Principles of Removable Partial Denture Design

Differences between the Two Main Types of Removable Partial Dentures

Certain differences are present between Kennedy Class I and Class II types of partial dentures on the one hand and the Class III type of partial denture on the other:

First, Support. The Class I type and the distal extension side of the Class **II** type derive their primary support from tissues underlying the denture base and secondary support from the abutment teeth through the rests. The Class III type derives all of its support from the abutment teeth via the rests (Fig. 1).

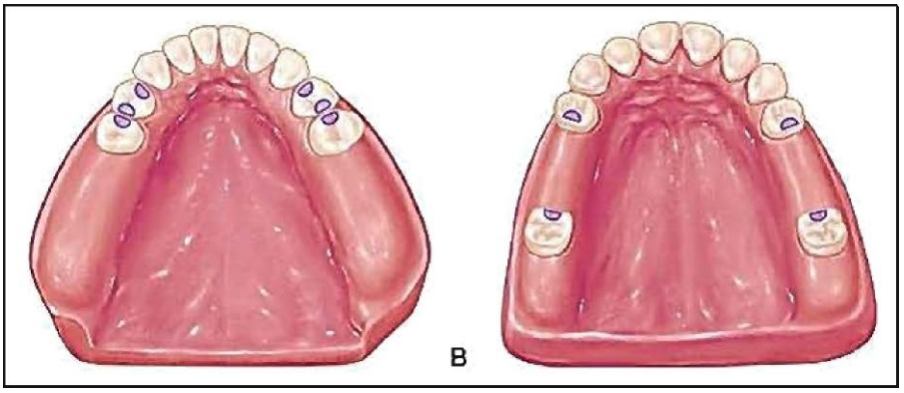


Figure 1: Support for tooth supported & tooth-tissue supported partial dentures.

Second, the method of impression registration and the jaw record required for each type will vary.

Third, the need for indirect retention exists in the distal extension type of partial denture, whereas in the tooth-supported there is no need for indirect retention because each end of each denture base is secured by a direct retainer on an abutment tooth.

Fourth, distal extension partial dentures often necessitate the use of a base material that can be relined, acrylic-resin, to compensate for tissue changes. Metal bases can be used for tooth supported partial dentures which do not require relining except: 1) when it is advisable to eliminate an unhygienic, 2) unaesthetic, or 3) uncomfortable condition resulting from loss of tissue contact. These cases demand the used of acrylic-resin as the base material.

Fifth, requirements for direct retention. The tooth-supported partial denture is totally supported and retained by abutment teeth at each end of the edentulous space. So, the only requirement for clasps is that they flex sufficiently during placement and removal of the denture to pass over the height of contour of the teeth in approaching or

escaping from an undercut area. Cast retentive arms are generally used for this purpose. These may be of the circumferential type or of the bar type.

In the tooth and tissue—supported partial dentures, because of the functional movement of the distal extension base, the direct retainer adjacent to the distal extension base may be designed in two different ways:

1) The first way is when the retentive tip of the clasp lies in an undercut area mesial to the fulcrum (distal occlusal rest) (Fig. 2). A clasp design must be able to flex to dissipate stresses that otherwise would be transmitted directly to the abutment tooth as leverage. This can be achieved with the use of a combination clasp which is a retentive arm of the circumferential clasp made of wrought metal wire.
2) The second method is the placement of the occlusal rest mesially to the abutment tooth adjacent to the edentulous span (Fig. 3). The retentive tip of the clasp arm will disengage the abutment tooth during tissue ward movement of the distal extension base. This serves the purpose of reducing or "breaking" the stress, "*stressbreakers*".

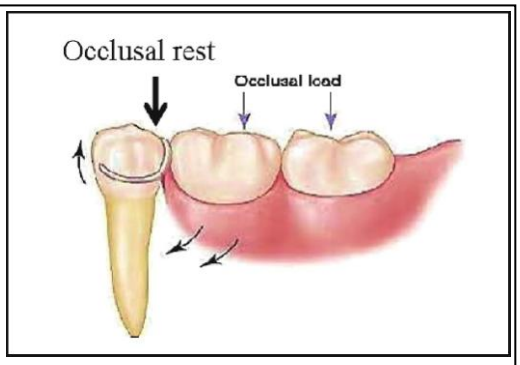


Figure 2: Design with a distal occlusal rest & wrought wire retentive clasp.

