Principles of Clasp Design

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Direct Retainers

- A removable partial denture must include components that prevent displacement of the prosthesis from the patient’s mouth during function.
- There are 2 types of retainers: 1-direct retainer 2-indirect retainer
- The components of a removable partial denture that engage abutments and resist dislodging forces are called direct retainers.
- There are two types of direct retainers: intracoronal direct retainers and extracoronal direct retainers

**Intra-coronal direct retainers**

As its name implies, an intra-coronal direct retainer resides within the normal contours of an abutment and functions to retain and stabilize a removable partial denture.

The retainer consists of two distinct components:

1. The first component, or **matrix**, is a metal receptacle contained within the normal clinical contours of a fixed restoration.
2. The second component, or **patrix**, is attached to the corresponding removable partial denture. The binding forces and friction between the matrix and patrix components provide measurable resistance to displacement.

- Intracoronal direct retainers may be subdivided into two categories based on the method of fabrication fit between components:
  - **Precision attachments**: If components are fabricated in metal using high-precision manufacturing techniques.
  - **Semiprecision attachments**: They display a less intimate fit between matrix and patrix components. Usually originate as wax or plastic patterns, and subsequently cast in metal.
**Extracoronal direct retainers**

They consist of components that reside entirely outside the normal clinical contours of abutment teeth and may be divided into two distinct subcategories: *extracoronal attachments* and *retentive clasp assemblies*.

Like their intracoronal attachments, these derive their retention from the closely fitting components *matrices and patrices*. They permit vertical movement of prostheses during occlusal loading. This is intended to minimize the transfer of damaging forces to the abutments giving “stress breaking” or “stress directing” action.

**Retentive clasp assemblies**

Represent the most common method for extracoronal direct retention. Each clasp assemblies consist from:

- retentive arm (buccal surface)
- reciprocal arm (lingual surface)
- rest.
- minor connector.

Clasps can be divided into two types according to the direction of approach of retentive arm to the undercut area into:

1. **Suprabulge clasps (occlusally approaching, circumferential or encircling clasps):** The retentive arm approaches the undercut area from the suprabulge direction.

2. **Infrabulge clasps (gingivally approaching or bar clasp):** The retentive arm approaches the undercut from the infrabulge direction e.g.: bar clasp (I bar clasp)

**NOTE:** *Combination Clasp Assembly:* Joining two components
Circumferential and bar.
Wrought wire and cast arm.

The retentive element of an individual clasp assembly is a metal clasp arm with limited flexibility that allows the tip of the retentive clasp to pass over the greatest diameter of an abutment and contact the surface of the tooth as it converges apically.

The practitioner must understand two important concepts:

- The path of insertion and removal for the prosthesis
- The height of contour for each abutment.

To properly design a removable partial denture, the practitioner must consider the path along which the prosthesis will be inserted and removed from its fully seated position. Upon insertion, the clasp arms
will contact the axial surfaces of the abutments. With continued seating, the retentive clasp arms will flex as they pass over the greatest convexities of the abutments. Once the point of greatest tooth convexity is reached, further placement of the prosthesis allows each retentive clasp arm to return to its “unstrained” or “passive” state. This places the retentive terminus in an undercut relative to the path of insertion and removal. If this is not the case, the clasp assembly will not contribute to optimal retention of the prosthesis.

Forces such as gravity or the pull of sticky foods acting to dislodge a removable partial denture typically occur perpendicular to the occlusal plane.

Proper use of a dental surveyor is the only reliable method of effectively analyzing teeth for their potential contributions to retention of a removable partial denture.


**REQUIREMENT OF A CLASP ASSEMBLY:**

1. Retention.
2. Support.
4. Reciprocation.
5. Encirclement.
6. Passivity.

1. **RETENTION:** Is the quality of the clasp assembly that resists forces acting to dislodge components away from the supporting tissues. Retention is provided by the retentive arm which prevents
the partial denture from displacement away from the tissues toward the occlusal. While the partial denture is seated the retentive tip must be passive. However, it should touch the tooth in the undercut area.

