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REVIEW ARTICLE

PRECISION ATTACHMENT- AN OVERVEIW

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ABSTRACT

A precision attachment is mechanical devices made up of two or more parts. One part is connected to a tooth, root or implant, the other to an artificial prosthesis to provide mechanical connection between the two. Attachments are used as alternative to clasps in removable partial denture therapy for both aesthetic and functional purpose. Their application is not only limited to removable partial dentures, but has a broader usage in fixed bridges, over dentures, implant supported dentures as well. Although added preparations and skills are required to provide precision attachment more favorable esthetics and load distribution which may outweigh the disadvantages. This article reviews different systems of classifying these devices to provide an overview of the designs available.

INTRODUCTION

The term precision denotes "the quality or state of being precise" (Abhilash Anantharaju, 2013). The precision attachment denture has long been considered advantageous in dentistry as it combines fixed and removable prosthodontics in such a way so as to create the most esthetic partial denture possible. Nevertheless in past they have been largely ignored by most dental professionals for understandable reasons, notably due to cost and inadequate grasp of their application (Gareth Jenkins, 1999). Misconceptions about the use of intracoronally retained prosthesis have discouraged many practitioners to use them in their dental practices. However the prosthodontist who employs this form of treatment quickly learns of its benefits in providing patients with an esthetic prosthesis and with increasing demand for complex and esthetic restoration and an increase in popularity of implant has brought a concomitant increase in the popularity of attachment retained prosthesis. Precision attachments are sometimes said to be a connecting link between the fixed and removable type of partial dentures because it incorporates features common to both types of prosthesis (Abhilash Anantharaju, 2013). Steiger and Boitel (1959) wrote that precision attachments in dentistry are a means of bodily function for a removable bridge or partial dentures (Khuthija Khanam, 2013). Precision attachments retain and attach a removable bridge or partial denture on natural teeth vital or nonvital. Some serve as retainers for full dentures (overdentures) where few abutments remain. The main purpose of each precision attachment besides retention is its concealment within or under a restoration as an esthetically better alternative to a visible clasp retainer (Abhilash Anantharaju, 2013). Inherent in the conceptions which have led to the development of precision attachments are two basic objectives. These are:

- To relate the desired platform to the available tooth support.
- To distribute as far as possible the load to be thrust on the teeth by the appliance.

History

The historical background of precision attachment work is some obscure. Winder and Parr invented devices which are

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clearly attachments both in principle and design, credit is usually given to George Evans 1888 for introduction of precision attachment retainer system. Winder gave screw joint retention also termed as "winders design". Parr (1886) gave "Extracoronal socket attachment" Early pioneers such as Peeso (1894), Carr (1898) Goslee (1913) Gilmore (1913), Fossume (1906), Bennett (1904), Brown, Bryant, Conduit, Golobin, Kelley, McCollum, Morgan, Roach, Sorensen, Supplee (all from Unites States of America) were highly innovative with their designs, had only limited insight into the biologic dynamics of fixed and removable prosthodontics as related to the periodontal apparatus (Harold, 1979). In the 19th Century the various extracoronal and intracoronal attachments were developed. Among the first custom crafted intracoronal types of attachments system used was the winged lug attachment. This consisted of an intracoronal rest seat soldered into a restoration and a rest soldered to the partial denture framework. Manufactured attachment system were developed and introduced during the late 19th and early 20th century. These attachments simplify construction of the restorations. They allow standardization of the component parts and permit easy repair of the sections.

Without doubt, the most important character in the development of precision attachment dentistry was Dr. Herman. E. S. Chayes. He can be called the father of precision intra coronal retainer. Chayes was born in 1880 in Poland, from where he emigrated to New York in 1893. He invented a parallelometer (1908-1910) and in 1912 he designed Chayes attachment. This was the first attachment to be placed in the general market and still forms the basic pattern for most of the modern attachments. It is an intracoronal mesiodistal attachment. Chayes also gave the stress breaker design which is essentially an attachment to which a hinge has been added, so allowing limited simple movement this design was later improved by McCollum (Reeta Jain, 2017). Since then, the technology of attachments have progressed at such a rapid rate, that from a very simple T shaped attachments and bar attachments (1915-1935) to various attachments of most diversified designs are available today.

