ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 01 | January - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

PRECISION ATTACHMENTS IN PROSTHODONTICS: A REVIEW

Dentistry

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ABSTRACT

The precision attachment denture has long been considered advantageous in Dentistry as it combines fixed and removable Prosthodontics in such a way as to create the most esthetic partial denture possible. Nevertheless they have in the past been largely ignored by most dental professionals for understandable reasons, notably cost and inadequate grasp of their application. Last decade with greater demand for complex and esthetic restoration and an increase in the popularity of implant has brought a concomitant increase in the popularity of attachment retained prosthesis.

KEYWORDS

Frictional attachments, Internal attachment, Parallel attachment, Precision attachment.

INTRODUCTION

The term precision denotes the quality or state of being precise. Precision attachment is "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 teeth / dental implant and the patrix is attached to a pontic or the removable dental prosthesis framework".[1] It is a mechanical device for the fixation, retention and stabilization of a prosthesis. In context to removable partial denture it is a mechanical device other than clasp that function as a direct retainer. They are designed to replace occlusal rest, bracing arm and retaining arm of the conventional clasp retained partial denture. when this resides within the normal clinical contours of an abutment, they function to retain, support and stabilize the removable partial denture. They are generally smaller and machined to fine tolerance and are much more efficient in resisting the forces applied to the denture than are the conventional parts of clasping unit.[2]

Precision Attachments Also Known As: [3,4]

1) Internal attachments.
2) Frictional attachments.
3) Slotted attachments.
4) Parallel attachments.
5) Key and keyway attachments.

INDICATIONS (APPLICATIONS OF PRECISION ATTACHMENT)[2,3,5,7]

1) All tooth supported partial dentures (Kennedy's class III)
   a) 4 large well rounded abutments are available.
   b) For esthetic concerns in the anterior part of the mouth
2) Stress breakers cantilevered pontic is to be used as abutment.
3) Most efficient bilateral bracing and supports are essential (when one or more of the abutment have reduced alveolar support).
4) Proposed abutments are flared labially or bucally.
5) As retainers in overdenture (for both tooth supported or implant supported).
6) For movable joints in sectional dentures.
7) As connectors in fixed partial denture construction (long span bridges).
8) Implant prosthodontics, they are used for connection between the tooth and the implants
9) To retain removable partial denture and overdentures.

Use of attachment in fixed Prosthodontics [2,6]**:**

10) Existence of malaligned abutment where abutments have differing paths of withdrawal and the paralled preperation might result in devitilization.
11) Long span FPDS – As a connectors in long span FPDS.
12) The presence of mobile teeth which need to be splinted together with a fixed prosthesis. Through the use of interlocks smaller segments can be cemented with the splinting effect provided by interlocks.
13) The existence of pier abutment (middle abutment) which promote a fulcrum like situation that can cause the weakest of the terminal abutment to fail.
14) Divergent abutment teeth with high survey lines difficult to get parallel path of placement of the removable partial denture which is determined by parallel placement of the attachment within the surveyed crowns independent of the parallelism of the crowns themselves.

CONTRAINDICATIONS: [2,3,5,7]

1) Poor periodontal support / health of abutment teeth excessive periodontal probing depth renders the patient an unacceptable candidate for attachment retained RPD. (Fig :3.4.5)
2) Poor crown to root ratio.
3) Compromised endodontic and restorations conditions.
4) Abnormally high caries rate.
5) Inadequate space/room to employ the attachment.
6) Poor oral hygiene habits risk of failure.

Advantages Of Precision Attachments [2,3,4,5,7]

1) Improved esthetics and elevated psychological acceptance

of the prosthesis conventional clasp assemblies and rests may be visible and unaesthetic. Clasp arm direct retainers placed on canine and premolar abutments may be esthetically objectionable, appropriate use of attachments may eliminate the need for facial clasp arm while providing acceptable retention, support and stability to the prosthesis – attachment is concealed within the contours of abutment teeth or within the body of RPD.

2) Mechanical Benefit In The Intracoronal Attachment.

- Because the attachment resides within the normal anatomic contours of the abutment teeth functional forces and loads are directed more favorably along the long axis of the teeth and more apically.
- Force application is more close to the fulcrum of the tooth than in case of occlusal rest or incisal rest therefore, decreased lever arm. Reduces non-axial loading and decreases torquing forces and rotational movement of the abutment.

