal sleeve that fits exactly to the widest part of the male portion. Retention is due to frictional fit and a perforated metal plate is attached to the top of the sleeve for retention in the denture. The presence of a spacer allows vertical movement.

The Baker clips

This joint attachment consists of U shaped clip made to fit over a round wire of either 11 or 14 gauge. The simplicity and inexpensive cost of it are its key advantages. If the clip is worn or broken it can be easily

replaced by grinding the denture base and new one can be inserted.

Ackerman and CM clips

Ackerman and CM clips are capable of both vertical and horizontal movements. Because of their compact size and simple installation, they are ideal choices for situations that require a bar system.

Indications for bar attachments

- Patients having sufficient or reasonably large inter-arch space.
- When minimum resiliency and maximum retention from a removable denture are expected.

Contraindications

- Patients with minimum inter-ridge space.
- Patients with poor compliance in maintenance and oral hygiene.
- Patients with financial limitations.
- The utilization of bar attachments in a V-shaped ridge is not recommended due to the potential encroachment upon lingual space.

Advantages of bar attachments

- Rigidly splint the teeth.
- Provides good retention, stability, and support.
- Provides cross-arch stabilization.
- Situated in proximity to the alveolar bone, demonstrating reduced leverage.

Disadvantages

- Technique-sensitive, expensive, and present difficulty in hygiene maintenance under the bars, leading to mucosal swelling or gingival hyperplasia.

Magnets

Magnetic retention system has been used in prosthodontics for some 110-120 years. Initially Co-Pt alloy or Alnico alloy were used to make magnets. The pioneering work of Gillings lead to the development of split pole magnet assembly using cobalt, samarium alloys. When paired with magnetisable alloy this produced closed magnetic retention.[8] Magnetic attachments are shorter, can be used in cases of reduced inter-arch space, and allow for moderately nonparallel abutments. They do not require laboratory procedures and are more resilient, allowing easy prosthesis movement. However, they require removal before magnetic resonance imaging due to streaking, and their retention is less than ball attachments when the number of implants is few. Additionally, heating during sterilization can decrease retentive forces in long-term use.[20–22]

Recent Advances and Future Perspectives

Overdenture attachment systems can be combined with more recent materials. Polyether ether ketone (PEEK) and polyether ketone ketone (PEKK) have gained significant popularity in the field of implant and restorative dentistry in recent times.[23,24]

Conclusion

Overdentures, a removable dental prosthesis, have been used for over a century to prevent future problems related to form, function, and appearaence. They maintain proprioception, directional sensitivity, and canine response, and are suitable for patients with compromised dental arches, congenital anomalies, maxillofacial trauma, worn-out dentition cases, and abnormal jaw size. Overdenture attachments include stud, bar, magnets, and telescopic. Regular evaluations are necessary to ensure the health of supporting tissues. Advances in materials like PEEK and PEKK have further improved overdenture attachment systems.

References

1. Winkler S. Essentials of complete denture prosthodontics. 2nd ed. (AITBS Indian ed.). Delhi: A.I.T.B.S. Publishers, 2009.
2. Dhir R. Clinical assessment of the overdenture therapy. J Indian Prosthodont Soc 2005; 5: 187.
3. The Glossary of Prosthodontic Terms 2023. J Prosthet Dent 2023; 130: e1–e3.
4. Reitz PV, Weiner MG, Levin B. An overdenture survey: Preliminary report. J Prosthet Dent 1977; 37: 246–258.
5. Yalisove IL. Crown and sleeve-coping retainers for removable partial prostheses. J Prosthet Dent 1966; 16: 1069–1085.
6. Kapadia A, Wankhade S, Khalikar A, et al. Comparing the functional efficiency of tooth-supported overdentures and implant-supported overdentures in patients requiring oral rehabilitation: A systematic review. Dent Res J 2022; 19: 94.
7. Dolder EJ. The bar joint mandibular denture. J Prosthet Dent 1961; 11: 689–707.
8. Preiskel HW. Overdentures made easy: a guide to implant and root supported prostheses. London: Quintessence, 1996.
9. Crum RJ, Rooney GE. Alveolar bone loss in overdentures: A 5-year study. J Prosthet Dent 1978; 40: 610–613.
10. Samra R, Bhide S, Goyal C, et al. Tooth supported overdenture: A concept overshadowed but not yet forgotten! J Oral Res Rev 2015; 7: 16.
11. Miller PA. Complete dentures supported by natural teeth. J Prosthet Dent 1958; 8: 924–928.
12. Brewer AA, Morrow RM. Overdentures. 2nd ed. St. Louis: Mosby, 1980.
13. Manly RS, Pfaffman C, Lathrop DD, et al. Oral Sensory Thresholds of Persons with Natural and Artificial Dentitions. J Dent Res 1952; 31: 305–312.
14. Loiselle RJ, Crum RJ, Rooney GE, et al. The physiologic basis for the overlay denture. J Prosthet Dent 1972; 28: 4–12.
15. Rissin L, House JE, Manly RS, et al. Clinical comparison of masticatory performance and electromyographic activity of patients with complete dentures, overdentures, and natural teeth. J Prosthet Dent 1978; 39: 508–511.
16. Heartwell CM, Rahn AO. Syllabus of complete dentures. 4th ed. Philadelphia: Lea &Febiger, 1986.
17. Lord JL, Teel S. The overdenture: Patient selection, use of copings, and follow-up evaluation. J Prosthet Dent 1974; 32: 41–51.
18. Morrow RM, Feldmann EE, Rudd KD, et al. Tooth-supported complete dentures: An approach to preventive prosthodontics. J Prosthet Dent 1969; 21: 513–522.
19. Miller PA. Complete dentures supported by natural teeth. J Prosthet Dent 1958; 8: 924–928.
20. Boeckler AF, Ehring C, Morton D, et al. Corrosion of Dental Magnet Attachments for Removable Prostheses on Teeth and Implants. J Prosthodont 2009; 18: 301–308.
21. Ceruti P, Bryant SR, Lee J-H, et al. Magnet-retained implant-supported overdentures: review and 1-year clinical report. J Can Dent Assoc 2010; 76: a52.
22. Boeckler AF, Morton D, Ehring C, et al. Mechanical Properties of Magnetic Attachments for Removable Prostheses on Teeth and Implants. J Prosthodont 2008; 17: 608–615.
23. Alqurashi H, Khurshid Z, Syed AUY, et al. Polyetherketoneketone (PEKK): An emerging

biomaterial for oral implants and dental prostheses. J Adv Res 2021; 28: 87–95.

24. Najeeb S, Zafar MS, Khurshid Z, et al. Applications of polyetheretherketone (PEEK) in oral implantology and prosthodontics. J Prosthodont Res 2016; 60: 12–19.