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Review article

DENTAL PRECISION ATTACHMENTS- AN INSIGHT

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ABSTRACT

The desire to balance between functional stability and cosmetic appeal in partial dentures gave rise to the development of precision attachments, since then precision attachments have always been surrounded by an aura of mystery. The use of precision attachments for partial denture retention is a practice builder for the better class of dentistry and helps to elevate the general standard of partial denture prosthetics. This work is not given with the idea of discrediting the usual type of partial denture work, which of necessity, must be used principally because of economic reasons. That can be given in partial denture construction. The precision attachment is sometimes said to be a connecting link between the fixed and the removable. The present article is a review on the role of precision attachments and its dental advancement.

Keywords: Precision, Attachments, Connecting link, Tenon, Mortise, Dentistry.

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INTRODUCTION

According to GPT-7 A precision attachment is: A retainer consisting of a metal receptacle (matrix) and a closely fitting part (patrix); the matrix is usually contained within normal or expanded contours of the crown on the abutment tooth and the patrix is attached to a pontic or the removable partial denture framework or an interlocking device, one component of which is fixed to an abutment or abutments, and the other is integrated into a removable prosthesis to stabilize and/or retain it. Frequency used synonyms are "internal attachment", "frictional attachment", "slotted attachment", "Key/key way attachment" and "parallel attachment" [1,2].

The precision attachment is constructed out of several materials and as the terminology implies, the fit of the two working elements is machined to very close tolerance, hence is more precise in construction than is the typical laboratory fabricated attachment. The male portion also called as 'rest', 'key' or 'patrix' most often takes the shape of a "T" or "H" which fits an appropriately shaped slot. The female attachment also called as 'rest seat', 'key way' or 'matrix' is fitted into the restoration in the tooth either by casting the gold to it or by placing it in a prepared receptacle in the restoration and attaching the two together with solder. The precision attachment system is the only type of intra-coronal attachment that provides for all three functions of a removable partial denture retainer system: Lateral force transmission, or bracing from the parallel proximal walls of the rest against the rest seat. Occlusal force transmission or support from the flat gingival floor of the rest seat & Primary retention from the frictional fit between the rest and rest seat. he precision attachment

derives its functional through closely fitting, coupling parts [3].

Literature Review: A total of 53 articles were downloaded & analysed using the following meshwords precision, attachments, connecting link, tenon, mortise & dentistry searching pubmed & science direct data bases. 13 articles were finally selected and examined as per the requirement of the present review article on Dental Precision attachments.

Development of Precision Attachments: Prior to the manufacturer of attachments, the early attachments were bent, cut, and soldered into shape by their inventories such as Evans, Parr, Peeso, Roach, Morgan and Chayes. The materials employed were gold, platinum and iridioplatinum. Some of these early intra-coronal retainers were named the split-bar attachment, tube and split post attachment, solid post and tube attachment, and the winged lug attachment.

Classification: It is based to provide an overview of the designs available and to identify the common feature of each class. Precision attachments may be classified as 'intra-coronal' or 'extra coronal'. An intra-coronal attachment is one that is contained within the contour of the crown of the tooth, whereas the extra-coronal type may be all or partly contained outside the confines of the crown. The usual reasons for employing the extra-coronal type is either that the crown of the tooth is too small to accommodate all of the receptacle or that the pulp of the tooth is so large that it might be encroached upon by an attachment which was completely housed within the crown the extra-coronal type of retainer often has built into it a movable joint of one type of another which permits the base to move independently of the retainer. Neither type of attachment is applicable to all circumstances.

Selection of an intra coronal or extra coronal attachment is based on design considerations for the prosthesis and the anatomic morphology, location and position of the abutment of tooth. Intra coronal attachments have the advantages of maintaining forces more in line with the long axis of the tooth and having a more desirable resistance to vertical and lateral forces [4].