3) Cross arch load transfer / force transmission and prosthesis stabilization may also be improved with attachments particularly when rigid precision attachments are used.
4) In case of distal extension base removable partial denture prosthesis attachment positioned between the abutment and extension bases incorporate broken stress philosophy that limit the potentially damaging forces (stress transfer) imparted to the abutment as these attachment permit vertical, horizontal / rotational movement of the denture bases during function relative to the abutment
5) Compared to conventional clasp retained partial denture they give.

i) Better retention and stability.
ii) Less liable to fracture than clasp.
iii) More esthetic than clasp.
iv) Less food stagnation.
v) They are less bulky and more aesthetic than clasp.

6) Lateral forces in the abutment during the insertion and removal are eliminated and more axial force during functions are achieved.

- **Disadvantages** [2,3,4]

1) Complexity of design, complex principles and procedures for fabrication and clinical treatment.

- Abutment must be crowned in order to incorporate attachment component.
- Precise and structurally demanding tooth preparation so that the attachment components can be housed within the normal anatomic contours of the abutment.
- Encroachment on the root canal space in attempt to prepare abutment to receive attachments.

2) Minimum abutment occlusogingival height of 4-6 mm is

necessary depending on the attachment system used.
- In order to facilitate acceptable emergence profile.
- To incorporate attachment components without over contour.
- To satisfy minimum vertical space requirement.
- Shorted abutment may yield over contoured coronal restorations and reduced frictional / binding retention of the attachment.
- Enough length of parallel contact between the component of attachment to enable adequate retention.

3) Expensive – increased overall cost of the treatment.
- Because of complexity of the laboratory and clinical procedures involved in the construction of attachment retained prosthesis.
- Attachment maintenance (repair or periodic replacement)

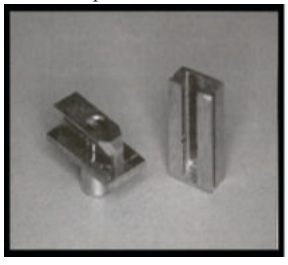
4) Attachment components will wear because of friction between metal parts overtime and may require repair or replacement.
5) Requires high technical expertise for successful fabrication experience and knowledge on the part of dentist and laboratory technician are essential.
6) Cooperation and manual dexterity on the part of the patient.
- Attachment retained removable partial dentures are more difficult to insert and remove from the mouth.
- (visually or manually challenged patient better served with more conventional design).

7) Increased demand on oral hygiene performance.
- Poor oral hygiene
- Inability to comprehend instructions.
- Inadequate manual dexterity contraindicates the complicated restorations.

8) More direct and definitive functional load transfer to the abutment can be expected with some intracoronal precision attachment.
9) Anatomy of tooth – Placement of attachments in the incisor and canine areas may pose difficulties because of limited faciolingual width.
10) Aggressive tooth preparation is necessary to permit the placement of intracoronal precision attachment within the normal anatomic contours of the planned crown.

Classification Of Precision Attachments[2,8]
Based On Their Method Of Fabrication And The Tolerance Of Fit Between The Components-

I. Precision attachment (prefabricated types) prefabricated machined components with precisely manufactured metal to metal parts with close tolerance.(Fig :3.2.1, 3.2.2)

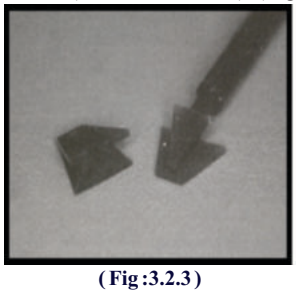


(Fig :3.2.1)

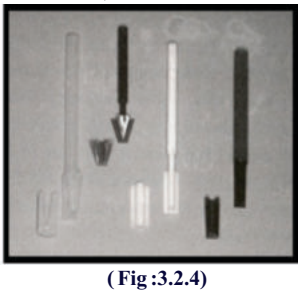
(Fig :3.2.2)

II. Semi precision attachment (laboratory made or custom made types) components usually originate as prefabricated or manufactured patterns (made of plastic, nylon or wax) or Hand waxed.

