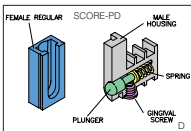
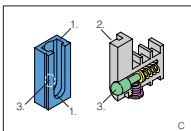
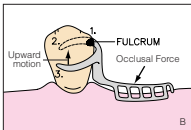
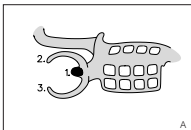


**3 Basic Principles of a Clasp:**

- 1) Occlusal rest
- 2) Bracing or reciprocal arm
- 3) Retentive arm

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Attachments in Dentistry

In our fast paced and upwardly mobile society, patients will see a dentist for two main reasons: discomfort and / or esthetics. The dental professional must be able to relate to the patient's concerns, both physically and psychologically. Attachments provide a very important psychological union in treating a patient as a whole and not merely as a disease. Just as patients' needs differ, so do attachments. It is important to realize no attachment is perfect for every application.

Attachment Applications

Let us take a look at the applications where attachments may be necessary and/or beneficial:

- Crown & Bridge restorations
- Partial Denture restorations
- Overdenture restorations
- Implant restorations

Attachment Example

To provide you with an excellent example of the benefits of an attachment, let us look at the RPD (Removable Partial Denture) restoration.

A conventional RPD prosthesis is retained and positioned by various clasps. Each clasp having three basic principals (A) :

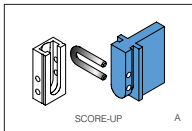
- 1) Occlusal rest
- 2) Bracing or reciprocal arm
- 3) Retentive arm

Clasps however, may create many difficulties for the patient, including food entrapment which can lead to future periodontal involvement and poor esthetics resulting in lower self-esteem. A clasp can also act as a "bottle opener" and gradually extract the abutment. (B)

Attachments provide the same basic principals (C) :

- 1) Occlusal or gingival rest seat
- 2) Bracing or reciprocal walls
- 3) Retentive section

The correct use of attachments may overcome both physical and psychological problems associated with conventional RPD designs.



What is an Attachment?

An attachment is a connector consisting of two or more parts (A). One part is connected to a root, tooth, or implant and the other part to a prosthesis. There are certain exceptions as some attachments have only one manufactured part and the other part must be made by the dentist or the dental technician (B). Some attachments must also have a rest seat prepared to meet all three principles. The Hannes Anchor (like the IC), SwissTac, Tach E-Z and other plunger type attachments fall into this category. (C)

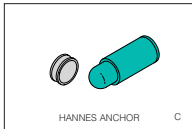


Attachments can be divided into two categories: Precision and Semi-Precision. We will examine both of them prior to attachment consideration.

Precision vs Semi-Precision

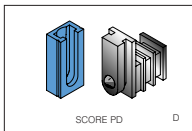
1. Precision Attachments

Precision attachments are just that - "precision". Their components are machined in special metal alloys under precise tolerances. These tolerances are within 0.01mm. Since the specific hardness of the alloys is controlled, precision attachments offer the advantage of less wear on the abutments, and standard parts which allows the components to be interchangeable, and usually easier to repair when necessary. (D)



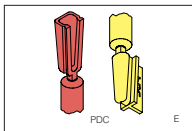
Caution:

Whenever casting around the metal components of a precision attachment, make sure there is minimum 0.5mm of cast metal around the female and/or the male component. If not, there will be most likely stress cracks in the porcelain due to coefficient differences between the cast alloy and the machined alloy.



2. Semi-Precision Attachments

A Semi-Precision attachment is fabricated by the direct casting of plastic, wax, or refractory patterns. Most semi-precision attachment patterns are injection molded to reduce the overall cost. They are considered "semi-precision" since in their fabrication they are subject to inconsistent water/powder ratios, burn out temperatures, and other variables. The resulting components therefore, vary to a small degree.



Their main advantages are: economy, easy fabrication and ability to be cast in a wide choice of alloys without the problem of coefficient differences between the cast alloy and the machined alloy. (E)



1. Location

2. Function

3. Retention

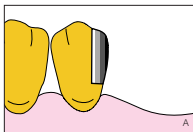
4. Space

5. Cost

To properly select attachments, five factors should be considered and evaluated. First location, then function, retention, available space and finally cost.