I Intra-coronal Attachments: This class includes the largest number of attachments. Intra-coronal attachments may be subdivided into two groups to reflect the type of retentive mechanism used to hold the parts together. They are:
Frictional, with designs that include tapered and parallel-walled boxed and tubes, adjustable metal plates, springs, studs, or locks; and Magnetic.

1. FRICTIONAL: Tapered and parallel-walled boxed and tubes. These attachments are designed to join sections of a fixed partial denture. They can be made individually by a dental technician who prepares a deep interproximal occlusal rest or box within the wax pattern of a crown. After the crown is cast, the male section of the attachment is made by flowing wax into the box and this wax pattern is joined to the wax pattern of the adjacent crown or pontic. It is possible to buy plastic prefabricated patterns that can be incorporated into the wax pattern of the fixed partial denture or splint. The prepared varieties are the simplest of the intra coronal attachments and like a deep occlusal rest, they provide vertical support and lateral stabilization[5].

Adjustable metal plates: These attachments are similar to the rectangular block and box variety, but are made so that friction between the parts can be increased. A narrow slit is provided in the metal block or male part of the attachment. This slit can be widened with a scalpel blade to enlarge the block and enhance the friction against the sides of the box. This provides a simple but effective form of direct retention:
Examples: Mc Collum, Crismani or Stern Attachments and Chayes Or Ney

The length of the slit within the block influences the resiliency of the retaining mechanism so that at least 2.5mm of tooth height is required to accommodate them. There is a limit to the movement and durability of the metal and eventually these achievements succumb to fatigue.

Springs: Some manufacturers consider it more efficient to include a small spring within the metal block to control the friction between the male and female parts. The spring activates a plunger rod that protrudes from the block to engage a depression in the wall of the box and it can be replaced when it deteriorates eg: Schatzmann attachment approximately 4-5mm of vertical height is required between the occlusal surface and the gingival crest to accommodate these more complex attachments.

Studs: Another form of direct retention for a removable partial denture or overdenture is obtained by using a stud that clips into a flexible ring. A metallic stud can be soldered to a post and core and cemented into an abutment tooth, while the ring is contained within a cavity in the denture base E.gs: Ceka attachment and the Gerber or Rotherman attachments.

The ring may be adjusted to grip the stud or the head of the stud may have two intersecting slits to increase its circumference, the stud or the ring are replaced when they are no longer resilient. The height of the stud should not interfere with the arrangement of the artificial teeth on the denture and when vertical space is small, the Rotherman attachment, with a height of 1.6mm is particularly useful. A stud attachment is available that can be assembled directly in the mouth without using a cast post and core. It consists of a metallic funnel shaped tube

that is cemented into the root canal of a tooth and a polyethylene stud that is attached to the denture base. The head of the stud squeezes past a constriction in the neck of the funnel to retain the denture on the tooth and it can be replaced easily when necessary.

Locks: It is possible to obtain a device with parts that lock rigidly together eg: The T-block attachment. Sections of a fixed prosthesis are assembled by the dentist directly on the supporting teeth and held in place by the attachment screw. However, the vertical height required for this attachment is at least 6mm.

2. MAGNETS: Although magnets have been used in various forms to help retain complete dentures, they were not effective until a small but strong closed-field cobalt samarium (Co_5 5m) magnet was developed that would fit onto the surface of a tooth. A metal keeper is attached to the tooth surface, usually into the root canal, and the magnet is contained within the resin of the denture base. The alloy in the magnet produces a magnetic force that is both constant and extraordinarily strong. It is claimed that the magnets cause no tissue damage and the constant force implies that they never need to be adjusted. Nevertheless, the magnets are brittle and will corrode in the mouth unless protected in a stainless steel shield.

II Extra-coronal Attachments: These classes of attachment devices may be subdivide into two groups:

Bar attachments: The cantilever designs may be rigid or mobile and the mobile designs include rotational and resilient types.

