Lec 12

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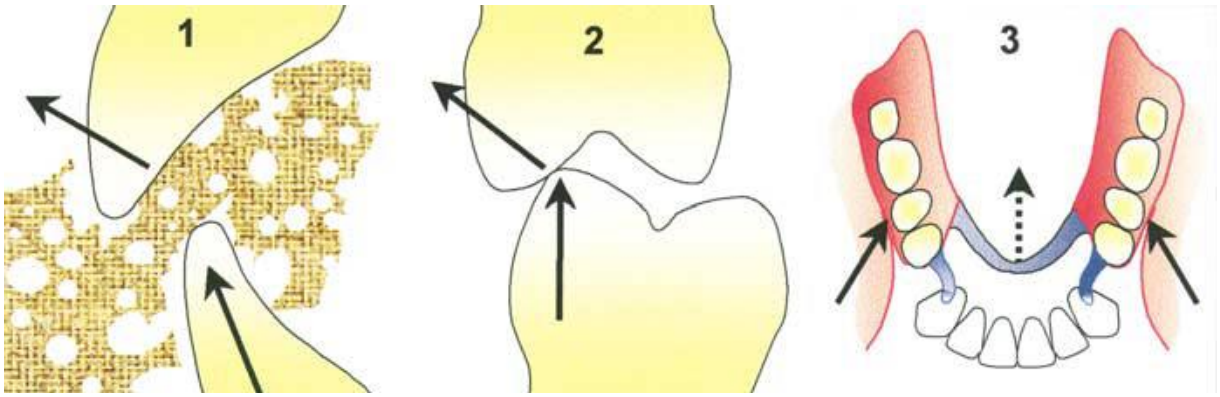
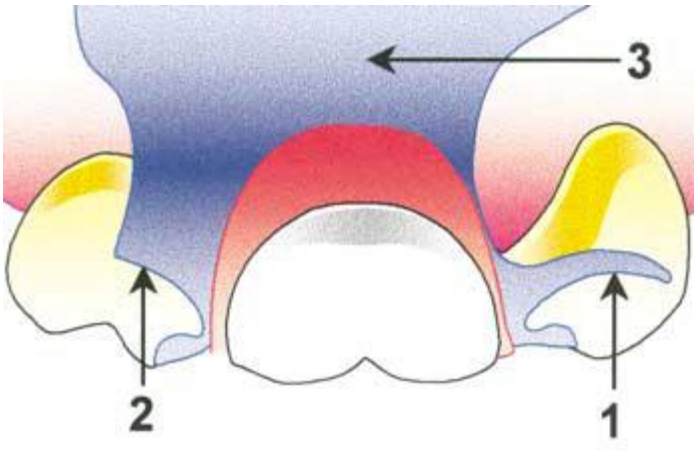
Bracing and Reciprocation

Horizontal forces are generated during function by occlusal contact (1 and 2) and by the oral musculature surrounding the denture (3). These forces tend to displace the denture in both antero-posterior and lateral directions.



The horizontal forces are resisted by placing rigid components of the denture (bracing components) against suitable vertical surfaces on the teeth and residual ridges.

Bracing on teeth may be achieved by means of rigid portions of clasp assembly (1) or plates (2). **Bracing** on the residual ridges and in the palate is obtained by means of major connectors and flanges (3).



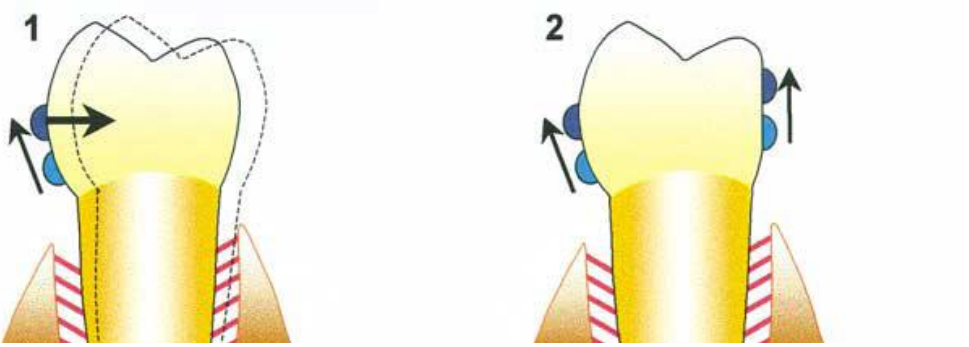
A distal extension saddle is capable of being displaced posteriorly and of rotating in the horizontal plane. Furthermore, the lateral force must be distributed widely so that tissue damage is avoided. The problems are more acute in the mandibular arch. Posterior movement of the distal extension saddle is prevented by coverage of the pear-shaped pad and by the minor connector which contacts the mesiolingual surface of the premolar tooth.

