

ATTACHMENT SYSTEMS IN OVERDENTURE THERAPY: A REVIEW

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Abstract

Overdenture conventionally is a partial or complete denture prosthesis constructed over existing teeth or root structure. Attachments are the linchpins of an overdenture. Based on the clinical situation there are various attachment systems that are used accordingly. It is important that the clinician knows well about the attachment system and the amount of mechanical load that the clinical situation is going to deliver on the system. This article reviews the various attachment systems available in the market and their descriptions, advantages and disadvantages.

Keywords: Overdenture, attachment systems, implant supported overdenture, tooth supported overdenture, stud attachments, bar attachment, magnets, telescopic attachment

Introduction

Overdenture conventionally is a partial or complete denture prosthesis constructed over existing teeth or root structure. The use of overdenture therapy

was dated back a century back and has been still follow prosthodontists.¹ Preventive prosthodontics has become a trend and the use of overdentures has increased to the point where it is now feasible alternative to most treatment plan outlines in the construction of a prosthesis for patients with some remaining teeth or even no teeth. Implant supported overdentures are presently one of the best options for replacing missing teeth due to their added advantages as well as they are not very expensive and are within the reach of many patients. Attachments are the linchpins of an overdenture. It is important that the clinician knows the attachment system well and the amount of mechanical load that is going to deliver on the system. In tooth supported overdentures there are many conventional techniques including simple tooth modification and reduction, tooth reduction and cast coping, endodontic therapy with amalgam plug, endodontic therapy with cast coping utilizing some form of attachments.¹

Attachment Systems

Usually, a tooth supported overdenture procedure

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that incorporate the use of attachments will commonly use anterior teeth, preferably two canines. After endodontic therapy, the clinical crowns are reduced to the height of the adjacent tissues. The denture is then completed and delivered to the patient. The teeth that are to receive the attachments are prepared following the necessary adjustment period. A special diamond rotary instrument is used for this preparation.⁹

The mostly commonly used approach for using abutments in overdenture therapy is using endodontically treated teeth with cast coping using some sort of attachment. This approach should be reserved for patients which requires significant improvement in retention and stability. The abutment need low caries index, adequate bone support, good periodontal prognosis and meticulous oral hygiene for taking the increased stress that the attachment brings to the tooth. Better retention is given on the casting by various means like lengthening the post in the root canal or by adding pins to the casting. The attachment needs some available interridge space for its construction.

Classification

Even though various types of attachment systems are available, mainly there are four types of attachment assemblies which are commonly used namely

Stud attachment

Bar attachment

Magnets

And Telescopic²

Wismeijer et al. (1999)⁵ and Epstein et al⁶ had described the absolute retentive capacity of overdenture attachments. Based on retention, the attachments can be classified into

- 1) Frictional,
- 2) Mechanical,

3) Frictional-Mechanical and

4) Magnetic Attachments.

According to Winkler¹ they can be rigid or resilient based on the type of movement. Leung and Preiskel had suggested the resiliency of the attachments in relation to stress dissipation.⁷ Attachments based on resiliency are classified as²:

- Rigid nonresilient attachment: No movement is seen between the abutment and implant in such attachments. It is only recommended when adequate number implants are available. They are rigid and hence do not provide any relief to the supporting implants.
- Restricted vertical resilient attachment: Such attachments doesn't allow any lateral tipping or rotary movements. They can provide around 5-10% of relief by allowing attachment movements in a vertical direction.
- Hinge resilient attachment: They are able to resist rotational forces and lateral tipping. They also provide 30-35% of reduction in load to the supporting implants
- Combination resilient attachment: There is unrestricted vertical and hinge movements in these and provide 45-55% of load relief by uniformly transferring the masticatory load from implants to the residual ridges
- Rotary resilient attachment: vertical, hinge, and rotation movements are allowed by these attachments. And to the supporting implants they provide 75-85% of load relief.
- Universal resilient attachment: all kinds of movements are almost possible. There is 95% of load relief to the supporting implants.⁸

Stud Attachments

Stud attachments are one of the oldest attachments used in overdentures. It has a male stud type that is attached to the base, which is a coping over an

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endodontically treated tooth stump or an implant abutment.¹ They can be divided into two groups:

- Extraradicular, where male component projects from root stump or implant.
- Intraradicular, where male component is a part of the denture base.¹⁰



Fig:1

Ball attachment, Locators, O-ring attachments, Extracoronal Resilient Attachment (ERA) attachments are very commonly used. ERA attachments are rigid attachments and are considered best for parallel implants. For clinical application with implant-supported overdentures ball attachments are considered as the most simplest type of attachments. But, the main drawback of this system is that the O-rings loose retention with time and to be replaced periodically.¹¹

If implants are nonparallel and angulation is $> 15^\circ$, stud attachments cannot be used.² To overcome this disadvantage of stud attachments, locators were developed in 2001.¹² Also stud attachments provide two movements-vertical and hinge, whereas locators has universal hinge movement. The major areas to be considered while aligning these attachments is its relation to one another and to the path of insertion of denture.