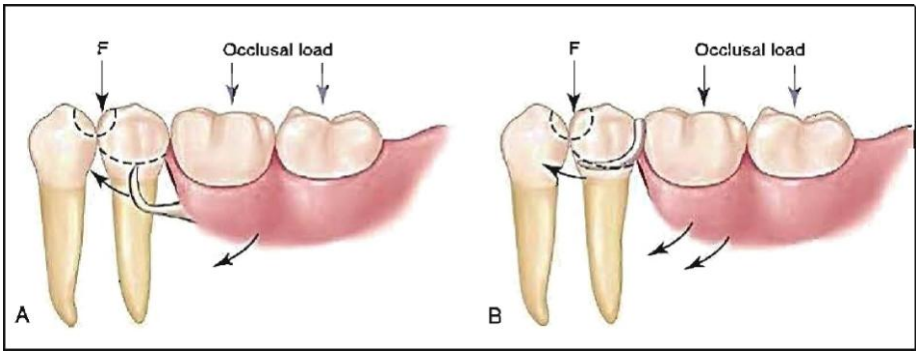


Figure 3: Design with mesial occlusal rest & cast retentive arm.

Steps of Partial Denture Design

The first step is to determine how the partial denture is to be supported. In an entirely tooth-supported partial denture, the most ideal location for the rests is on prepared rest seats on the occlusal, cingulum, or incisal surface of the abutment adjacent to each edentulous space.

The support provided by an abutment tooth is dependent on:

1. Periodontal health.
2. Crown and root morphologies.
3. Crown-to-root ratio.
4. Location of the tooth in the arch.
5. Relationship of the tooth to other support units (length of edentulous span)
6. The opposing dentition.

In a tooth and tissue—supported partial denture, attention to these same considerations must be given to the abutment teeth. However, equitable support must come from the edentulous ridge areas.

Denture base areas adjacent to abutment teeth are primarily tooth supported. As one proceeds away from the abutment teeth, they become more tissue supported. Therefore it is necessary to distribute the functional load equally between the abutment teeth and the supporting tissues of the edentulous ridge.

The support available from edentulous ridge areas depends on:

1. The quality of the residual ridge, which includes quality of the supporting bone and mucosa (Fig. 4).

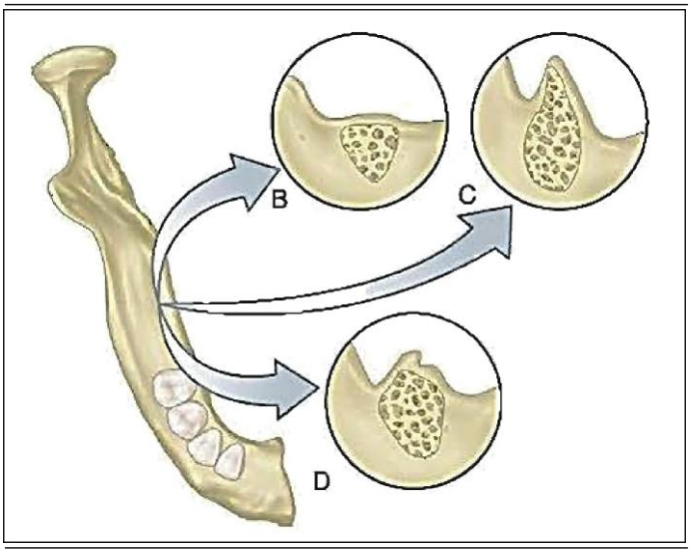


Figure 4: Shape of the residual ridge in the edentulous span.