Ash (1912) introduced the split bar attachment system

Steiger, Boitel, Muller and Biaggi were the force runners. In 1959, Alfred Steiger and Raoul B. Boitel perfected channel shoulder – pin (C.S.P. system). In Europe, laboratory made attachments were known during first world war, when readymade attachments from United States were unobtainable. Helmut Hader(1960) discovered the HADERBAR, those available as prefabricated plastic pattern. After that in 1992 English, Donnel & Staubli discovered the Hader EDS system. Louis Blatter Fein(1969) has given four aspect of rest seat preparation (circular, dovetail, rectangular and mortice). E M attachment gauge discovered by Matsus in 1970, Dr MC Mensor introduced E M Attachment selector in 1973. E M Selector have 105 attachments for quick references and 30 point of information (Merrill, 1973). Boitel discovered Rigid, Resilient (ERA and O-Ring) and Bar attachment in 1978. In 1980 Wolf R E gave limitation of use of attachments. First semi precision attachment was given by Gillete in 1923. Ira D Zinner (1979) had given Locking semi precision attachment and non-locking semi precision attachment (Zinner Ira, 1985; Zinner Ira, 1985). Gerardo Becerra and others (1987) introduced Intradental (frictional and magnetic) and extra dental (cantilever and bar) attachment (Gerard Becerra, 1987). Yen Chen Ku et al (2000) discovered the concept of "ERA" (esthetic, vertical resiliency, easy replacement of worn denture) (Ku, 2000).

Definition

Precision attachment

- A retainer consisting of a metal receptacle (matrix) and a closely fitting part (patrix); the matrix is usually contained within the normal or expanded contours of the crown on the abutment tooth/dental implant and the patrix is attached to a pontic or a removable partial denture or
- An interlocking device, one component of which is fixed to an abutment or abutments, and the other is integrated into a removablepartial denture to stabilize (GPT 9, 2017)
- Are wholly or partially machined accessories used in dentistry for the retention of removable or semi-removable prosthesis (G.E.Ray precision attachments; George E Ray 1978)
- A retainer used in fixed and removable partial denture construction consisting of a metal receptacle and a closely fitting part, the former is usually contained within the normal or expanded contours of the crown of the abutment tooth, and the latter is attached to a pontic or to the denture frame work (Jack H. Swepston – Dental laboratory Proceedings, Removable partial dentures – Rhoads, Rudd, Morrow, 1931)
- Implies a partly or wholly machined device consisting of a male and female components which is used in restorative dentistry to retain removable or semi-removable prosthesis (D.H. Roberts – Fixed bridge prosthesis, 1980)

Synonyms

Internal attachment, parallel attachment, frictional attachment, key and key way attachment, slotted attachment.

Intracoronal precision attachments

The bulk of the soldered or cast, one portion of the joint lies within the anatomical contours of the treated teeth (George E Ray, 1978)

Extracoronal precision attachments

Are used to join a prosthesis to a retainer, part of all of their mechanisms is outside the contour of the retainer (Merrill C. Mensor – Dental Laboratory Procedures, Fixed Partial Dentures, Rhoads, Rudd, Morrow) [John E. Rhoads et al., 1986]

Semi Precision Attachment

A laboratory fabricated rigid metallic patrix of a fixed or removable partial denture that fits into a matrix in a cast restoration, allowing some movement between the components; attachments with plastic components are often called semi precision attachments even if prefabricated (GPT 9, 2017).

Advantages (Kenneth D Rudd 1986; Roberts, 1980; John E. Rhoads, 1986; Harold W Prieskel, 1979; Carr, 2005; Misch, 2005; Stewart, 1986; Miller, 1979; Malone, 1997; Graber, 1988).

1. The labial or buccal clasp arm can be eliminated altogether. This makes spectacular improvement in the esthetic excellence of a denture especially in the maxillary arch.
2. Precision attachments are less stressful to the abutment teeth than conventional clasps. Precision attachment is located deep within the confines of the tooth therefore all stress is directed along long axis of the teeth.

Disadvantages (KennethD Rudd 1986; Roberts, 1980; John E. Rhoads, 1986; Harold W Prieskel, 1979; Carr, 2005; Misch, 2005; Stewart, 1986; Miller, 1979; Malone, 1997; Graber, 1988).

The tooth may have to be extensively cut to provide requisite space to accommodate intracoronal attachment.

- The attachment is subjected to wear as a result of friction between metal parts. As wear occurs, male portion fits more loosely thus permitting excessive movement and threat of injury to abutment teeth.
- The extra coronal type of retainer extends out from the tooth near the gingival border there may be a gingival irritation followed by usual inflammatory sequel.