The term semi precision is a misnomer as when properly made the laboratory fabricated attachment is just as precise as the prefabricated version (Joel M Zahler 1980)[2] (Fig :3.2.3, 3.2.4)



(Fig :3.2.3)



(Fig :3.2.4)

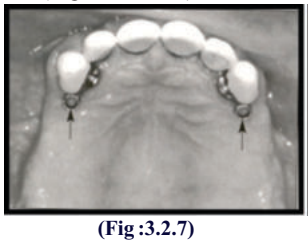
- **According To Their Relationship To The Abutment Teeth**

1) Intracoronal / internal attachment If the attachment resides within the body / normal contours of the abutment teeth. (Fig :3.2.5, 3.2.6)

(Fig :3.2.5)

(Fig :3.2.6)

2) Extracoronal / external attachment[2, 9] If the attachment resides outside the normal clinical contours of the abutment crown / teeth. (Fig :3.2.7 , 3.2.8)



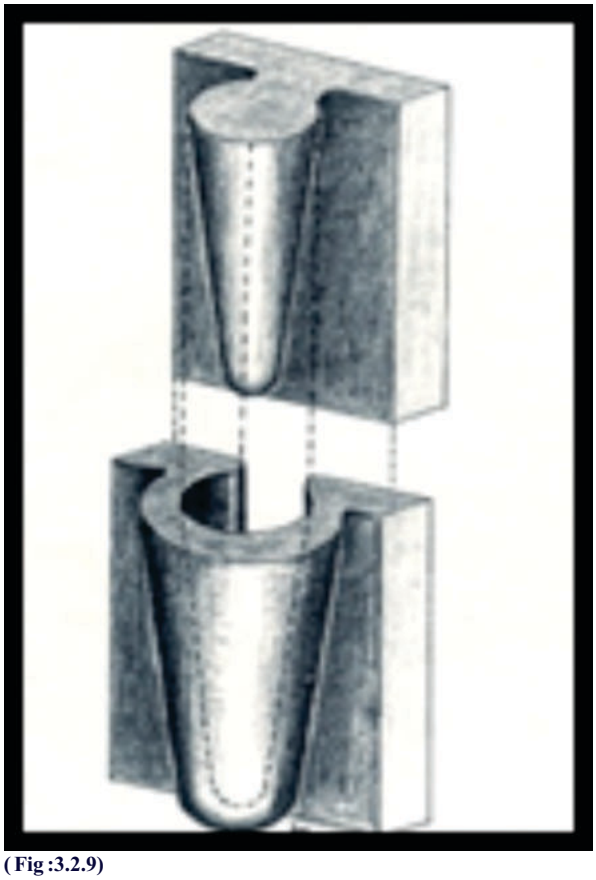
(Fig :3.2.7)

(Fig :3.2.8)

- **Based On The Stiffness Of The Resulting Joint[2]**

Rigid Attachment
When metal to metal contact of the patrix and matrix restrict the relative movement between the abutment and prosthesis during the functional loading (of the removable partial denture) the attachment is said to be rigid. (Fig :3.2.9)

Rigid attachment are those that theoretically allow no movement of their component parts during function. These attachments are usually used in bounded saddle

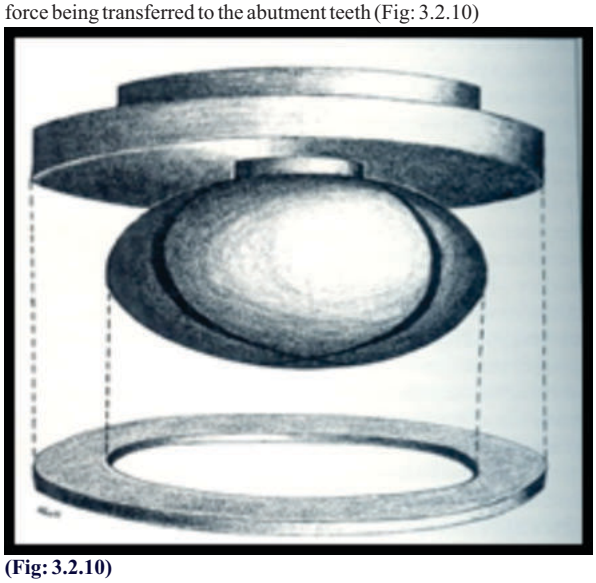


(Fig :3.2.9)

Resilient Attachment
Many attachments are designed to permit movement of the denture

base during functional loading these attachments are considered to be resilient attachments. Functional movement of the prosthesis may be restricted to defined vertical, horizontal and or rotational path or omnidirectional displacement of the prosthesis may be permitted.