Rotation and anteroposterior movement of bounded saddles are resisted by contact of the saddles with the abutment teeth. It therefore remains to design bracing elements which will safely distribute the lateral forces acting on the denture.

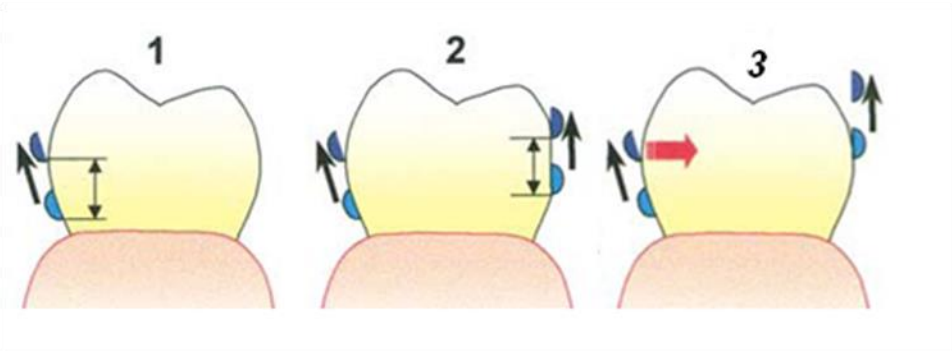
Reciprocation

The bracing element which is in contact with the side of the tooth opposite the retentive clasp can also play an important role in the effectiveness of the latter, and thus in the overall retention of the denture. (1) A horizontally directed force is produced as a retentive arm is displaced in an occlusal

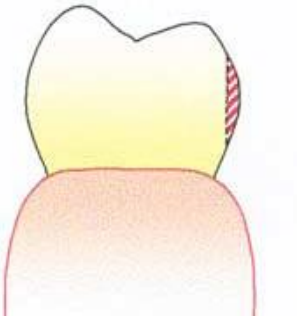
direction over the height of contour of a tooth. If the clasp arm is unopposed, the tooth is displaced orthodontically and much of the retentive capability will be lost. (2) If the retentive clasp is opposed by a rigid component which maintains contact with the tooth as the retentive arm moves over the height of contour, displacement of the tooth is resisted, the retentive arm is forced to flex and thus the efficiency of the retentive element is increased. This principle is known as reciprocation. It is thus apparent that reciprocation is required as the denture is being displaced occlusally whilst the bracing function, as mentioned earlier, comes into play when the denture is fully seated.



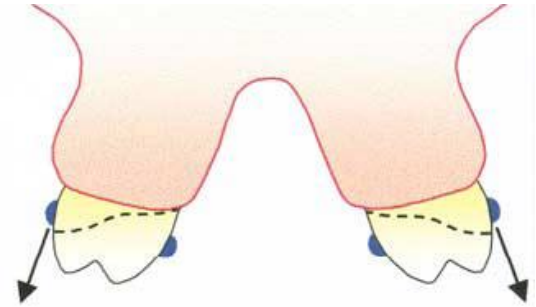
In the following fig; (1) A clasp is effective in retention from its position when the denture is fully seated to where it escapes over the height of contour. This vertical measurement may be termed the 'retention distance'. It will be appreciated that the reciprocal element on the other side of the tooth should be in continuous contact with the tooth surface as the retentive arm traverses the 'retention distance. Effective reciprocation can be achieved (2) by a clasp arm contacting a guide surface of similar height to the 'retention distance'. (3) If the reciprocating clasp is placed on a tooth without an adequate guide surface, it will lose contact with the tooth before the retentive arm has passed over the height of contour of the tooth and fail to provide effective reciprocation.



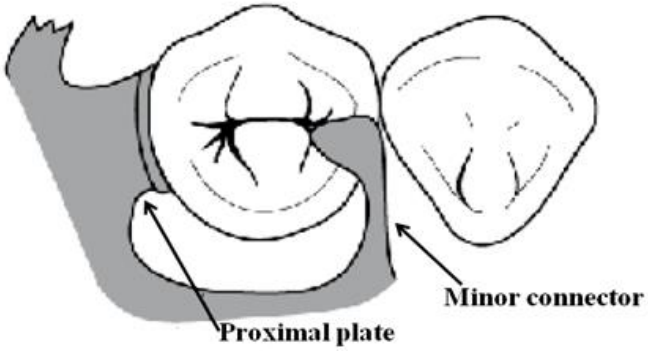
It may be possible on rare occasions to find a guide surface which occurs naturally on a tooth. More often it will be necessary to create a suitable surface by (1) minimal shaping of the enamel or (2) creating the appropriate surface into a cast metal restoration.
The reciprocating clasp is placed at the gingival end of a guide surface (which is usually 2–3 mm in length) to maintain contact with that surface as the retentive clasp moves through the retention distance.