Cantilever: The limitations placed on the size of intra-coronal attachment and a desire to provide movement between the abutment crown and the denture base prompted the development of joints that project from the surface of a cast crown and are cantilevered over the ridges.

Rigid: The design of this group emphasizes the need for a rigid connection between the parts and movement can occur only along the path of insertion. Therefore the prosthesis becomes a rigid extension of the cantilever; examples : Stabilex or Conex attachments and the Scott attachments.

Essentially they are pin and tube joints that use a slit in the pin, or multiple pin tubes and slots to enhance the retentive friction between the parts with natural teeth on either side of the edentulous spaces and strong periodontal support these attachments offer excellent stability and retention to a removable partial denture supported entirely by natural teeth.

Mobile: The cantilever inherent in the rigid attachment can produce destructive force on the periodontium of the abutment teeth consequently a variety of attachments have been developed to allow rotation and resilience within the joints in the hope of minimizing the torque on the teeth. They range from relatively simple hinges to complex devices that attempt to combine the rigidity of the intra-coronal attachments with some rotation around a movable horizontal axis.

Rotational: Hinges allow the prosthesis to rotate around a horizontal axis and transmit some of the occlusal forces to the residual alveolar ridge example Gerber hinge and the Gaerny hinge. They can be used to attach a unilateral prosthesis to an abutment tooth, but because of the precise fit of the parts it is difficult to align two of them across the arch in bilateral removable denture.

A method of anchoring a bilateral distal extension removable partial denture to crown restorations on abutment teeth has been described by Thompson and Becker et al. It consists of a rest that rotates within an intra-coronal box and an extra-coronal clasp arm that engages a dimple undercut on the gingival surface of the crown. This arrangement will retain the removable partial denture on the abutment teeth while allowing horizontal rotation. The Dalbo attachment is a good example of a ball and socket joint in which the ball is cantilevered off the abutment tooth and the socket is attached to the prosthesis. The wall of the metal socket has several small slits to provide a resilient entrance to the socket and offers some direct retention to the attachment when the socket engages the ball over its height of contour.

Resilient: The action of the Dalbo ball and socket joint has been expanded with the addition of a spring within the body of the socket to allow a small amount of vertical settling of the removable partial denture beside the abutment teeth. Without this spring, the prosthesis will rotate around the horizontal axis through the ball and socket, and the distal extension base will not be evenly supported by the edentulous ridge. It has been suggested that this uneven pressure is undesirable and possibly destructive to the alveolar bone. A slightly different and more elaborate design is available from the Crismani attachment [6]. It consists of a metal block in two parts that rotates around a fixed axis and rests on a spring that is contained within a box on the distal surface of a cast crown. The springs provide axial movement and the split block allows rotation.

Bar attachments: Bars connected to cast metal crowns or copings can be used to support and retain dentures. Custom made bars can be cast with a flat upper surface to support the prosthesis and parallel sides help to stabilize it them can be obtained in standard forms consisting of a bar with an overlapping matrix. The Ackerman bar may be bent to conform to the contour of the edentulous ridge, and several short matrices rest on the bar to attach the denture base. An

oval cross-section has been used in the Dolder bar to offer direct retention to a resilient matrix but it must be placed in a straight line between the abutment teeth.

Choosing an attachment: It is the length of the attachment, not its width that is the main criterion in choosing attachments, there are three sizes of precision attachments – An anterior, a bicuspid and a molar, they differ in the width, not in the length of the precision attachment.

The width of the precision attachment is measured from one side of the rest to the other. For example a 0.096 Stern's attachment would be for a molar and a 0.085 Stern's attachment would be for a premolar. The full length of a precision attachment is 8mm. For the full benefit of bracing, support and retention to be obtained from a precision attachment, it must be at least 5mm in height. If the fabricated crown is less than 5mm height. Another retainer system should be selected. This means that the clinical length of the constructed crown casting must be at least 7mm height, as the attachment is 5mm in length and there must be, in addition, a minimum of 2mm between the gingival floor of the attachment and the gingival margin. Otherwise, a periodontal problem may be created.

