Attachment-Retained Partial Dentures

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Removable partial dentures fabricated with precision attachments for retention and support are the best prosthesis available to dentistry where fixed restorations are contraindicated. Precision attachments are prefabricated attachments consisting of two matched metal components, male and female. They are usually made of precious metal and are machined to a close tolerance. They are used in removable partial dentures to join the removable prosthesis to a fixed restoration.

The proper application of internal attachments has the following advantages over clasp-type removable partial dentures:

1. *Cosmetics:* Unlike the clasp-type partial denture, there is no visible evidence of labial or buccal metal retainers.
2. *Periodontal health:* The precision attachment is less stressful to the abutment teeth than clasp-type attachments. There are decreased lateral vectors of force since most of the forces are directed along the long axis of the tooth and can be more easily resisted by the fibers of the periodontal ligament. This type of directed stress places less leverage on the abutment teeth and thus provides a better environment for maintainable periodontal health.

Prefabricated Attachments

There are many different types of prefabricated attachments available. They are usually classified on the basis of shape and form.

Intracoronal attachments: These attachments consist of two parts a slot (female) and a flange (male). The flange is connected to the removable prosthesis and fits into the slot which is embedded in a fixed restoration. This attachment was designed by Herman Chayes in 1906 and with only slight modifications, is still in use.

Extracoronal attachments: These attachments have most of their mechanism outside of the diameter of the abutment restoration. In most types, a projecting receptacle is soldered to the crown, and a corresponding fitting or housing is incorporated in the removable prosthesis. With this type of attachment, there is usually a certain amount of movement between the two sections of the prosthesis.

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Stud attachments: This attachment is composed of a projection soldered to a post-type crown and a corresponding female receptacle that is embedded in an overlay type of denture prosthesis.

Bar attachments: This type of attachment consists of a bar spanning an endentulous area that splints the existing teeth together. The bar is then used to support a denture prosthesis that houses matching, prefabricated sleeves.

The intracoronal type of attachment is probably the most widely used attachment. For more than 30 years, we have used intracoronal attachments, in particular the APM Sterngold #7 precision attachment. They have functioned with great success. In our experience, the average case has lasted from 15 to 20 years, with many cases still functioning after 30 years. (Figures 1a, 1b and 1c). To obtain such results, however, it is essential that exacting and precise techniques as well as strict adherence to basic engineering and mechanical principles are followed at all times. The following fundamentals which are based on experience from 1,500 clinical cases are required for maintainable periodontal health and abutment longevity.

Fundamental Criteria for Attachments

1. *Preparation of abutment teeth:* The preparation of choice is a full-shouldered preparation with an even, circumferential width of shoulder on the corresponding casting. Since most of the stress from the functioning attachment case is transmitted in a vertical direction, the even shoulder helps to equally distribute the load to the supporting structures with little lateral stress inflicted on the abutment. The shoulder should also be related as close to the bone as possible to prevent undue torquing of the abutment teeth. This approach to the preparation of abutment teeth conforms to accepted engineering principles of design and construction.

2. *Splinting of abutments:* In every case, at least two attachments should be placed in crowns that are splinted to other teeth in order to aid in distributing the forces. Auxiliary attachments may then be used on available single teeth to provide additional support and retention. The only exception is the placement of attachments in long canines that have good bone support. For patients who have lost most of their posterior teeth, cross arch splinting of the remaining anterior teeth, that includes the two strategic attachments, is the method of choice.

3. *Attachments:* The manufacturer fabricates the male 7mm in length. This is the ideal length, but it is not always possible to create this much space without interfering with the occlusion. The average crown can usually accept between five and seven millimeters of male attachment if the teeth and the periodontium have been prepared properly. Any attachment under 4mm in length will function more as a rest than as an attachment and should not be used as one of the two essential strategic functioning attachments.