2. The accuracy and type of impression registration. Three factors must be considered in the acceptance of an impression technique for distal extension removable partial dentures: (A) the material should record the tissues covering the primary stress—bearing areas in their supporting form; (B) tissues within the basal seat area other than primary stress—bearing areas must be recorded in their anatomic form; and (C) the total area covered by the impression should be

sufficient to distribute the load over as large an area as can be tolerated by the border tissues. This is an application of the principle of the snowshoe.

3. The accuracy of the denture base. Materials and techniques that will ensure the greatest dimensional stability should be selected.
4. The extent of residual ridge coverage by the denture base.
5. The occlusal load applied. This may be influenced by reducing the area of occlusal contact through fewer, narrower, and more effectively shaped artificial teeth (Fig. 5).

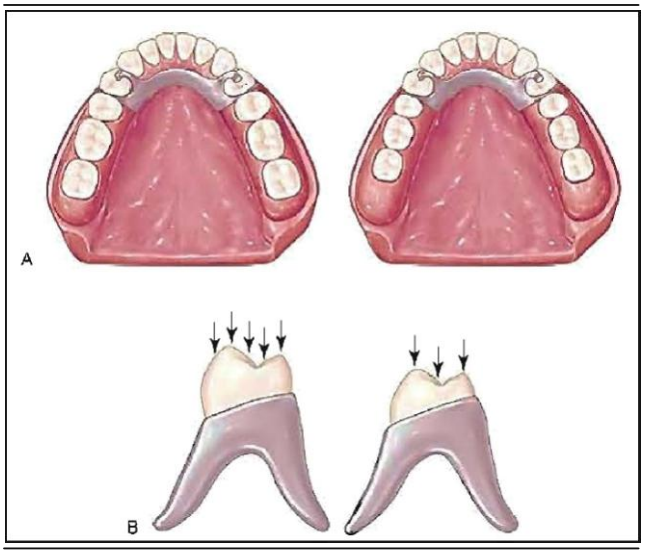


Figure 5: Influence of reduction in occlusal surface area.

The second step in the design for any removable partial denture is to connect the tooth and tissue support units. This connection is by designing and locating major and minor connectors.

The third step is to determine how the removable partial denture is to be retained. Retention is accomplished by 1) clasps on the abutment teeth and 2) by the intimate relationship of the denture bases and major connectors (maxillary) with the underlying tissues.

The key to selecting a successful clasp design for any given situation is to choose one that will:

1. Avoid direct transmission of tipping or torqueing forces to the abutment.
2. A clasp design with correctly positioned component parts on abutment tooth surfaces.
3. Provide retention against dislodging forces.
4. Compatible tissue contour and esthetic desires of the patient.
5. Location of the undercut is the most important single factor in selection of a clasp.

The fourth step is to connect the direct and indirect retainers to the support units, rests, through the rigidity of the major connector.

The fifth and last step is to outline and join the edentulous area (denture base areas) to the already established design components.

Components of Partial Denture Design

All partial dentures have two things in common: (1) they must be supported by oral structures, and (2) they must be retained against reasonable dislodging forces.

In the Kennedy Class III partial denture, three components are necessary: support provided by rests, the connectors (stabilizing components), and the retainers.

In distal extension base dentures the support, connectors, and retainers must be designed and executed more carefully because of the movement of tissue-supported denture base areas. In addition, three other factors have to be placed in mind:

1. The best support must be obtained from the resilient tissues that cover the edentulous ridges. This is accomplished by a) the impression technique more than by the partial denture design and b) the area covered by the denture base

2. The method of direct retention must take into account the tissue-ward movement of the distal extension base. Direct retainers must be designed so that occlusal loading will result in direct transmission of this load to the long axis of the abutment teeth instead of as leverage.

3. The partial denture, with one or more distal extension denture bases, must be designed so that movement of the extension base away from the tissues will be minimized through indirect retention. Also, retention of the denture base itself can be made to help prevent this movement.

Acrylic Removable Partial Dentures

Sometimes there is a need for a temporary replacement of missing teeth and associated structures, while tissue is healing or related treatment is being provided. For such situations, an interim prostheses is constructed.

