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An insight into various attachments used in prosthodontics: A review

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Abstract

Partially edentulous patients require more attention and the dentist has to use his knowledge and skill in providing an esthetic and functional prosthesis, using the support of the remaining teeth and ridge. Precision attachment denture has always been considered beneficial for the patient, because it combines both fixed and removable prosthodontics, giving a more esthetic and functional outlook to the denture. Use of precision attachment has simplified and amplified the aspects of retention, function and esthetics when compared to the conventional removable partial dentures. This article discusses about the various attachments used in treating partially edentulous patients.

Keywords: precision attachment, intracoronal attachment, extracoronal attachment, keyway attachment

Introduction

In the present society, patients approach a dentist for two main reasons; discomfort or esthetics. The dental professional must be able to relate to the patient's concerns, both physically and psychologically. Attachments are used as alternative to clasps in removable partial denture therapy, which gives both esthetic and functional outcome. According to GPT 9, Attachment is defined as a mechanical device for the fixation, retention and stabilization of a prosthesis. It includes frictional, internal, intracoronal, extracoronal, key-key way, parallel, precision and slotted types. The correct use of attachments may overcome both physical and psychological problems associated with conventional RPD designs. Just as patient's needs differ, so do attachments.

Attachments act as stress redirectors and absorbers. Their function is to preserve soft tissue and bone as well as provide retention. The direct retention function of precision attachments prove to be more efficient than clasps, but the clinical situations in which they are used require careful assessment, as in all cases the patient's standard of oral hygiene must be good and this factor is of even greater importance to the success of a precision attachment partial denture.

In recent years, patients have become aware of the treatment possibilities available to them from restorative dentistry and as a result the demand for advanced restorative techniques has increased. So the modern day practitioner should view precision attachment as a device that can add versatility to the practice of dentistry.

History

The history of precision attachment work dates back to 1886, when Stair devised a unilateral removable partial denture employing anterior and posterior telescopic abutment restoration [1]. Parr (1886) gave "Extracoronal socket attachment". George Evans in 1888, got the credit for the introduction of the precision attachment retainer system [2].

In the 19th Century the various extracoronal and intracoronal attachments were developed. Bennett (1904), Fossume (1906), and Gilmore (1913) had designed bar attachments as substitutes for fixed restorations, their names are still applied to various forms of bars. Materials employed were gold, platinum, and iridioplatinum. Earlier intracoronal retainers were named the split-bar attachment, tube and split-post attachment, solid-post and tube attachment, and the winged lug attachment. Among the first custom crafted, intracoronal types of attachment system used was the winged lug attachment [2].

Dr. Herman E.S Chayes, developed the concept of internal frictional resistance early in the twentieth century. Chayes in 1906, developed the T shaped precision attachment. In 1912, he designed Chayes attachment. This forms the basic pattern for most of the modern attachments. Chayes also put forward the stress breaker design, which is an attachment to which a hinge was added, thus allowing limited simple movement and this design was later improved by McCollum^[3,4].

Ash in 1912 introduced the split bar attachment system. Helmut Hader in 1960 discovered the Haderbar, those available as prefabricated plastic pattern. In 1978, Boitel discovered Rigid, Resilient (ERA and O-Ring) and Bar attachment.

In 1923, the first semi precision attachment was given by Gillete. Gerardo Becerra and others introduced Intradental (frictional and magnetic) and extra dental (cantilever and bar) attachment in 1987.^[5] Yen Chen Ku *et al* discovered the concept of “ERA” (esthetic, vertical resiliency, easy

replacement of worn denture) in the year 2000^[6].

Classification

1. Based on their method of fabrication and the tolerance of fit between the components

A. Precision attachment - They are prefabricated machined components with precisely manufactured metal to metal parts with close tolerance.

B. Semi precision attachment- They are laboratory made or custom made type. The components usually originate as prefabricated or manufactured patterns (made of plastic, nylon or wax) or Hand waxed^[1,7].