**Retention action of a clasp depends on:**

a) Depth of the undercut.

b) Amount of clasp arm that extend below the height of contour.

c) The distance between the survey line and the tip of the retentive clasp.

d) Flexibility of clasp arm, **factors influence the flexibility:**
   - Length of the clasp arm: the longer the clasp arm, the more flexible it is, the less retention it gives.
   - Diameter of clasp: Flexibility increases with decreased diameter.
   - Uniformed taper: a uniformly tapered clasp is more flexible than a non-tapered clasp of the same diameter.
   - Cross-section: a circular cross section is flexible in all direction while a half-round only flexes in two directions, so it is more retentive.
   - Material from which clasp is made: Alloys containing chromium are more rigid than gold.

e) Angle of approach of the clasp arm.

f) The position of the clasp in relation to dislodging force and fulcrum axis

2. **STABILITY:** The quality of a clasp assembly that resists displacement of a prosthesis in a horizontal direction. All framework components that are rigid and contact vertically oriented hard and soft tissues may contribute to the stability of a prosthesis.
In a clasp assembly, stability comes from:

a. Reciprocal element.

b. Shoulder(s) of a cast circumferential retentive clasp.

c. Vertically oriented minor connectors.

3. SUPPORT: Is the quality of a clasp assembly that resists displacement of a prosthesis in an apical direction. Support in a clasp is generally provided by the rest. Thus, while chewing food the rest prevents tissueward movement of the clasp assembly, plus directs the force along the long axis of the tooth, thus reduces periodontal tissue damage.

4. RECIPROCATION: Is the quality of a clasp assembly by that counteracts lateral displacement of an abutment when the retentive clasp terminus passes over the height of contour. Lateral forces must be offset by components of the clasp assembly.

- Retentive clasp must flex to pass over height of contour which leads to application of lateral forces to the abutment.

- A clasp assembly must include a rigid component that resists lateral movement of the affected tooth. This component is known as a reciprocal element. May be:

1. A cast clasp.

2. Lingual plating.

3. A combination of mesial and distal minor connectors.

**NOTE:** the reciprocal element must be rigid and contact the abutment tooth at or occlusal to the height of contour.
5. **ENCIRCLEMENT:** Is the characteristic of clasp assembly that prevents movement of an abutment away from the associated clasp assembly. Each clasp assembly must be designed to provide direct contact over at least 180 degree of the tooth's circumference. This contact provide encirclement and prevents movement of the abutment away from the clasp assembly. Provided in the form of:

a. Continuous contact (circumferential clasp assemblies).

b. Discontinuous contact (infrabulge clasp assemblies).

- If discontinuous encirclement is planned, the clasp assembly must contact the abutment tooth at **three widely separated areas** that encompass more than half the tooth’s circumference.
• Inadequate encirclement leads to *movement or “escape” of the abutment tooth from the confines of the clasp assembly during functional movement of the prosthesis.*

6. **Passivity**: Quality of clasp assembly that prevents the transmission of adverse forces to the associated abutment when the prosthesis is completely seated.

• When fully seated, a clasp assembly should be *passive*.
• Retentive arm is activated **ONLY** when dislodging forces are applied to RPD.
• If the clasp assembly is not fully seated, this causes that the *retentive terminus* will **NOT** be positioned in its intended location, so the clasp assembly will apply *non-axial (lateral)* forces to the abutment.
• The sustained application of non-axial forces may result in:
  1. Significant dental discomfort.
  2. Unintended tooth movement.
  3. Premature failure of the retentive arm due to metallurgical fatigue

**Criteria for Selection of a Clasp Assembly**

A. Type of support (nature of supporting tissues):

1. **Tooth borne PD:**
   • Dento-alveolar support.
   • Rest **adjacent** to edentulous area.
   • No need for clasp assemblies that direct forces to the ridge.

2. **Tooth tissue borne PD:**
   • Dento-alveolar and muco-osseous support.
   • Rest **away** from edentulous area.
   • Force directing, equalizing or stress breaking clasp assemblies must be used due to difference in *displaceability* between Dento-alveolar and muco-osseous segments.
B. Minimal tooth and gingival coverage: Preferred to reduce plaque accumulation.

C. Location of survey line: Influences the location of retentive and reciprocal arms.

D. Contour of tissues adjacent to abutment tooth. If the tooth is tilted or there is a tissue undercut.

E. Anatomic Limitation: Occlusion, axial inclination or teeth overlapping.

F. Esthetics.