There When You Need Them: 10 Principles of Successful RPD Treatment

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The 10 Principles of Removable Partial Denture Design

Principle 1: Restore to Centric Relation
Many RPD’s fail because the occlusal relationship of the denture interferes with complete seating of the temporomandibular joints. If maximal intercuspation of the occlusion is aligned with displaced condyles (A), there is a tendency for the most posterior tooth on the RPD to strike first when the condyles move up to their completely seated position in centric relation (B). This has been demonstrated to hyperactivate the elevator muscles and can result in pounding of the supporting ridges. Partial denture patients are always more comfortable if the occlusion is in harmony with the TMJ’s

The contour and position of abutment tooth restorations should always conform to correct maxillomandibular relationships. When positioning precision attachment fixtures or bars, the occlusal relationship must always be an important consideration.
**Principle 2: Design to Preserve Abutments**
A removable partial denture should do more than just replace missing teeth. Correct design enables the removable segment to provide such effective stabilization of abutment teeth that it is often possible to save teeth with severely compromised bone support while using them as abutments. Preservation of the remaining teeth should be the first objective of a correct RPD design.

**Principle 3: Design Horizontal Stabilization First**
Horizontal stabilization is always the first priority of design in order to preserve abutments. Once that is achieved the rest of the design is simplified. The objective of reciprocal stabilization is that the teeth stabilize the partial segment, while the fit of its base against the tissue has a stabilizing effect on the teeth. When the denture base is firmly adapted against the ridges or up against the palatal vault, the denture base is prevented from horizontal movement. A correct design uses the teeth to hold the partial base in its correct relationship against the tissue. In turn, the denture base, stabilized against the tissue, prevents the abutment teeth from rocking or moving horizontally. Horizontal stabilization is effective if the abutment teeth cannot separate horizontally from the partial denture base, and the base cannot move away horizontally from the teeth. Horizontal stabilization can be achieved by the following means:

**Clasps**
If a clasp is to fulfill the requirement of horizontal stabilization, it must engage more than 180° around the tooth. When horizontal stabilization is achieved, horizontal separation of the teeth from the partial base cannot occur.
Intracoronal Attachments
Any deep-seated rest or keyway slot that is shaped to prevent horizontal movement of either the teeth or the partial denture base can be used as an intracoronal attachment. Intracoronal keyways are of diverse shapes and sizes, but all require considerably more tooth reduction than extracoronal attachments, and all require a display of metal at the occlusal surface. Even though intracoronal keyway attachments have been popular in the past, there are numerous benefits and no disadvantages in the use of extracoronal attachments.
Extracoronal Attachments
The ideal extracoronal attachment uses a male segment that is external to the normal crown contour. The keyway (female) segment is a part of the removable denture base. Extracoronal attachments have several advantages over intracoronal keyways. They require less tooth reduction, and they are invisible when the partial denture is in place.

Bar Attachments
Bars are joined at both ends to abutment teeth. The bar acts as the male segment and the housing that fits over the bar is the female segment. The bar and its matrix serve as a large precision attachment. Bars provide strong and stable horizontal stabilization. The bar partial has been used for decades and has stood the test of time as a comfortable, trouble-free prosthesis.
**Principle 4: Minimize Torque on Abutment Teeth**

One cardinal precept must be meticulously adhered to in order to minimize torque on abutment teeth. The completely seated denture base must relate to the passive position of the abutments. There are three practical means with which to achieve this relationship:

1. Custom-Made Impression Tray with Uniform Relief over Teeth and Soft Tissue. The impression must permit border moulding and very slight over-all compression of soft tissues in relation to passive position of abutment teeth.
2. Denture Base Related to Abutments in the Mouth. After the denture base is completed, it is held in firm apposition to the soft-tissue support area, while attachments to the teeth are joined to the base.
3. Postplacement Reline. The completed prosthesis is placed and immediately relined to the passive position of abutments. This means that closure to tooth contact is not permitted during the reline procedure. After the reline impression has set, the occlusion must be reevaluated and corrected, if necessary.

**Principle 5: Use Rigid Attachments**

Considerable debate about the selection of rigid versus nonrigid (stress breaker) attachment of the denture base to the abutments has taken place in the past. While the concept of stress breaker attachments sounds appealing, long-term observation of both types of attachments has demonstrated the rigid attachment to be the clear choice, clinically and conceptually. Correctly fabricated rigid attachment partials serve for years without relining. They are more trouble free and rarely require postoperative adjustments.

To understand the rationale for rigid attachments, an analysis of the principles of splinting is presented, as demonstrated by the use of a rigidly attached bar partial to mobile teeth with compromised bone support. Note how forces are redirected by the splinting effect of the rigid attachments in the fixed segment and the removable segment.