1. Location

- Intracoronaral
- Extracoronaral
- Radicular / Intraradicular Stud Type
- Bar Type

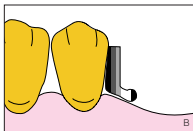


INTRACORONARAL ICON

Intracoronaral

Intracoronaral attachments are incorporated entirely within the contour of the crown (A). The advantage of an intracoronaral attachment is that the occlusal forces exerted upon the abutment tooth are applied close to the long axis of the tooth. An intracoronaral attachment however, usually requires a box preparation to allow the attachment to fit within the crown contour. If it is not possible to create a box preparation that will totally incorporate the female element, then an extracoronaral attachment should be considered.

Since all intracoronaral attachments are non-resilient, we recommend double abutting. In a case with limited vertical space, milled lingual shoulders on the abutments are recommended. Most wear on the intracoronaral precision attachments occurs during the insertion and removal of the restoration.



EXTRACORONARAL ICON

Extracoronaral

Extracoronaral attachments are positioned entirely outside the crown contour (B). Advantages of extracoronaral attachments are that the normal tooth contour can be maintained, minimal tooth reduction is necessary and the possibility of devitalizing the tooth is reduced. Also, the path of insertion is easier for patients with dexterity problems.

Most extracoronaral attachments have some type of resiliency (stress redirectors). Even with resilient attachments, we recommend double abutting whenever possible.

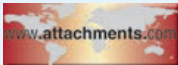
It is however, more difficult to maintain hygiene with extracoronaral attachments and patients should be instructed on the use of dental floss and hygiene accessories. This will help prevent unnecessary tissue irritation caused by food entrapment or calculus build-up.

Caution:

Whenever you use resilient attachments and milled in linguals, the resiliency of the attachment will be eliminated making it Class 1A solid (non-resilient).

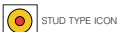
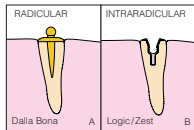
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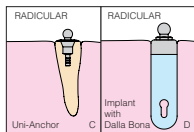


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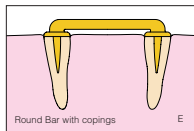
**Radicular / Intraradicular Stud Type**

Radicular and Intraradicular stud type attachments are connected to a root preparation. The female or male is soldered or cast to a root cap coping (A). The female element of intraradicular stud type attachments fit within the root form contour. The SwissLogic, Zest and the ZAAG are examples of this type of attachment (B). Some stud type attachments, such as the Uni-Anchor and the Direct O-Ring, are directly cemented into the prepared root without requiring a cast coping. (C)



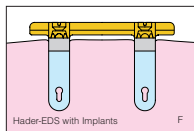
Stud type titanium implant attachments are also available to screw directly into implants or tissue extensions. (D)

One advantage of utilizing stud type attachments is that they promote better oral hygiene. The crown-root ratio is also enhanced with the low profile of the stud type attachments.

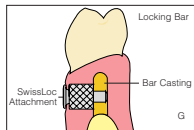
**Bar Type**

Bar type attachments span an edentulous area and connect abutment teeth, roots (E) or implants (F). The removable bridge, partial denture, or overdenture fits over the bar and is connected to it with one or more retention sleeves, riders/clips, or retentive plungers.

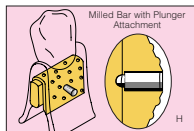
The advantages of bar attachments are that they splint questionable abutments together for mutual support and in some instances, may allow for later conversion to a stud type attachment if one of the abutments fail. To convert the restoration from a bar retained to a stud retained restoration, the Schubiger attachment must be used initially. The bar is then connected to the Schubiger sleeve, later the Gerber attachment will replace the bar.



Bar restorations, when properly related to the gingiva, should not cause food entrapment, blanching of the tissues, nor encourage tissue proliferation. (Hard and soft tissue conditions should be taken into consideration when designing bar type restorations).