A full-shoulder preparation is the recommended method of tooth preparation. Due to the flat undersurface of the housing, a shoulder allows the female to be placed in a more gingival direction. This relationship of the female to the abutment will result in the placement of the maximum length of usable male, which in most cases is a critical factor. The abutment teeth should be prepared normally, with no additional emphasis on deepening the axial wall for the acceptance of the female. The female housing will not be completely within the confines of most normally contoured abutments (unless endodontic therapy was instituted) but will force the restoration to have a slightly larger diameter. Since most components of force are applied vertically by the functioning attachment, this slight overextension appears to have no clinical significance in the health of the supporting structures. If this overextension is a critical factor in the esthetics of the case, the first pontic tooth on the prosthesis may be extended labially to overlap the excess metal and hide the true diameter of the abutment tooth. For this reason, processed acrylic teeth adjacent to the abutments are used to relate the shape and form of the pontics esthetically with the fixed restorations.

4. *Retention mechanism:* Every type of removable partial denture has to handle the problem of preventing gravitational and muscular forces from dislodging the partial denture during function. This is especially true for the average distal extension partial denture. To resist these forces, many different mechanical aids have been developed, including all varieties of clasps, rests, springs, flanges, snaps, latches, plungers and retentive arms. Despite the differences in design and application, almost all of these retention mechanisms are used to grip the abutment teeth with enough rigidity to prevent a force from dislodging the prothesis.

Unfortunately, while being retentive, these mechanisms inflict lateral stresses on the abutment teeth through their torquing action. These additional lateral stresses may eventually harm the periodontal support of the abutment teeth and limit the longevity of the resotration. An ideal retainer should be passive and place minimal stress on the abutment teeth. The use of a double-tilt for the path of insertion of the parallel precision attachment is an alternative method of mechanical retention that eliminates the torquing stresses that most abutments are forced to absorb from conventional mechanical retention mechanisms.

Traditionally, intracoronal attachments have been surveyed so that they are approximately perpendicular to the occlusal plane. This method requires a strong additional retention mechanism to resist dislodging forces. Double-tilt retention, however, uses an unconventional path of insertion to retain the prosthesis. An anterior-posterior tilt as well as a mesio-distal tilt is used in the surveying procedure to place the attachments. The resulting path of removal does not coincide with the path that any oral movement or gravitational force will produce to dislodge the partial. It is, therefore, unlikely that any normal function of the musculature and tongue will have any affect.

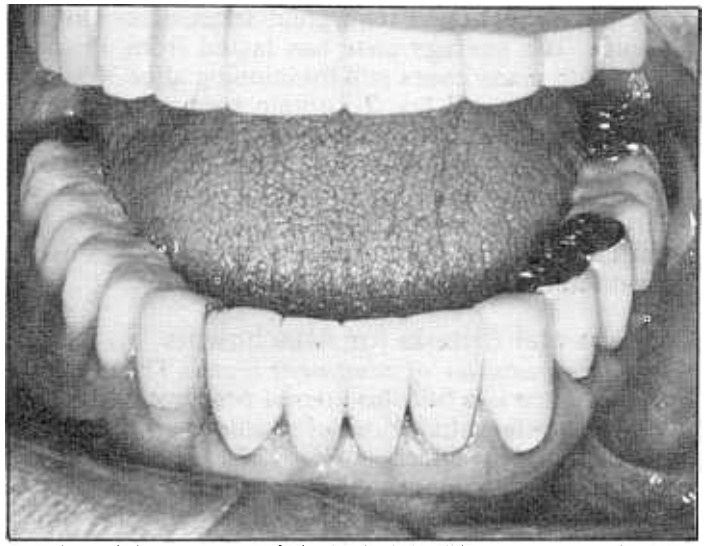

Figure 1a—Patient displaying lower precision attachment partial with remaining teeth splinted after 21 years.

