Direct retainer

**Definition** - A direct retainer is a unit of a removable partial denture that engages an abutment tooth in such a manner as to resist displacement of the prosthesis away from basal seat tissues. It is usually composed of a retentive arm, a reciprocal (bracing) element or arm, a rest and a minor connector.

Retention is derived by placing a clasp arm into an undercut area so that it is forced to deform upon vertical dislodgment. Resistance of the clasp to deformation generates retention. Resistance is proportionate to the flexibility of the clasp arm. Non-flexible portions of clasp arms must be placed occlusal to the height of contour (suprabulge area).

**Requirements of Direct Retainers**

All clasp assemblies should meet the following requirements:

1. **Support** - resistance to gingival displacement (occlusal rests).
2. **Reciprocity** - resistance to orthodontic movement of teeth using reciprocal arms or elements placed against guiding planes. During placement and removal of the partial denture the retentive arm flexes over the height of contour and generates energy. At this point the rigid reciprocal arm should contact the guiding plane and prevent orthodontic movement from taking place.
3. **Stability** - resistance to lateral movement (reciprocal arms, minor connectors).
4. **Retention** - retentive arms located in undercuts on the abutments.
5. **Encirclement of greater than 180°** of the tooth - prevents the prosthesis from moving away from the tooth.
6. **Passivity** - at rest, a direct retainer should not exert force against a tooth.
Factors affecting the magnitude of retention

1. Size of the angle of convergence and How far into the angle of convergence the clasp terminal is placed.

When the angle of convergence between two abutments differs, uniformity of retention can be obtained by placing the clasp arms into the same degree of undercut (i.e. both .01"). A guiding principle of partial denture design is that retention should be uniform in magnitude and bilaterally opposed amongst abutments.

2. Flexibility of the clasp arm. This is influenced by the following factors:
   i. Length
      - increased length increases flexibility (increasing clasp curvature increases length
      - length is measured from the point where the taper begins
      - length may be increased by using curving rather than straight retentive arms.
   
   ii. Diameter
      "diameter is inversely proportional to flexibility
      " in a uniform taper the average diameter lies midway
      " if the taper is not uniform a point of flexure will exist at the narrowed
      " area, weakening the clasp arm (possible fracture area)
      " the point of flexure determines flexibility regardless of average diameter
      A narrowing of the clasp arm creates a point of flexure which weakens, and affects the flexibility of the clasp, since flexure begins at this point.

   iii. Cross-sectional form
      a. round forms are usually more flexible (wrought or cast).
      b. 1/2 round shape is limited to flexure in only two directions (cast).
iv. **Clasp material**

a) with cast alloys flexibility is inversely proportional to bulk.
b) gold clasps are not as flexible or adjustable as wrought wire.
c) wrought wire clasps have greater tensile strength than cast clasps and hence can be used in smaller diameters to provide greater flexibility without fatigue or fracture.

**Clasps Designed Without Movement Accommodation**

it's also named suprabulge clasp or occlusally approach clasp since the clasp approaches the retentive undercut from occlusal direction. Clasps for tooth-borne partial dentures (Class III, IV) have one function – to prevent dislodgment of the prosthesis without damage to the abutment teeth. Since there is little or no rotation caused by tissue ward movement of the edentulous area (as happens in distal extension cases) stress releasing properties are usually not required. These clasps can also be used in modification spaces for tooth and tissue supported removable partial dentures (Class I, II).

**1. Circumferential (Circle or Akers) clasp**

a. the most simple and versatile clasp (clasp of choice in tooth-borne cases).

b. clasp assembly has one retentive arm opposed by a reciprocal arm originating from the rest.

c. the retentive arm begins above the height of contour, and curves and tapers to its terminal tip, in the gingival 1/3 of the tooth, well away from the gingival.
d. the bracing arm is in the middle 1/3 of the tooth, and is broader occluso-gingivally, does not taper and is either entirely above the height of contour or completely on a prepared guiding plane – it should never be designed into an undercut, as it is a rigid element.

![Diagram](image)

**Advantages:**
- Excellent bracing qualities.
- Easy to design and construct.
- Less potential for food accumulation below the clasp compared to bar clasps.

**Disadvantages:**
- More tooth coverage than bar clasps.
- More metal is displayed than with bar or combination clasps.
- Adjustments are difficult or impossible due to the half round nature of the clasp.