Indications

Movable joints in fixed movable bridge work

- As stress breaker in free end saddles and bridges.
- Intracoronal attachments are effective retainers for removable partial dentures.
- As a connector for sectional dentures.
- Sections of a fixed prosthesis may be connected with intra coronal attachments.
- To lock a connector joining a saddle in the opposite side of the arch.
- As contingency devices for the extension or conversion of existing fixed appliances.
- Periodontal involvement that contraindicates fixed partial dentures.
- Labial clasp arms which would otherwise be displayed in the anterior part of the mouth and would be esthetically displeasing.
- To retain hybrid dentures.

Contraindications (Kenneth, D Rudd 1986; Roberts, 1980; John E. Rhoads, 1986; Harold W Prieskel, 1979; Carr, 2005; Misch, 2005; Stewart, 1986; Miller, 1979; Malone, 1997; Graber, 1988)

- Sick and the senile (prosthesis with attachments must be inserted along one precise path of insertion; the patient must possess an average degree of manual skill).
- Periodontosis.
- Abnormally high caries rate.
- Inadequate space to employ those teeth (Teeth that are very narrow facio-lingually).

Classification

Attachment classification by goodkind and baker 1976

Intra coronal attachments

- Resilient intracoronal attachments
- E.g. Crismani 689-A, Crismani 689-D.
- Non-resilient intracoronal attachments (Rigid attachments).

Extracoronal attachments

- Resilient extra-coronal attachments
- E.g. Crismani Resilience joint, Dalbo resilience joint, ASC 52 attachment
- Non- resilient extra-coronal attachments
- E.g. Spang Stabilex, Spang Conex

Attachments Can Be Classified Based on Method of Fabrication (Dr Burns, 1990)

- Those pre-fabricated by the manufacturer is called as precision attachment.
- Pre-fabricated type of attachment is usually made of precious metal.
- e.g. Channel shoulder pain attachments (C.S.P.)
- Plastic attachments:
- Indicated for removable and fixed dentures.
- e.g. Reinefert's Unirest B, Mortise Rest

Precision attachments can be classified according to rigid or movable articulations (g.e.ray) (George E Ray, 1978)

Rigid articulations

Group I: Attachments used principally with vital teeth. Passive, active or channel shoulder pin (C.S.P)
Group II: Anchorage used principally with pulp less teeth. Screw blocks and slide blocks

Movable articulations

Group I: Conjunctors – separable joints used principally with vital teeth
Group II: Connectors- separable joints used principally with pulp less teeth

Precision attachment can be described as passive, active, locked (g.e. ray) (George E Ray, 1978)

Passive attachments:

Are made in solid section so that patrix fits into the matrix in the fashion of interlocking parts of a jig saw, the retention between two parts depends on accuracy of the fit, shape of the joint, and area of contact.

E.g. Passive Omega attachment Passive Beyler attachment

Active attachments

Differs from passive attachments that some form of spring is used to give additional retention. Devices which incorporate leaf-springs, split rings or expanded collars are referred to Active friction grip attachments. E.g. Omega attachments active friction grip, McCollum attachment active friction grip, Schatzmann Snap – Grip attachments

Locked precision attachments

Locked precision attachments are either bolted together by means of a sliding bolt or latch (latch grip) or May by pinned or screwed together.

PRECISION ATTACHMENTS ARE CLASSIFIED INTO: (BY G.E. RAY) (George E Ray, 1978)

- Intracoronal attachment
- Extracoronal attachment
- Conjunctors
- Anchors
- Bars
- Accessory components

Classification of precision attachments which is based on the use of which they are put (devised at the institute of dental surgery, by Mr. R.valentine in collaboration with colleagues, eastman dental hospital, london).