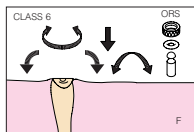
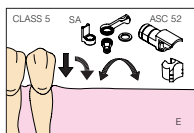
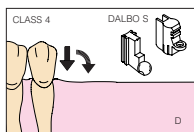
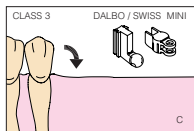
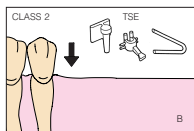
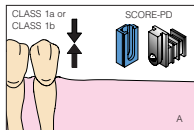
**Locking Bar Type**

Locking Attachments are utilized to mechanically lock a patient removable restoration in place until the patient disengages the attachment. Locking attachments prevent lift-off caused by cantilever forces. SwissLoc, Swivel Loc and MK1 are examples of this type of attachment. (G)

**Auxiliary Type**

Auxiliary Attachments include components such as plungers, hinges and screws. These types of attachments must be incorporated into the design of the prosthesis.

Plungers (H), such as the Hannes Anchor, Swiss Tac and Tach E-Z, require a form of reciprocation and occlusal stop in the design. Hinges, such as the Ai-Hinge, are cast to a chrome partial denture framework. Screws, such as the Tube & Screw System, require female threads that are cast-to or tapped into the restoration.



2. Function

It is important to differentiate between a solid and resilient type restoration. Abutment/tooth supported restorations are considered solid, where abutment/tooth and tissue supported restorations are considered resilient. Abutment/tooth supported attachments are subclassified into two types, non-lockable and lockable. Resilient attachments are categorized into 5 classifications ranging from vertical to universal resiliency. The higher the number of classification, the less torque transferred to the abutment, root or implant.

Classification

SOLID

- Class 1a Solid, rigid, non-resilient
- Class 1b Solid, rigid, non-resilient, lockable with a U-Pin or Screw

RESILIENT

- Class 2 Vertical resilient
- Class 3 Hinge resilient
- Class 4 Vertical & Hinge resilient
- Class 5 Rotational & Vertical resilient
- Class 6 Universal, Omni-planar

Class 1a

Is a solid/rigid/non-resilient attachment allowing no movement between the abutment teeth and the attachment. (A)

Examples: *Intracoronaral: SCORE-PD, SCORE-BR, Beyeler, PDC, PT-Snap, MGS etc.*

Examples: *Extracoronaral: SwissEx, 2.7 and D 3.0, OT Strategy, Vario, Allegro etc.*

Class 1b

Is the same type of attachment as the Class 1a however, the female and male components are locked together with a screw, U-Pin or other mechanical means. (A)

Examples: *SCORE-UP, Swiss Bloc, Screw-Bloc, T-Bloc*

Class 2

Is a vertically resilient type attachment allowing only movement in the vertical plane. (B)

Examples: *TSE, Vertica*

Class 3

Is a hinge type resilient attachment allowing movement around a given point. (C)

Examples: *Dalbo Mini, SwissMini, Ancorvis Gilmar, SwissMar, May's, Ai-Hinge, etc.*

Class 4

Is a vertical and hinge type resilient attachment allowing movement in both the vertical plane and the hinge axis simultaneously. (D)

Examples: *Dalbo S, Ultra-M, possibly Dalbo Mini or SwissMini with spacer*

Class 5

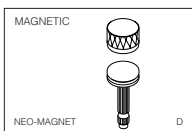
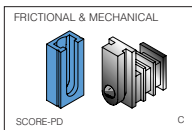
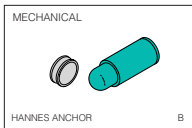
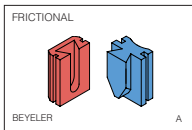
These rotational and vertical type resilient attachments allow both rotational and vertical resiliency simultaneously. (E)

Examples: *SwissAnchor SA, ERA, ASC 52, Ceka, etc.*

Class 6

The universal, omni-planar resilient type attachments allow movement in any plane. (F)

Examples: *ORS, Logic, Zaag, etc.*



3. Retention

There are five different types of retention available to the patient. When selecting the attachment it is best to be familiar with all of them. Patients generally like a lot of retention for psychological reasons. Even so, it is advisable whenever possible to provide initially only minimum retention and later increase if needed. Keep in mind however, that not all attachments are adjustable.

- Frictional
- Mechanical
- Frictional & Mechanical
- Magnetic
- Suction

Frictional

Frictional retention is resistance to the relative motion of two or more surfaces in intimate contact with each other (A). The Beveler attachment is a good example.

Caution: If attachments are over-polished, frictional retention may be lost.