A direct retainer should be designed with its elements in the proper positions and in the correct proportions. If the height of contour is incorrect for placement of the arms of the direct retainer, the heights of contour and NOT the direct retainer should be altered (i.e. perform abutment modifications – don’t distort the design of the direct retainer)

2. **Ring clasp**
- Encircles nearly the entire abutment tooth
- Usually used with mesially and lingually tilted mandibular isolated molars
c. The undercut is on the same side as the rest seat (i.e. adjacent to edentulous span)
d. Should always be used with a supporting strut on the non-retentive side with an auxiliary occlusal rest on the opposite side. Omission of the supporting strut will allow the clasp arm to open and close with minimum or no reciprocation.
e. Use a cast circumferential clasp with lingual retention and buccal bracing, in preference to a ring clasp whenever possible, unless a severe tilt of the tooth will not permit.

Advantages:
a. Excellent bracing (with supporting strut).
b. Allows use of an available undercut adjacent to edentulous area.

Disadvantages:
a. Covers a large area of tooth surface, therefore requiring meticulous hygiene.
b. Very difficult to adjust due to the extreme rigidity of the reciprocal arms.
c. The lower bracing arm should be at least 1 mm from the free gingival margin and relieved to prevent impingement of the gingival tissues.

Contraindications: excessive tissue undercuts prevent the use of a supporting strut.
3. Embrasure (Double Akers) Clasp

- Used in a quadrant where no edentulous area exists, in cases of unilateral edentulous span of an unmodified Class II or Class III partial denture, no edentulous spaces are available on the opposite side of the arch to aid in clasping. (bilateral bracing of unilateral edentulous span)
- Two rests, two retentive arms, and two bracing arms
- Double rests with definite shoulders to prevent weakening of clasp arms, separation of teeth and food impaction.
- Buccal and lingual proximal areas must be opened (i.e. Blend with axial contours, reduce height of contours, round occluso-axial line angles).

Advantages:
- Allows placement of direct retainer where none could otherwise be placed (especially contralateral to the edentulous span on a Class II case)

Disadvantages:
a. Extensive interproximal reduction is usually required
b. Covers large area of tooth surface - hygiene considerations.

4. Hair-pin or Reverse action clasp
When a proximal undercut must be used on a posterior abutment, and when tissue undercuts, tilted teeth, or high tissue attachments prevent the use of a bar clasp arm, the reverse-action clasp may be used successfully.
A reverse-action, or hairpin, clasp arm may be used on abutments of tooth-supported dentures when the proximal undercut lies below the point of origin of the clasp. It may be esthetically objectionable and covers considerable tooth surface. It should be used only when a bar-type retentive arm is contraindicated because of a tissue undercut, a tilted tooth, or a shallow vestibule.

Advantages:
a. Allows use of undercut adjacent to edentulous space

Disadvantages:
a. Almost impossible to adjust
b. Non-esthetic
c. Difficult to fabricate so the upper portion of the retentive arm clears the opposing occlusion
d. Covers extensive tooth surface and acts as a food trap
e. Insufficient flexibility on short crowns due to insufficient clasp arm length.

**in summery**, Cast suprabulge clasps should be used in most tooth borne cases. Exceptions to this rule include:
1. Esthetic concerns.

2. Where a posterior abutment is mobile or of questionable prognosis.

3. Some clasps can be ineffective on teeth tilted buccally or lingually

4. Some varieties cover more tooth surface than is desirable.

5. Poor esthetics in the anterior region.

**Clasps Designed to Accommodate Functional Movement**

It's also named infrabulge or gingivally approach clasp since it approach the undercut areas from gingival direction.

Tooth and tissue borne situations (Class I & II) require special attention in direct retainer selection, due to stresses created by rotational movements of the prostheses. When the denture bases are placed under function, rotation occurs about the rest seats of the most posterior abutments. Excessive occlusal forces on the distal-extension portion of the denture could cause a torquing action on the abutment teeth unless direct retainers are designed with stress-breaking capabilities. Stress releasing clasp assemblies include:

1. the bar clasp with mesial rest (e.g. RPI)
2. the RPA clasp
3. the combination clasp.