Their advantages are that it can be used in cases of limited inter-arch space and can accommodate inter implant angulations up to 40° . Locator attachments provide two types of retention, one which is mechanical and another is frictional. The

mechanical retention is given by outer margin of attachment engaging the shallow undercut area on abutment. Since the nylon male component is slightly oversized than its female component it gives a frictional fit. Locator attachments are used without an inner retention feature so that they can correct implant angulation.¹²

Disadvantages of using locator attachments are that they cannot be used in cases where rigid restoration is required and due to constant wear and tear, regular replacement of male nylon part is needed. In a retrospective no significant difference was observed between stud and bar attachments.¹⁴

Some stud attachments can be entirely rigid because of their small size. Springs and other devices have been incorporated in some designs so as to allow for some movement. Gerber, Dalbo, Zest, ERA, Prosnap, Profix are different stud attachments. Gerber is the largest stud unit.¹⁰

Gerber attachment allows vertical movement and a rigid attachment that does not allow movement of base. Retention is given by the spring clip in the female housing engaging a groove in the male section. It is easily replaceable.

Dalbo attachment can be rigid, resilient, and stress broken, the resilient being the most commonly used. They allow vertical and rotational movement of the female component around a sphere shaped male component.

Ceka attachments has male component affixed to tooth with four sections capable of being compressed and are flexible.

Zest anchor attachments derives retention from within root and female component is cemented to place. They have advantage of overcoming the space problem that the attachment is within root structure. Also the leverage on the abutment tooth is negligible because the point of attachment is well below the alveolar bone level and the attachment procedure is simple without any casting. If more

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than one tooth is involved then parallelism may not be necessary because of the flexibility of nylon male component. They have disadvantages of susceptibility to caries and fracture.

Introfix attachments is tall stud attachment providing frictional retention. It is adjustable as well as replaceable. Due to their height they are subjected to torque and hence should be used in only tooth supported overdentures. They also require paralleling mandrel if more than one attachment is used.

Schubiger attachment uses a permanent form of fixation using a screw system. They also require paralleling mandrel and are highly indicated for teeth with diverging roots. They can be converted and interchanged with Gerber attachments if one or more abutment teeth is lost.

Bar Attachments

The purpose of bar attachment are splinting of the abutment teeth, retention and support of the prosthetic appliance. There are rigid types called bar units and non rigid ones called bar joints. The former is tooth borne and the later is utilizes residual ridge support.

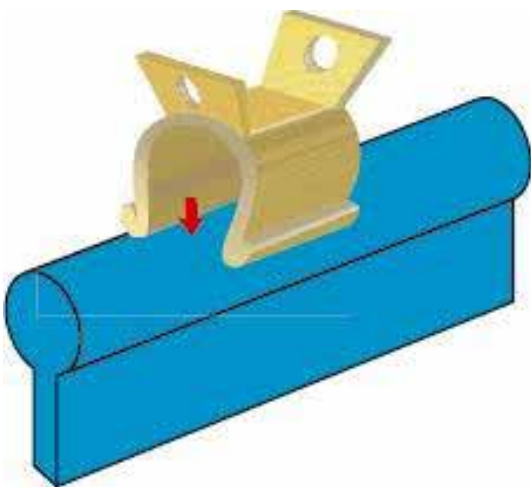


Fig:2

Hader bar system consist of preformed plastic bars and plastic/ metal clips. Retention can be improved by adding more clips.

Dolder bar system supplied as both bar unit and joint. Since the bar is preformed it can approach only close adaptation to the ridge contour because it remains in a straight line. Retention is due to frictional fit. They are bulkier making esthetics very difficult. Baker clip consist of a small 'U' shaped clip designed to fit over a round wire.

Ackerman and CM clip can have vertical and horizontal movements. Due to their smaller size and ease of fixation they are excellent option where bar system is indicated.