Individual teeth with compromised bone support and mobility in all directions.
Same teeth after splinting with a bar. Note how lateral forces are redirected down the long axis when the teeth are rigidly splinted together.

The bar causes lateral forces to be redirected but does not prevent the teeth from rocking in a forward-and-back pattern of mobility.

The effect of a rigidly attached denture base that is properly adapted to the ridge is to further stabilize the abutment teeth. If the attachment to the teeth is flexible, the teeth could still move, even if the denture base is stable.
**The next three principles are important for optimal reduction of torque to the abutment teeth.**

**Principle 6: Stabilize The Denture Base Vertically**

There are three choices for vertical stabilization of a removable partial denture.

1. Completely tooth-supported
2. Completely tissue-supported
3. Combination of tooth and tissue-supported

Tooth-supported RPD’s have all the same characteristics as a fixed bridge, except that part of the prosthesis is removable. This type of RPD may be used when there are sufficient teeth to support a fixed bridge, but ridge deformation requires adding simulated soft tissue for esthetics. A removable section of the prosthesis is usually designed to facilitate cleaning of concave surfaces.

Completely tissue-supported RPD’s have a poor long-term expectancy. As the partial base compresses into the soft tissue, the RPD frequently develops a stepped occlusion. Some authorities refer to such partials as”gum strippers.” Experience has demonstrated a definite need for vertical stabilization of the removable segment in relation to the abutment teeth.

Combination tooth- and tissue-supported RPD’s are the design of choice. The purpose of a rest in a rest seat is to ensure vertical stabilization of the denture base in relation to the abutment teeth. Such stabilization also ensures the maintenance of a continuous occlusal plane that remains in its designated relationship to the dentulous segment.

The tissue support must be firmly resistant to occlusal forces to avoid a torquing effect on the abutments. This is a prerequisite of major importance to combination support.

The next two principles are the keys to ensuring effective mutual support.

**Principle 7: Place A Brick-Like Stop Under The Back End Of The Partial**

If a partial denture is supported as its front end by stable brick-like stops on the abutment teeth and there is a stable brick-like stop under the back end of the base, it is obvious that no torque can be applied to the abutment teeth. There must be movement toward the tissue at the back end of the partial in order to create torque at the front. Correct RPD design requires that the appropriate stop is found and the denture base is rested on it.
Three stops effectively serve this purpose:
1. The retromolar pad
2. The bony palatal vault
3. Firm tuberosities

Note how a partial denture base can torque abutment teeth if it does not have firm support at the back end of the saddle (A). Compare the absence of torque when the support is adequate (B).

The retromolar pad is not a hard bony stop in itself, but it locates the hard cortical bone at the beginning of the ascending ramus. Extending the denture base back far enough to rest on this stable stop has the effect of placing a brick-like stop under the base. The alveolar bone, anterior to the retromolar pad, is not as resistant or as stable.
Cortical bone in the palatal vault is the most stable stop for maxillary RPD’s. Careful adaptation of the denture base to the vault provides the best possible long-term stability and resistance to torque at the abutment teeth.

Firm tuberosities also serve as effective stops. In combination with good palatal bone support, tuberosities provide excellent support as well as horizontal stabilization for the denture base.
Principle 8: Equalize Tissue Support Throughout

The master impression for an RPD cannot be compromised. Whether the impression is made with a custom tray technique, or the denture base is relined after the initial placement, the denture base must be fully supported.
Principle 9: 
Provide Retention After Horizontal And Vertical Stabilization has Been Designed

Retention for the RPD must be designed to prevent vertical displacement from its predetermined relationship to the abutments. A basic rule is: Always design horizontal stabilization and vertical support first.

Engaging an undercut is the best way to provide retention. Numerous attempts have been made to retain RPD’s by frictional fit, but long-term experience with frictional retention has been unsatisfactory.

There are several different ways to engage an undercut. The most popular way is to use the tip of a flexible clasp. Prior to using the clasp, it must be ascertained that the horizontal and vertical relationship of the RPD to the abutment is secure.

Another way to provide retention is the use of resilient attachments. They are available in many different sizes and configurations. The main differentiating factor in choosing an attachment is the amount of available interocclusal space in which to fit not only the nylon female but also the metal housing around it which secures it in place and makes replacement simple.
Principle 10: Restore To The Correct Neutral Zone

The zone of neutrality between the outward force of the tongue and the inward force of the perioral musculature in the cheeks and lips is called the neutral zone. Any interference with normal muscle function results in uneven forces that tend to dislodge the RPD or cause irritation to the tongue, cheeks, or lips. A considerable number of RPD’s fail or cause general dissatisfaction because of neutral zone errors. In placing any bar or precision attachment fixture, excessive bulk or misalignment can compromise comfort or stability.