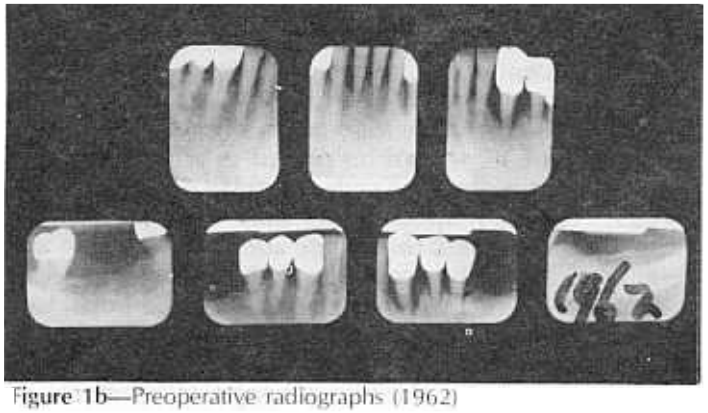

Figure 1b—Preoperative radiographs (1962)

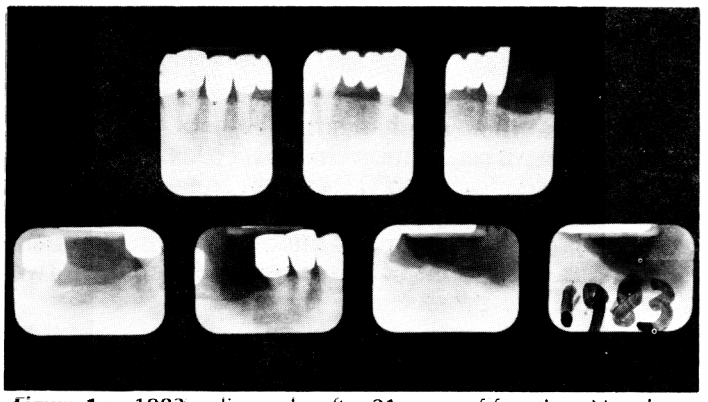

Figure 1c—1983 radiographs after 21 years of function. Note bone level, especially on left lateral.

Establishing the Double-Tilt Path of Insertion

After waxing the abutments, the dentist or technician simply mounts the model on the parallelometer with the occlusal table approximately parallel to the floor and the anterior teeth facing forward. The heel of the model is raised approximately 10 degress to provide an anterior-posterior tilt. The left-or right-hand side of the model is then raised approximately 10 degrees to provide a mesio-distal tilt. This double-tilting of the model results in the correct line of insertion for the prosthesis, whether it be an upper or lower prosthesis. The parallelometer is now locked, and the attachments are placed into the restorations (Figure 2).

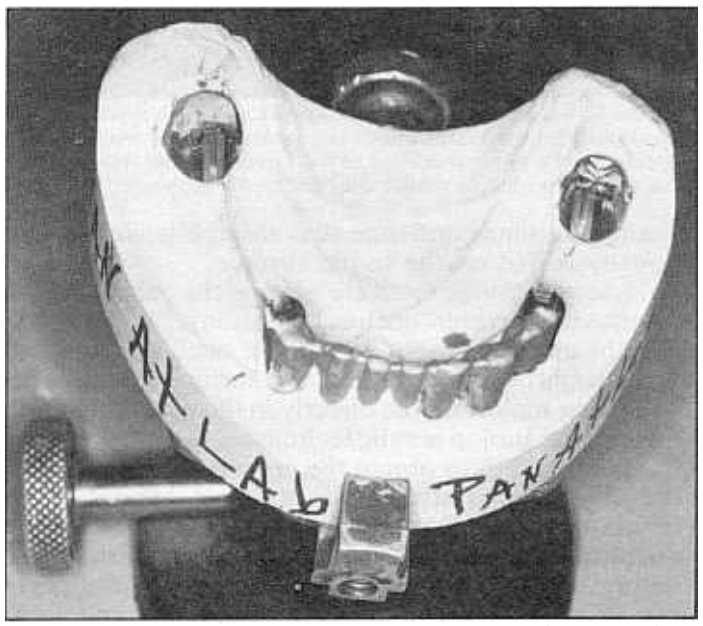

Figure 2—Model cast on the surveyor table with attachment in place and ready for soldering. Note the double tilt of the cast to the horizontal plane. The heel of the cast has been raised and tilted to the left

Figure 3—Three partial attachment prostheses having the same type of intracoronal attachment but with different mechanisms for retention. At Left: Double-tilt path of insertion. Note the increased length of the male. Center: Lingual spring mechanism. At right: Layer lingual arm