Mechanical

Mechanical retention is resistance to the relative motion of two or more surfaces due to a physical undercut (B). The Hannes Anchor attachment is a good example.

Caution: If the plunger of the attachment does not engage the female undercut, there will be no mechanical retention.

Frictional & Mechanical

Frictional and Mechanical retention combines both features of frictional and mechanical retention as discussed above (C). The Score-PD attachment is a good example.

Caution: If attachments are over-polished, frictional retention may be lost. If the plunger is not protruding from the male, there will be no mechanical retention. Check the spring to make sure it is not broken.

Magnetic

Magnetic retention is the resistance to movement caused by a magnetic body that attracts certain materials by virtue of a surrounding field of force produced by the motion of its atomic electrons and the alignment of its atoms. (D)

Caution: Magnets do not provide lateral stability and are contra-indicated for flat ridges.

Suction

Suction is a force created by a vacuum that causes a solid object to adhere to a surface. An example would be a well fitting denture.

Caution: Most removable restorations require a periodic check of tissue conditions and if need be, a reline. See Reline Procedures page 61.

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**4. Space**

Space considerations should include the Buccal-Lingual and Mesial-Distal dimensions as well as the vertical space required. Additional vertical space is also required for the restorative tooth over the attachment.

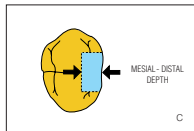
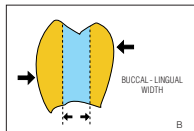
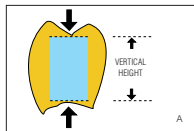
Comfort for the patient should be given special consideration as well as esthetics.

Effort should be taken so as to not overcontour the final restoration which would adversely affect comfort and speech.

- Vertical
- Buccal-Lingual or Labial-Lingual
- Mesial-Distal or Distal-Mesial

Vertical

The vertical space is measured from the tissue to the marginal ridge, or from the margin of the abutment to the marginal ridge of the opposing dentition. Use the full length of the attachment, whenever possible, and place it as low as possible without impinging on the tissue. (A)

**Buccal-Lingual or Labial-Lingual**

Buccal-lingual or labial-lingual space is very critical, especially with removable partial dentures. Buccal-lingual or labial-lingual space should be measured accurately to avoid over-contouring the restoration in this dimension. An additional 1mm should be added to the buccal-lingual measurement for metal precision attachments to allow for the casting alloy. We recommend setting the teeth prior to the selection of an attachment. This will aid in the size determination and exact position of the attachment. (B)

Mesial-Distal or Distal-Mesial

Mesial-Distal or Distal-Mesial measurements are critical for intracoronal attachments, since a box preparation is required. Select the largest attachment possible for the space available. (C)

A good way to show how much reduction is necessary is to prepare the study model. It is also helpful for the dentist to have the intracoronal female chairside while the abutment is being prepared.

5. Cost

Cost is always a factor, however, it should be the last consideration. It is less expensive in the long-term to utilize a more expensive attachment with a low maintenance factor than a low cost attachment with a high maintenance factor. The cost is directly related to the type and material of attachment selected as described below.

In this manual we use a Cost Icon to represent the approximate cost. Each dollar sign represents \$25. We include plus and minus signs to further define the price. For example, 3 dollar signs and a plus indicates the attachment costs around \$76-\$99. As the cost of attachments and implant components may change without notice, this pricing guide is only approximate.

Precision attachments

The higher cost of a precision attachment is directly related to the complexity of the manufacturing and to the composition of the precision attachment. All precision attachments are precision machined from a known alloy. Computer controlled CNC mills and screw machines are used to manufacture extremely accurate components.

Semi-precision attachments

The low cost of semi-precision attachments is mainly due to the simplicity of the manufacturing techniques - injection molding vs machining etc., and the materials selected. Most semi-precision attachment patterns are made of plastic, or refractory materials and are subject to slight variables during manufacturing and their use in the laboratory.

COST ICON

Approximate cost = \$25
\$+ = \$26-\$35
\$- = \$24-\$5



Approximate cost = \$50
\$\$+ = \$51-\$74



Approximate cost = \$75
\$\$\$+ = \$76-\$99



Approximate cost = \$100
\$\$\$\$+ = \$101-\$124



Approximate cost = \$125
\$\$\$\$\$+ = \$126 and up