2. Based on shape, design and primary area of utilization of attachment (MENSOR-1973)^[8] Table: 1

- A. Coronal
- B. Radicular
- C. Accessory

Table 1: Based on shape, design and primary area of utilization of attachment (Mensor-1973)

Coronal	Radicular	Accessory
1. Intracoronal 2. Extracoronal	3. Telescope stud (pressure buttons) 4. Bar - Joints - Units	5. Auxillary A. Screw units B. Pawl connectors C. Bolts D. Stabilizers/balancers E. Interlocks F. Pin/screws G. Rests

Goals

The goals given below parallel the classical objectives of restorative dentistry, that is, to restore function, esthetics, comfort, and be less invasive and more conservative. The goals for fabrication of precision attachment partial denture are as follows:

1. To provide an efficient masticatory replacement for lost dental organs.
2. To be removable and replaceable without stress or strain on the abutment teeth and supporting structures.
3. To permit normal anatomic form to the abutment teeth.
4. To be capable of being tissue supported in a controlled manner.
5. To provide many years of comfortable service to the patients.

6. To be made of materials those are biocompatible.
7. To be esthetically acceptable and satisfactory to the patient.
8. Minimal amount of tooth structure to be removed.
9. To avoid endodontic procedures.
10. To be hygienically clean.

Indications and contraindications^[9, 10, 11, 12]

In partially edentulous cases, it is important to decide whether to go for a fixed prosthesis or removable or both. And if removable, whether the treatment decided can be applied or not. In order to reach at final treatment plan it is very important to know where these attachments can be used and where they are not indicated.

Table 2: Indications and contraindications of precision attachments

Indications	Contraindications
<ol style="list-style-type: none"> 1. Long-span replacements 2. As stress breaker in Free-end saddles 3. Periodontal involvement that contraindicates fixed partial dentures 4. Situations which require maximum esthetics 5. Movable joints in fixed movable bridge work 6. As contingency devices for the extension or conversion of existing fixed appliances. 7. Sections of a fixed prosthesis may be connected with intra coronal attachments 	<ol style="list-style-type: none"> 1. Teeth with short clinical crowns (this can be overcome with periodontal surgery). 2. Teeth that are narrow faciolingually. 3. Teeth that have extremely large pulps (young people). 4. Any patient who has a contraindication for a partial denture (health, non co-operative). 5. Patient’s lack of dexterity or ability to use the hands. 6. Severe periodontitis 7. In high caries index patients

Guidelines to be followed in precision attachment cases^[2]

1. Splinting of abutment teeth

The abutment teeth selected for precision attachment in removable partial denture should be splinted together.

2. Length of attachment

- The length of the attachment is more important than the

width.

- A full length, narrow attachment is preferable to a short, wide attachment.
- The length of the attachment to be embedded in the abutment tooth for proper fabrication of the prosthesis is governed by the height of the clinical crown of the tooth.
- All precision attachments used should be of equal length.

If this is not feasible, pairs of precision attachments on similar teeth bilaterally should be of equal length.

3. Parallelism of attachment

The attachments should be parallel to each other in order to avoid improper fit, mutilation of attachments.

Different attachments

Intracoronal attachments

They are used to connect units of fixed partial prostheses, retaining restorations with distal extension or bounded removable prostheses. Intracoronal attachments are effective as retainers for bilateral and unilateral prosthesis. They are effective as connectors to join sections of fixed prosthesis. They come as two components, matrix and patrix. Matrix (female component) is waxed into the crown or bonded into a preparation in the tooth. Patrix (male component) is attached to the framework usually by soldering. They are classified.

1. Based on retention

a. Those whose retention is entirely frictional

E.g. McCollum intra coronal unit.