Magnets

Magnets were not very commonly used for dental purposes till few decades ago. Their benefits include simplicity, low cost, automatic reseating after denture displacement, comparative freedom of lateral denture movement, a low potential for trauma to the retained roots, self-adjustment, inherent stress breaking and no need of adjustments.¹⁵



Fig:3

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Magnets which are commonly used in implant dentistry are basically made of aluminum-nickel-cobalt metals. As they allow all the movements of the prosthesis, they are classified as universally resilient attachments. But unlike the mechanical attachments, the magnetic forces of attraction generated to provide retention were weaker. Hence these are not very successful to provide retention. They can also get corroded in saliva on long-term use.¹⁶ To overcome this, newer generation magnets were developed which is made up of rare earth elements such as samarium and neodymium.¹⁷ These have improved the properties of conventional magnets.^{18,19}

The advantages of magnetic attachments are that as they are shorter when compared to others, they can be used in cases of reduced inter-arch space.¹⁷ Moderately nonparallel abutments can also use them since they do not follow a specific path of insertion.¹⁷ Laboratory procedures associated with castings are not necessary. They are more resilient and hence allow easy movement of prosthesis.

Disadvantages include, attachment needs to be removed before taking magnetic resonance imaging because it causes streaking¹⁷, when numbers of implants are relatively few, retention is not as good as when ball attachments are used. They have least retention and heating during sterilization leads to decrease in retentive forces in long-term use.²⁰

Telescopic Attachment

The telescopic crowns have been in use since years, to connect teeth to overdenture, but their use in an implant supported overdenture is limited. As they provide rigid attachment they are sometimes used for immediate loading. But due to its design they require adequate inter-arch space to be used, in cases where sufficient inter-arch space is not present it cannot be used. The new syncone system has been used in immediate loading cases.²⁰

Syncone-concept

The syncone system contains of prefabricated titanium abutments and their corresponding gold retainers with 4-6° taper. The abutments are able to correct the angulations by 15° and can rotate 360° for better alignment. Gold retainers fit on titanium abutments and has excellent retention which also improves over time due to the settling phenomena.²⁰

Advantages of telescopic crown techniques are that they give excellent immobilization of the restoration, flexibility of design, easy maintenance of oral hygiene. The syncone system has wear resistant attachments and also be used on angulated abutments.

Discussion

It is critical that the appropriate attachment be used for each individual patient situation. These classification systems helps in having a broader view about the type of attachment to be used in each clinical situation for which an attachment is intended.

In 1976 George L et al, in his article discusses a method of overdenture construction using the Dolderbarjoint attachment. He said the teeth selected as abutments should have approximately one-third of the supporting alveolar bone remaining and no more than Class II hypermobility.²² Reducing the clinical crown of periodontally involved abutment teeth brings the support for the overdenture bar more closer to the bone. The mobility can be reduced by cross arch splinting, Use of Quinlivan attachment showed satisfactory follow-up report in a case reported by Nair V et.al in 2020, in which use of metal press button is found to be a simple technique to fabricate overdenture attachments economically.²³ Chen T et al did a study to evaluate patient satisfaction and masticatory efficiency between two attachments-locators as stud attachment and magnetic (Magfit) attachment in single implant supported overdenture. Even though locator attachment showed a better

chewing efficiency than Magfit attachments, there were no reliable statistical significance.²⁴ In a finite element analysis John J et al the stress distribution around the implant supporting mandibular overdenture using two attachment- ball/O-ring and magnetic, was evaluated and concluded that if larger diameter attachments are used then implants with greater diameter can reduce the stress on the cortical bone.²⁴ The meta-analysis by Chaware SH evaluated the various attachments and suggests that ball attachments give excellent outcome when the number of implants is less and when more than two implants are possible, bar or locator attachments give better outcome. He also concluded that in maxillary arch splinted bar attachments are can be used and in mandibular arch, locators or un-splinted ball are preferred. Among all ball and locator attachments has been documented with excellent survival, favorable tissue response, and good patient satisfaction especially in case for mandibular overdentures through various studies.

Conclusion

There has been various attachment system used in tooth and implant supported overdentures. But to provide a successful treatment, the clinician should have a thorough knowledge of various attachments available, their use and adaptability in various clinical situations, benefits and demerits of using it. While using any particular type of attachment system clinician should try to fulfill almost all the necessary requirements which are essential for stable and successful esthetic and functional rehabilitation of that system.

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Conflicts of Interest

There are no conflicts of interest.

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