Rigid retainers	- Rigid attachments (non vital teeth)	- Adjustable	- Chayes
			- McCollum
			- Stern
			- Crismani
		- Non-adjustable	- Beyeler
			- C & M 643
	- Rigid anchorages (vital teeth)	- All adjustable	- Eccentric
			- Bona
			- Gerber

Movable retainers	- Movable attachments (Non vital teeth)	- Dalbo, Crismani
	- stress breakers (for partial denture)	-Gerver Hinger, Ancorvis Hinger
	-movable anchorages (non-vital teeth)	- Bona, Dolder bar, Andrews bar
Auxiliary devices		- Isoclip
	Activators	- Schubiger
	latches, bolts, screws	- Hruska

According to types of installation of prefabrication attachment on abutment crowns

- Intra coronal E.g. McCollum attachment, Schwartzman attachment
- Extra coronal or Para coronal
- Interproximal attachment E.g. Snap-rox by Schwartzman
- Within a cantilevered bridge pontic Eg. Biloc attachment with wraparound
- On a cantilevered pontic E.g. Conex attachment by spang.
- Attachments in inter abutment bridge pontic.
- Prefabricated cap post systems on root copings E.g. Gerber retention cylinder.

The "Spectrum of Function, outlined identifies five classes of attachments based on their resilient function(s) or lack of them (Sossamon, 1986).

Class I	Rigid	Sterngold type 7 attachment, G/L attachment, D2.7 attachment
Class II	Vertical	Hader vertical, Preciverteg, Cylindrical resilient Dallabona
Class III	Hinge	May's attachment, Miniature Dalbo attachment
Class IV	Combination	Combination e.g. Octolink attachment, Standard Dalbo attachment
Class V	Rotation (+ Vertical)	O-So male attachment, Micropin female

Mechanism of Action (Gareth Jenkins, 1999; Harold W Prieskel, 1979)

Retainers must hold the prosthesis securely in place during chewing swallowing, speaking and other oral functions. Therefore, male and female portions must fit together precisely.

Resistance to separation within the attachment is by following mechanisms

Friction: Occurs when parallel walls of closely fitting bodies pass over one another. Friction occurs between contacting parallel walled bodies. The frictional force is directly related to the area of the opposing surfaces as well as to the length of axial walls. The shape of the passage also plays a substantial role.

The holding ability of frictional attachment can be enhanced by addition of active retention elements.

- **Spring –** loaded bolts on plungers
- **Leaf –** springs
- **Ring –** springs
- Bolts
- Rubber devices

Binding:- Occurs when a parallel walled body tips within its receptor site. Eccentric loads on frictional elements produce tipping movement, which create an additional binding effect significantly increasing resistance to withdrawal.

Wedging of conical bodies:- Friction comes into play only in the terminal position and is lost as soon as the bodies begin to separate.

Internal spring loading-: as produced by a clip within a cylinder. The friction within retainers is often increased by loading with internal spring clips. A slot in the male portion allows the pressure to be adjusted.

Active Retention:- That is when one body must be temporarily deformed to be withdrawn from its fully seated position. Active retention means a physical obstruction to separation of other parts. One part must undergo elastic deformation before separation can occur. Active retention by meant by means of a bulge at the end of a resilient slotted post. Active retention from ring spacing.

Guidelines for utilization of precision attachments

- When selecting potential abutment teeth for use in precision attachment type removable partial dentures, selected teeth should be splinted together for proper distribution of forces.
- Use a minimum of two thirds of the attachment (as supplied by the manufacturer).
- 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 and is a most important factor in attachment retention and stability. If the attachment length is less than 5 mm, another type of intracoronal attachment must be substituted, as there will be insufficient length for optimal utilization of the precision attachment.
- The length of the attachment is more important than the width. A full length, narrow attachment is preferable to a short, wide attachment.
- Prepare the abutment tooth sufficiently, so that the rest seat portion is maintained within the normal confines for the crown contours for proper periodontal health.
- All of the precision attachments utilized should be of equal length. When this is not feasible, pairs of

precision attachments on similar teeth bilaterally should be of equal length.

- clinical and laboratory procedures must be followed precisely. The attachments must be parallel to each other to avoid improper fit, mutilation of attachments and torqueing of abutments.

DISCUSSION

Ever since stress breaking became a part of prosthetic dentistry there has been a controversy with regards to it. Stress breakers were first introduced in Switzerland. They claimed that stress breaking was necessary in order to avoid torque and leverage upon the abutment teeth of a free end saddle denture. In the United States, they advocated rigid anchorage, according to them the rigid attachment would not cause any damage to the abutments because of bodily and torque free movements. Both school of thoughts have shown success and failure. Sound judgment, a nontraumatic occlusion, a healthy periodontium and a patient motivated for home care can help increase the success rate. The rule of thumb says that a healthy resistant periodontium usually does not require stress broken dentures whereas periodontally susceptible or damaged abutments need splinting of teeth into group unit and blocks and stress breaking the tissue supported parts of the partial dentures. A long saddle may be rigidly attacked but a short one resiliently, since torque upon the abutment decreases with the increase in saddle length.