The friction fit intracoronal attachments with adjustment potential are Chayes, Crismani attachments, McCollum unit, Ankra attachment, T-Geschiebe 123. Whereas, those frictional fit intracoronal attachments without adjustment potential are considered to be unsuitable for removable prosthesis, as repeated insertion and removal will lead to the wear of the attachment. They are useful for joining a series of crowns without a common path of insertion. E.g.: Beyler.

b. Those whose retention is augmented by a mechanical lock. E.g. Schatzmann unit.

2. Based on the cross sections

- H-Shaped flanges-This strengthens the attachment, without increasing the size of the female part.
- T-shaped flanges. E.g. Chayes attachment.
- Attachments with a circular cross section- They are suitable only for joining two sections of a fixed prosthesis.

Extracoronal attachments^[13]

These attachments provide stability and retention for removable distal extension prostheses.

- Projection units: These units are attached to the proximal surface of a crown. E.g: ASC -52.
 - Those that provide a rigid connection. e.g.: Conex attachment.
 - Those that allow play between the components. e.g.: Dalbo, Ceka attachment.
- Connectors: These units connect two sections of a removable prosthesis and allow a certain degree of play E.g.: Dalbo-fix used between a telescope crown and partial denture.
- Combined units: This attachment consists of an extracoronal placed hinge type unit connected to an intracoronal attachment. E.g.: Schatzmann attachment consisting of an intracoronal section with a projection.

Stud attachments: They are in the form of ball & socket and this attachment serves primarily for over denture stabilization and retention of the prosthesis. Zest anchor, Rothermann unit, Baer and Fah units are examples of stud attachments.

Advantages –

- Better oral hygiene

- Crown root ratio is improved with low profile stud attachments.

Bar attachments

It consists of a bar over an edentulous area joining together teeth or roots. The denture engages over the bar and is connected to it with one or more sleeves. They are of 2 types. One is the bar joint which permits rotation and other is bar unit which is rigid.

Bar joints can be subdivided into-

Single sleeve bar joints. Eg: Dolder Bar Joint

Multiple sleeve bar joints. Eg: Gilmore, Ackerman, Hader bar joints

Multiple sleeve bar joints have more versatility than single sleeve bar joints, but bar seems to have less rigidity. The bar units provide excellent retention and stability for a denture while rigidly splinting the abutments.

Drawback-Bar provides a medium for accumulation of plaque.

Magnets as attachments

Magnets used in dentistry are made of either samarium cobalt (Sm-Co), neodymium iron boron (Nd-Fe-B) ^[14, 15]. Their small size, strong attractive force, constant retention, automatic reseating, cost and less lateral force to the abutment tooth can be mentioned as advantages. Whereas, their disadvantage is that they are liable to corrode in oral fluids over time. Overdentures with magnetic attachments are known as Magnetic dentures.

Auxiliary attachments

Usually they are used with other attachments for improving retention. A variety of attachments fall into this category. They are screw and tube attachment, key and keyway/interlocks, press o matic, Sectional dentures, bar connectors ^[16].

Benefits and drawbacks

Apart from retention and esthetics, one of the major benefits of precision attachments is the versatility they can add to treatment planning and design of a case. The prefabricated precision attachment has the advantage of being fabricated from metal alloys which are harder and more wear-resistant. The complex design of clasp is eliminated and yet, serves the functions of an occlusal rest, clasp arm, and bracing arm and there is a considerable reduction in the bulk of the prosthesis. Whereas, the extensive preparation of abutment teeth, cost factor for the patient and lengthy laboratory and chairside time can be listed out as their drawbacks.

Conclusion

The greatest deterrent to the use of attachments is their complex design. A thorough understanding of the case and knowledge about the various attachments, and its applications and limitations is a must in order to apply in it clinical cases. Precision attachments serve the function of retention, stress distribution and esthetics successfully. Accurate selection of attachments depends mainly on location, retention and available space. Appropriate selection of attachments, plays a major role in the success of treatment. Proper maintenance and care by the patient and regular follow up decides on the long term success of the attachment and prosthesis. Use of precision attachment strengthens the aspects of retention and particularly, esthetics when compared to conventional removable partial dentures.

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