The double-tilt technique for retention was refined by I. Franklin Miller and has been used for more than 50 years. Traditionally, males have been fabricated with a slit so that retentive adjustment can be accomplished by spreading the wings of the male. When overadjusted these wings can weaken and present breakage problems. The double-tilt technique, however, eliminates the need for adjustment because only a precision fit of the attachment as well as a close fit of the partial base to the tissue are required for proper fit. Since no adjustments are necessary, a solid male is far superior to a male with a slit.** It can be machined to a closer fit and has far less tendency to wear and require replacement (Figure 3).

The double-tilt prosthesis is designed to fit lightly and is not rigidly held in place. During functional movements, if one side of the prosthesis is overloaded, the males may rise a fraction of a millimeter. The prosthesis cannot be dislodged because the direction of the forces applied do not coincide with the path of insertion. It will then gently slide back into place. This barely visible movement breaks the stress applied to the abutment teeth and gently massages the soft tissue at the same time. Clinical experience suggests that this highly restricted movement in a vertical direction physiologically preserves the alveolar crests, producing firm and healthy soft tissue as well as maintaining the stability of the abutment teeth.

Maintenance: The continued periodontal acceptance for case longevity requires an exacting maintenance program. All of the patients are recalled every four months for complete prophylaxis therapy and clinical evaluation. Physiological changes in oral anatomy are normal and occur at different rates for each individual. Periodically, therefore, the prosthesis will require alteration in occlusion as well as rebasing for tissue readaptation. A close fit of the partial to the soft tissue is essential for proper functioning of the double-tilt prosthesis. A slight rock of the appliance upon pressure or a feeling of looseness of the case consequently indicates that a relining procedure is necessary. (Figure 4). There is minimal wear in a properly

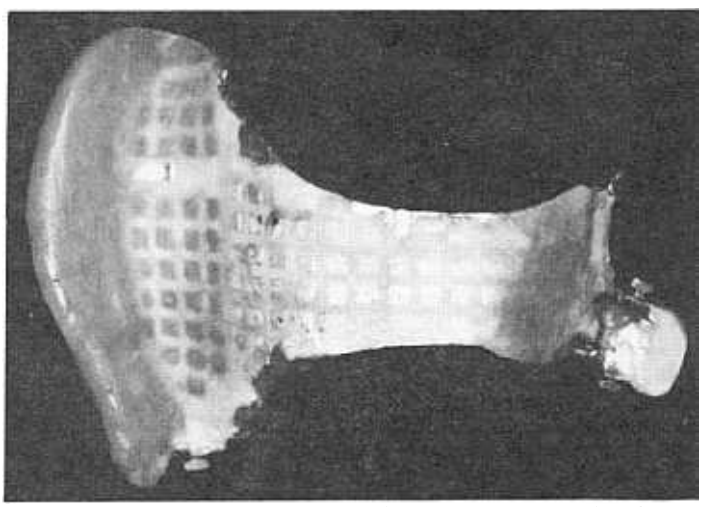

Figure 4—Maxillary partial base. Entire surface is covered with acrylic for exact tissue relationship and future rebasing procedures.

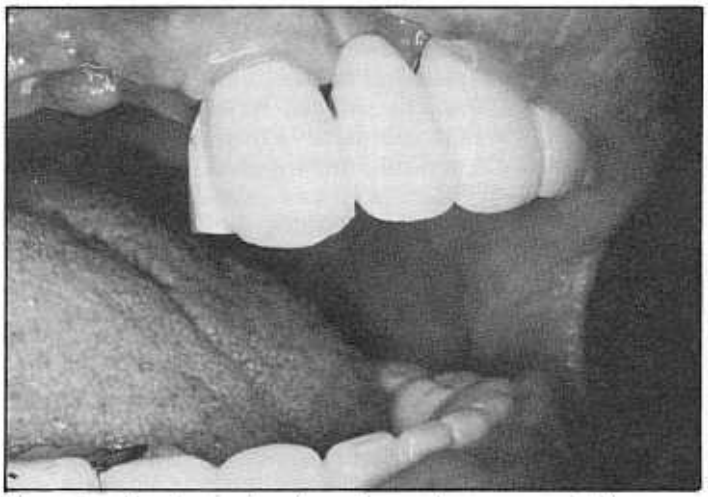

Figure 5a—Housing for female attachment is not covered with porcelain so that canine does not appear large mesiodistally.