Materials used in attachment fabrication: The materials used in the fabrication of precision attachments are platinum, iridoplatinum, gold and platinum, gold and palladium (Therma fit) and all gold. The metals are not selected haphazardly. The choice of which metals to use depends upon the type of case.

Indications: The prime indications for use of the precision attachment are for all tooth supported partial denture when: Four large well-formed abutments are available; clasp arms would otherwise be displayed in the anterior part of the mouth, which would be displeasing to the patient; only in case of tooth supported partial denture cases i.e. Kennedy Class III and Class IV situations; in selected cases it may be employed in preference to conventional retainers, to stabilize teeth which have been weakened by periodontal disease & they can be used to advantage in the badly misaligned abutment tooth (e.g., the buccally inclined maxillary canine) to eliminate the need for extensive cutting of tooth structure that is required for conventional clasping [7,8].

Contraindications: The precision attachment should not be used in the distal extension base type of partial denture, particularly in the mandibular arch. The reason for this contraindication is that some movement of the distal extension base, supported as it is by a displaceable mucosa, is inevitable and since the key/keyway mechanism allows no freedom of movement, other than in a vertical plane may reduce the space required for artificial teeth; it is expensive & it cannot be repaired / altered easily.

parallel to the long axis of the tooth, a great deal of masticatory stress will be transmitted directly to the abutment tooth as torque, this is almost certain to affect the health of the periodontal apparatus, because the prosthesis with a precision attachment must be inserted along one precise path of insertion, the patient must possess at least an average degree of manual skill to manage the maneuver with this facility [9,10]. For this reason the key/keyway type of construction generally is contraindicated for the senescent individual or for the one with an incapacitating handicap, because the keyway must be of reasonable length to generate the required frictional resistance to unseating a forces, the clinical crown of the abutment tooth must be of at least average height. Thus it follows that the precision attachment will not be successful when used with the tooth which has either a short or a very small crown; it is contraindicated in case of teeth with large pulp chambers; when the facility for repair and maintenance is not available; the labial or buccal clasp arm can be eliminated altogether hence this improves the cosmetic excellence of partial denture, particularly one for the maxillary arch; it is less stressful to the abutment tooth than is the conventional clasp. The basis for this reasoning is that, located as it is deep within the confines of the tooth, all stress is directed along the long axis of the tooth. Thus being resisted by virtually all of the fibres of the periodontal ligament. Stress so directed is concentrated nearer to the center of rotation of the tooth than in the case with a conventional clasp, which is clearly more ideal from a stand point of leverage; reciprocity is assured so that there is no problem of "Whiplash" effect, which the conventional clasp sometimes generates & they allow better cross arch force transmission and stabilization than clasps, but this is determined by the type of attachment used, the number of guiding surfaces and the design and adaptation of the framework and attachment.

Diadvantages: The tooth must be extensively reduced to provide the requisite space to accommodate the key way; the bulge in the crown, created by the keyway; may deprive the underlying gingival tissue of its customary massage; the two parts of the laboratory type of attachment seldom fit with perfect precision and the presence of even a minute crevice between the two parts raises the specter of un-cleanliness of the keyway; the attachment is subject to wear as a result of the friction between the metal parts and this can create a maintenance problem. As wear occurs the male portion fits ever more loosely in the keyway. Thus eventually permitting excessive movement of the base and posing the threat of injury to the abutment; if the extra-coronal attachment extends outward from the tooth near the gingival border, there is a very real danger of gingival irritation followed by the usual inflammatory sequelae; it

Use of precision attachments in fixed Prosthodontics: Precision attachments are also used in fixed prosthodontics. They are employed to reduce the size of a splint for ease of parallelism and for ease of cementation. A full arch splint can be sectioned between the cuspid and bicuspid with precision attachment. Rationales for employment are as follows:

1. Precision attachments facilitate parallelism of small sections rather than requiring attempts to parallel upto 14 teeth.
2. Usually the lower anterior teeth are flared; thus it is impossible to obtain a path of insertion between the lower anterior teeth and the 2nd molar for a one piece splint that will have a common path of insertion, unless a number of teeth are devitalized.
3. When using porcelain fused to metal, the more units the dentists places on the splint, the more contraction occurs when the porcelain is baked and the poorer the fit.
4. When the cementing medium washes out, it is usually the 2nd molar that washes out first. The dentists can then replace a small section instead of remarking a complete dental arch. The rest seat is placed in the strongest section which usually is the anterior section, with the rest in the posterior. The rest and rest seat should be at the desired occlusal height, and no porcelain should be placed occlusally over the attachment. If porcelain is placed occlusally over the attachment it will fracture [11,12].

Semi-precision attachments: It is also referred to as the "milled rest" or the "internal rest". As a rule, this type of retainer takes the form of a dovetail-shaped keyway built into the proximal surface of a wax pattern of (usually) a gold crown. The stud or male portion is then fabricated as an integrate part of the metal framework. A lingual clasp arm is customarily used with the semi-precision attachment which helps to guide the attachment into place in the tooth. The semi precision type of retainer has an advantage over the manufactured type in the fact that it is somewhat simpler to construct, hence is less time consuming and as a consequence, not as costly. A disadvantage is that the parts do not fit together with the same degree of machined precision [13].

Conclusion: Precision Attachment based removable partial denture is the treatment of choice because of enhanced esthetics. But the decision to use precision attachments in removable partial design should be carefully considered. Clasp type removable partial dentures should be used whenever practical because of their lower cost, ease of fabrication and maintenance and the predictability of results.

A thorough knowledge and understanding of Prosthodontic principles and attachment use as well as an awareness of the intricacies and special problems associated with the precision attachments. Hence it's alright to consider such a sophisticated treatment modality where the facilities for this precise laboratory work is available which is still very scanty in developing countries which limits its usage.

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REFERENCES

1. Becerra G, Macentee M. A classification of precision attachments. *J. Prosthet Dent*, 58, 1987, 322-7.
2. Burns D, Ward J. A review of attachments for removable partial denture design: Part 1 Classification and selection. *Int. J. Prosthodont*, 3, 1990, 98-102.
3. Burns D, Ward J. A review of attachments for removable partial denture design: Part 2 Treatment planning and attachment selection. *Int. J. Prosthodont*, 3, 1990, 169-74.
4. Caldarone C. Attachments for partial denture without clasps. *J. Prosthet Dent*, 7, 1957, 206-8.
5. Graber G. Color Atlas of Dental medicine. Vol.2, Removable partial dentures, New York, Thieme Medical publishers Inc., 1998, 75-9
6. Grosser D. The dynamics of internal precision attachments. *J. Prosthet Dent*, 3, 1953, 393-401.
7. Lorencki S. Planning precision attachment restorations. *J. Prosthet Dent*, 21, 1969, 506-8.
8. Miller E, Grasso J. Removable partial Prosthodontics. Ed.2, London, Williams and Wilkins 1982, 293-9.
9. Preiskel H. Precision Attachment: Uses and abuses. *J. Prosthet. Dent*, 30, 1973, 491-2.
10. Rush F. A technique for precision removable partial denture construction. *J. Prosthet Dent*, 31, 1974, 377-83.
11. Terrell W. Specialized frictional attachments and their role in partial denture construction. *J. Prosthet Dent*, 1, 1951, 377-50.
12. Zahler J. Intra-coronal precision attachments. *Dent. Clin North Am*, 24, 1980, 131-41.
13. Koper A. An intra-coronal semi-precision retainer for removable partial dentures – The Thompson Dowel. *J. Prosthet Den*, 30, 1973, 759-68.

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