**1. Bar Clasps**

a. The bar clasp is a cast clasp that arises from the partial denture framework and approaches the retentive undercut from gingival direction (as opposed to a circumferential clasp that approaches the undercut from the occlusal direction).

b. Retentive clasps are identified by shape of retentive terminal, i.e. T, Y, L, I, U, and S.

c. The shape is unimportant as long as the direct retainer is mechanically and functionally stable, covers minimal tooth structure with minimum display (the I bar most often meets these requirements).

d. T- and Y-shaped terminal ends are the most misused clasps. The full area coverage of the T and Y terminal ends is rarely necessary for adequate retention.
e. L-shaped clasp is same as an I clasp with a longer horizontal component. The U-shaped clasp is same as an L-shaped clasp with a terminal like a double I-clasp.
f. The S-shaped terminal end is used to avoid a mesial soft tissue undercut.

g. Soft tissue relief is provided under the approach arm with 28 or 30 gauge wax, to prevent tissue impingement.

**Contraindications:**

a) Deep cervical undercuts - food trap or impingements result.
b) Severe soft tissue or bony undercuts - food trap or impingements result

c) Insufficient vestibular depth for approach arm (requires 4 mm - 3 mm from free. gingival margin, 1 mm for thickness of the approach arm).
d) Pronounced frenal attachments in area – impingement.

e) Severe buccal or lingual tilts of abutment teeth.

The R-P-I Clasp
1. The components of this clasp assembly are:
   "R" - rest (always mesial).
   "P" - proximal plate.
   "I" - I-bar (retentive arm).

2. The rest is located on the mesio-occlusal surface of a premolar or mesiolingual surface of a canine.
3. The proximal plate (essentially a wide minor connector) is located on a guide plane on the distal surface of the tooth.

4. The I-bar clasp is located on the buccal surface of the premolar and on the mesio-buccal surface of the canine. The I-bar originates at the meshwork and approaches the tooth from the gingival direction.

5. On premolars, the proximal plate should extend lingually so that the distance between the proximal plate and the mesio-occlusal rest is less than the mesio-occlusal width of the tooth. The proximal plate in conjunction with the mesial rest (and minor connector) acts as the reciprocating element of the clasp and prevents the lingual migration of the tooth when the clasp arm moves over the height of contour.

6. On cuspids, the minor connector cannot be used for reciprocation since it does not contact the tooth until after the retentive element has passed across
the height of contour and the partial denture is seated. This is because the mesio-lingual rest is located fairly low on the cingulum of the tooth. Therefore, the I-bar is located in the mesio-buccal undercut and is reciprocated directly by the proximal plate.

7. The guiding plane is a parallel surface prepared on the occlusal one third of the distal surface of the tooth. The guiding plane extends lingually enough so that, along with the mesial rest, it can prevent lingual migration of the tooth. It is approximately 2 to 3 mm in height.

Contraindications to the R.P.I. Clasp
1. Insufficient depth of the vestibule. (The inferior border of the I-bar must be located at least 4 mm. from the gingival margin.).
2. No labial or buccal undercut on the abutment.
3. Severe soft tissue undercut.
4. Disto-buccal undercut (less than 180° encirclement).

2. RPA Clasp
This clasp assembly is similar to the RPI design except a wrought wire circumferential clasp (Akers) is used instead of the I-bar. This clasp arises from the proximal plate and terminates in the mesiobuccal undercut. It is used when there is insufficient vestibule depth or when a severe tissue undercut exists.
3. Combination Clasp
The combination clasp is similar to the cast circumferential clasp with the exception that the retentive arm is fabricated from a round wrought wire (platinum-gold-palladium alloy or chromecobalt alloy).

a. a cast reciprocal arm.
b. the wrought wire is flexible (round form)
c. more adjustable than cast or 1/2 round forms
d. better esthetics (due to its round form and smaller diameter - 18 gauge)
e. can used with a mesial or buccal undercut
f. can be placed in 0.02" undercut due to its flexibility (allows lower placement for better esthetics)
g. can be used in tooth borne cases as described earlier
h. for best results, the wire should be soldered remotely to the framework so it is not overheated, which would cause recrystallization of the metal and loss of flexibility. If wrought wire clasps are cast into the framework, a low heat chromium alloy should be used to avoid recrystallization as well