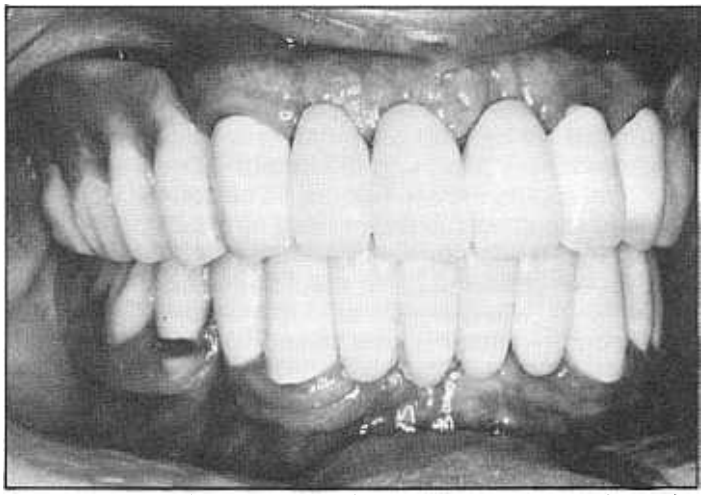

Figure 5b—Upper and lower attachment cases, seven years later. The bicuspid pontic overlaps the canine housing for esthetics. Note the groove on the gingival portion of the lower bicuspid makes it easier for patient to remove partial with double-tilt pathway.

functioning attachment. This procedure is the only method ever used to retighten the removable partial denture. The acrylic saddles are rebased indirectly by laboratory processing or directly by the use of Biolon acrylic impressions from the mouth. Biolon impressions have a great advantage since they can be processed, without making models, in 30 to 40 minutes while the patient waits. A pressure pot with pressure and temperature controls is used to cure the acrylic.

Every case is routinely rebased, 30 to 60 days after insertion, as the tissue will normally exhibit slight changes in shape and tone after the appliance has functionally rested on the tissue surface.

Acrylic pontic teeth are used on the partial denture to provide greater occlusal harmony. Within three months after insertion, the acrylic occlusals are shortened slightly and a new occlusal surface is established by adding Biolon acrylic directly in the patient's mouth. Prior to the Biolon acrylic technique, wax was added to the pontic teeth to obtain the correct occlusion. Then the case was routinely flasked and packed in the laboratory. This direct method provides a much better occlusal harmony with either dental restorations or natural teeth than the traditional grinding in of porcelain denture teeth. Every five to seven years, a new occlusion may be added to compensate for the wear and physiologic changes that occur. (Figures 5a and 5b).

Summary

Clinical evaluation of approximately 1,500 cases over a 30-year period indicates that intracoronal attachments using a double-tilt retention mechanism offer one of the most successful approaches for removable partial denture therapy. Adherence to precision techniques, proper diagnosis and periodic recall preventative therapy will result in successful treatment and preservation of the patient's existing dentition for many years. □

References

1. Feinberg, E.; 1970, Full Mouth Restorations in Daily Practice, J.B. Lippincott, Phila., Pa.
2. Preiskel, H.W.; 1979, Precision Attachments in Dentistry, 3rd Edition, C.V. Mosby, St. Louis, Mo.
3. Miller, E.L.; 1972, Removable Partial Prosthodontics, Williams and Wilkens, Baltimore, Md.
4. Singer, F.; Schon F.; 1973, Partial Dentures Die, Quintessence, Chicago, Ill.
5. Feinberg, E.; Diagnosing and Prescribing Partial Dentures, New York State Dental Journal: Vol. 48 No. 1, Jan. 1982.

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