Conclusion

The success of prosthesis depends on careful treatment planning and attention to the prosthodontic problems; the mechanical ingenuity of the attachment is important, but must take second place. Precision attachments serve the function of retention, stress distribution and aesthetics, successfully provided the case is planned based on sound biological and technical grounds and proper care is rendered by the dentist and the patient during the maintenance phase. Precision attachments present a challenge in the technical skill. A thorough understanding of the biomechanics of maxillomandibular function, different attachments available and knowledge of material science is essential in treating a case of precision attachment and also for success of prosthesis.

REFERENCES

Abhilash Anantharaju, Bobby Joseph, Chandan Kumar Kusum, Deviprasad Nooji. Connectors and attachments in oral rehabilitation; J NTR Univ Health Sci; 2013;2(3): 222-226

Carr AB, McGivney GP, Brown DT. 2005. McCracken's Removable Partial Prosthodontics. 11thed. St. Louis, Missouri: Elsevier Mosby.

D. H. Roberts – Fixed Bridge Prostheses. 2nd ed. Bristol, England: John Wright and sons; 1980.

Dr Burns and Ward JE. 1990. Review of attachments for RPD design Classification and selection: IJP; 3(1) : 90-102.

Gareth jenkins, Precision Attachments, 1999, page 7-8

George E Ray – Precision attachment, 2nd edition, chapter 1, page 9.

Gerard Becerra, Michael Mac Entee, 1987. A classification of precision attachments : JPD58(3); 322-326

Glossary of prosthodontics terms, 9th Edition, JPD 2017; 117(5s); 1-10

Graber G. C. 1988. olour Atlas of Dental Medicine vol 2 Removable Partial Dentures. Stuttgart, Germany: Georg Thieme Verlag.

Harold W Prieskel, 1979. Precision Attachments in Dentistry, 3rd edition.

John E. Rhoads, Kenneth D. Rudd, Robert M. Morrow Dental Laboratory Procedures Fixed Partial Dentures. 2nd edition, chapter 13, page 331-366.

Kenneth D. Rudd, Robert M. Morrow, Harold F. Eissmann – Dental Laboratory Procedures –Removable Partial Dentures. 2nd edition, chapter 16 page 458-459

Khuthija Khanam, H. M., Bharathi, M., Rajeev Kumar Reddy, K., Giridhar Reddy, S. V. 2014. Attachments in Prosthodontics: Different Systems of Classification: A Review". *Journal of Evolution of Medical and Dental Sciences,* 3(28): Page : 7937-7944

Ku YC, Shen YF, Chan CP. 2000. Extracoronal resilient attachments in distal-extension removable partial dentures. Quintessence Int., 31(5):311-317.

Malone WFP, Koth DL. 1997. Tylman's Theory and Practice of Fixed Prosthodontics 8th ed. Chennai, India: All India publishers and distributors.

Merrill C. Mensor, 1973. Classification and selection of attachments: *J. Prosthet. Dent.,* 29(5);page 494-497

Miller EL, Grasso JE. 1979. Removable Partial Prosthodontics. Baltimore, U.S.A: Williams and Wilkins.

Misch CE. 2005. Dental Implant Prosthetics. St. Louis, Missouri: Elsevier Mosby.

Prabhakar B. Angadi, Meena Aras, 2012. Cecil Williams, Suresh Nagaral, Precision Attachments: application and limitations, *Journal of Evolution of Medical and Dental Sciences,* 1 (6); 1113-1118.

Reeta Jain, Swati Aggarwal, 2017. Precision attachments- An overview, *Annals of Prosthodontics and Restorative Dentistry*,3(1):6-9.

Sossamon. J. M. 1986. Spectrum of function- a classification system for attachments in removable prosthodontic therapy. QI 17 (3): 52-56.

Stewart KL, Rudd KD, Kuebkar WA. 1986. Clinical Removable Partial Prosthodontics. 2nd ed. St. Louis, Missouri: CV Mosby

Zinner Ira D. 1985. Nonlocking type of semiprecision attachments DCNA 29(1): 97.

Zinner Ira D.1985. Locking types of semiprecision attachments. DCNA 29(1):81-96.

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