If the tooth surface on which the bracing arm is to be placed has a survey line at the level of the gingival margin, it will not be possible to achieve effective reciprocation on the same tooth. In such circumstances one may use the principle of cross-arch reciprocation, where a retentive clasp on one side of the arch opposes a similar component on the other side (**Where there are clasps on opposite sides of the arch, the retentive arms are best placed on opposing tooth surfaces, i.e. buccal/buccal or lingual/lingual**). The disadvantage of this approach is that, as the bracing arms leave the tooth surfaces and retentive clasps move along divergent paths of displacement, the teeth will move in their sockets (periodontal ligaments). This 'jiggling' action is potentially damaging to the supporting tissues and will reduce the effectiveness of the retention.



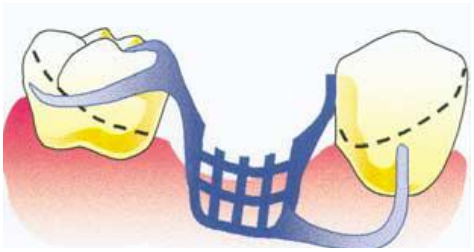
In RPI system, the minor connector carrying the mesial rest contacts the mesiolingual surface of premolar and together with proximal plate acts as a reciprocal for the retentive arm.



Factors governing the choice of retentive clasp

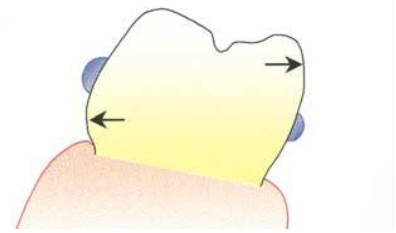
The choice of retentive clasp for an individual tooth depends upon the:

- **Position of the undercut**: survey lines on the molar and premolar teeth shown here indicate that there is a larger undercut on that part of the tooth which is away from the edentulous area. Typical designs of retentive clasp are the occlusally approaching clasp on the molar and the gingivally approaching 'I' bar on the premolar tooth.



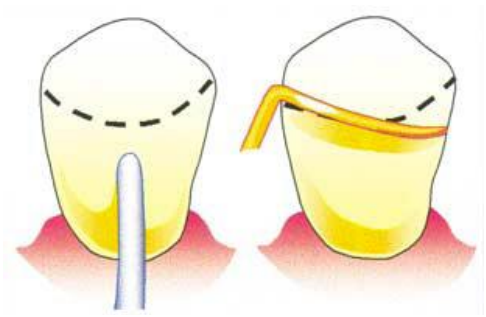
Survey line on this molar creates the larger undercut area nearer to the saddle. The design of the occlusally approaching clasp used on the molar would be inappropriate because it would prove difficult to keep the non-retentive two-thirds of the clasp out of the undercut while offering very little undercut for the retentive portion. An alternative design is the ring clasp that commences on the opposite side of the tooth and reach undercut from a more appropriate direction. An 'I' bar would be suitable for a premolar tooth with a survey line of similar orientation.

A low survey line (on the buccal side of the tooth) is present because the tooth is tilted; thus there is a high survey line on the lingual side of the tooth. Again, a ring clasp is a solution to the problem: the bracing portion of the clasp is on the left side of the tooth and the retentive portion on the right side.



If it is not appropriate or practical to lower the high survey line by altering the crown shape, it may be possible to position a flexible gingivally approaching clasp. if an occlusally approaching clasp is preferred, use a more flexible wrought wire clasp.

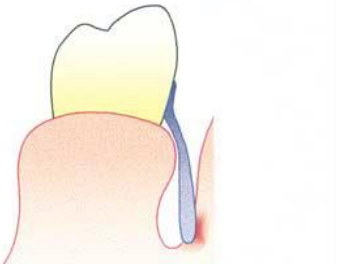
Even if the survey line is not high enough to create difficulties in clasping there will be advantages in using one of these more flexible types of clasp on a premolar tooth



- **Health of the periodontal ligament:** If the tooth has previous periodontal disease, there is the possibility that further damage will occur if a relatively inflexible retentive clasp system, such as a cast cobalt chromium occlusally approaching clasp. a possible solution is to prescribe a more flexible gingivally approaching clasp. However, this option should be used with caution if the gingival recession is associated with root caries in which case a wrought wire occlusally approaching clasp might then be more suitable.