Provide a defined amount and direction of movement of their components permitting movement of the denture base towards the tissue under function while theoretically minimizing the amount of force being transferred to the abutment teeth (Fig: 3.2.10)



(Fig: 3.2.10)

Hinged Motion – Allowing movement along one plane.
Rotary Motion – Allowing movement along many planes.

Depending on the geometric configuration and design of the attachment system-
Key and Keyway.
Ball and socket.
Bar and clip or bar and sleeve.
Telescope.
Hinge.
Push button.
Latch.
Screw units.
Interlock.

Classification Used In Literature:
1) MC Mensor (1973) [8]
An attachment classification according to shape, design and primary area of utilization of attachment.

Coronal	Radicular	Accessory
Intracoronal	Telescope	Auxiliary
Extracoronal	(Pressure buttons)	Screw units
	Bar attachment	Bar connectors
	(Bar joints and bar units)	Bolts
		Stabilizers
		Balances
		Interlocks

2) Gerardo Beccera and others (1987) [10]
Intra dental attachment
- Frictional
- Magnetic

These are contained in part within the crown or root structure of a natural tooth.
Extra dental attachments.
- Cantilever attachment.
- Bar attachment.

3) Depending On Articulation
Rigid Articulators:
These are separable joints designed to prevent any movement when fully articulated / seated.
Group I Attachment : (Used with vital teeth).
Group II : Anchors : (Used with non vital teeth).

Movable Articulators :
These are separable joint designed to permit specific movement when fully articulated.
Group I conjunctors : (Used with vital teeth).
Group II : connectors (resilient anchors) : (Used with non vital teeth)

Bar attachment are grouped under rigid and also under movable articulators. They are used with vital as well as non vital teeth.

4) Good kind and Baker 1976 [2,4,11]
Intracoronal
a) Resilient
b) Non resilient
Extracoronal
c) Resilient
d) Non resilient

Intracoronal Attachment :
Resides within the normal contours of the abutment.
Based on the method of fabrication and the tolerance of fit between the components.
- **Prefabricated types (precision attachment) :** Typically consist of precision milled male-female assembly . Components are fabricated in metal using high precision manufacturing technique.
- These attachment usually exhibit long, parallel walls and exceptional surface adaptation.
- Tolerance between accurately fitting components of an intracoronal precision attachment is so fine that the retention results from the frictional fit.

- **Laboratory made types (Semi precision attachment) [12]**

Components usually originates as prefabricated / manufactured pattern (wax or plastic nylon) hand waxed inserts which are then incorporated in the wax pattern, invested, eliminated and casted in metal.

Or alternative method (hand waxed) of fabrication is to use a tapered metal mandrel (Ti con mandrels).

Semi precision attachment often display gently tapering walls for ease of fabrication.

Less intimate fit between matrix and patrix component.
- Because of the inaccuracies inherent in their fabrication, most laboratory made attachments have limited amount of frictional retention compared to the commercially available precision attachments.

2) Extraacoronal Attachment [13,14,15] :
Resides outside the normal clinical contours of abutment crowns/teeth.
1) Bar attachment.
2) Stud attachment.
3) Magnets.
4) Auxillary or others
- Hinges.
- Split pin and tube –useful in sectional denture.
- Spring loaded ball.

CONCLUSION
The decision to use Precision Attachments in removable partial design should be carefully considered. However, if Precision Attachment removable partial denture is the treatment of choice because of esthetics, abutments alignment or the need for greater cross arch bracing, it must be used with a thorough knowledge and understanding of prosthodontics principles.

Precision attachments have many applications in the restoration of partially dentate mouth. When used with discretion they can help provide a good looking and well- retained restoration where the clasp retained or fixed restoration may not be altogether satisfactory. Useful as they may be, Precision attachments by no means alter the basic principle of sound prosthodontics.

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