These prostheses are usually resin with wire retention and may include components to provide tooth support. Patients must be informed that these prostheses are temporary and may threaten the integrity of adjacent teeth and the health of supporting tissue if worn for long periods without follow-up or maintenance.

Such prostheses are indicated as a part of total treatment for the following:

1. Appearance
2. Maintenance of space
3. Reestablishment of occlusal relationships
4. Conditioning of teeth and residual ridges
5. Interim restoration during treatment
6. Conditioning the patient for wearing a prosthesis

1. Appearance

An interim removable partial denture may replace one or more missing anterior teeth or both anterior and posterior.

Such a restoration is usually made of resin, which may be produced by A) sprinkling method, B) visible light-cured (VLC) method, or C) waxing, flasking, and processing with auto polymerizing or D) heat polymerizing resin.

It may be retained by A) circumferential wrought-wire clasps, B) Crozat-type clasps, C) interproximal spurs, or D) wire loops.

2. Space Maintenance

It is important to maintain the space of a lost tooth until healing of the tissues or until a definitive treatment can be achieved.

In younger patients, the space should be maintained until complete eruption of the adjacent teeth to facilitate restoration with a fixed restoration or with implants. In

adult patients, maintenance of the space can prevent undesirable migration and extrusion of adjacent or opposing teeth until definitive treatment can be accomplished.

3. Reestablishing Occlusal Relationships

Such treatment can be for the following reasons:

a. To establish a new occlusal relationship or occlusal vertical dimension
b. To condition teeth and ridge tissue for optimum support of the definitive removable partial denture that will follow.

4. Conditioning Teeth and Residual Ridges

The tissues of the residual ridge are more capable of supporting a distal extension removable partial denture when they have been previously conditioned by wearing an interim RPD. This is also true for abutments which are out of occlusion for a long period of time. If not conditioned than they may intrude after insertion of a definitive partial denture and thus alter the occlusal relationship in addition to causing gingival impingement even with adequate relief provided initially. Thus, conditioning such abutment teeth with an interim RPD before the impression for the master cast is made for a definitive treatment is advantageous.

Abutment teeth and supporting ridge tissue are more capable of providing continued support if they were previously conditioned by the wearing of a temporary interim restoration.

5. Interim Restoration during Treatment

There are certain situations which include:

A. An existing removable partial denture modified by relining and adding teeth and clasps.
B. An existing removable partial denture may be converted to a transitional complete denture for immediate placement while the tissue heals and an opposing arch is prepared to receive a removable partial denture.
C. A temporary interim removable partial denture made to replace missing anterior teeth in a partially edentulous arch that are to be replaced with fixed restorations.
D. The anterior portion is cut away when fixed restorations are placed. leaving the remainder of the denture to be worn while posterior abutment teeth are prepared.

E. An interim removable partial denture for temporary replacement of missing posterior teeth with a resin occlusion rim rather than with occluding teeth.

6. Conditioning the Patient for Wearing a Prosthesis

A temporary restoration may be made to aid the patient in making a transition to complete dentures when the total loss of teeth is inevitable. This type of a removable partial denture may be worn for prolonged periods, in the meantime undergoing revision, modification to include additional teeth lost, or relining when such becomes necessary or advisable.

Clinical Procedure for Placement

To ensure proper use of the remaining natural teeth, the prosthesis must be completely seated in the arch. Common areas requiring adjustment to ensure complete seating include:

1. Interproximal extensions.
2. Regions where clasps exit from the acrylic-resin base
3. Tissue undercuts (labial undercuts from recent extractions or the lingual/retromylohyoid region).
4. Any portion of the prosthesis that lies inferior to the height of contour, especially if bilaterally opposed.

Laboratory block out of the marginal gingival region and infrabulge regions is necessary to reduce seating problems. Infrabulge regions may include lingual, palatal, interproximal tooth surfaces, as well as modification space regions. After laboratory blockout, a duplicate of this cast will provide the necessary relief for use as a processing cast.

Stability and retention are improved when the prosthesis contacts the teeth superior to the height of contour.