- **Shape of the sulcus:** If a gingivally approaching clasp is selected, the shape of the sulcus must be checked carefully to ensure that enough room. If there is no enough room and no alternative to this clasp, consideration must be given to surgical intervention (e.g., removal of frenum).

  If there is an undercut in the sulcus, the arm of a gingivally approaching clasp would have to be spaced from the mucosa of the ridge to allow the denture to be inserted and removed without the clasp irritating the bulbous part of the ridge. If the undercut is deep, the resulting prominence of the clasp arm is likely to irritate the buccal mucosa and trap food debris, becoming intolerable by the patient.



- **Length of clasp:** already explained
- **Appearance:** Either type of clasp can be visible when placed on a tooth that is toward the front of the mouth. However, the gingivally approaching clasp has more potential for being hidden in the distobuccal aspect of a tooth provided that there is a suitable undercut area for the clasp.
- **Occlusion:** An occlusally approaching clasp must begin, and have two thirds of its length, in the area bounded by the occlusal contacts of the opposing teeth and the survey line on the tooth to be clasped. Providing an adequate space for the clasp may require tooth preparation. While gingivally approaching clasps have no influence on occlusal contacts.

Direct Retainer Choices

Kennedy Cl m & IV (Tooth Borne)

- Use circumferential clasps(or one of its modifications)
- *Exceptions*
  - Use stress-releasing clasps.
  - Esthetics is needed (infrabulge or wrought wire)
  - Poor prognosis for posterior abutment to allows conversion to distal extension denture

Kennedy Cl I & II (Tooth & Tissue Borne)

Stress-releasing Clasps which are

- **RPI Clasp**
- **RPA Clasp**
- **Combination Clasp**

For posterior abutments, or any tooth needing stress release:

- **Clasp of choice: RPI (mesial rest, distal proximal plate and I-bar)**
- If an I-bar is contraindicated, then use an **RPA** retainer
- If can't use a mesial rest because of:
  - Large mesial restoration
  - heavy centric contact on mesial
  - Insufficient room for rest or minor connector (rotations)
  - large amalgam restoration on mesial

  Then use **Combination Clasp**- Guide plane must not run entire occluso-gingival height

Number of direct retainers:

For all of the Kennedy classes the use of two clasps is the most popular choice for RPD retention.
Two clasps are advantageous because:

- Simple denture designs are often better tolerated and minimize tissue coverage.
- Two clasps usually generate sufficient retention.
- A pair of clasps easily creates fulcrum line and allows indirect retention to be obtained.

- Minimum of 2 clasps on posterior abutments for Cl I & II.
- All abutments for Cl III, IV - maximum of 4 clasps normally.

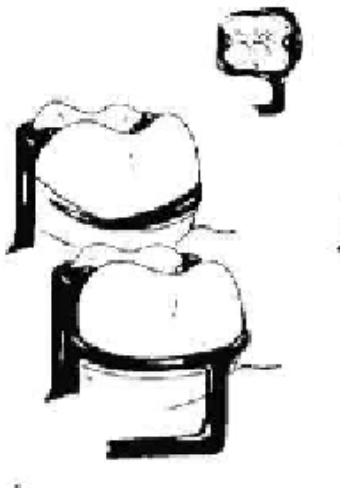
If eliminate a direct retainer for esthetics, plan more retention with other features (soft tissue coverage, longer guiding planes, rotational path of insertion, etc)

Comparison of occlusally and gingivally approaching clasps

1. **Retention:** suprabulge clasps and infrabulge clasps approach the undercut from opposite sides. Also the entire inner (tooth contacting) surface of the retentive clasp arm of suprabulge clasp contacts the tooth from originating area to tip. A gingivally approaching clasp contacts the tooth surface only at its tip. The remainder of the clasp arm is free of contact with the mucosa of the sulcus and the gingival margin.
   The length of the gingivally approaching clasp is not restricted by the dimensions of the clasped tooth. The length of the gingivally approaching clasp arm can therefore be increased to give greater flexibility which can be a positive advantage when it is necessary to clasp a premolar tooth or a tooth whose periodontal attachment has been reduced by periodontal disease.
2. **Bracing:** The occlusally approaching clasp is more rigid, and more of it is in contact with the tooth surface above the survey line. It is therefore capable of transmitting more horizontal force to the tooth and is a more efficient bracing component.
3. **Appearance:** already explained.
4. **Hygiene:** The gingivally approaching clasp crosses a gingival margin. If the patient does not practise good oral hygiene, the gingivally approaching clasp could cause periodontal disease. The gingivally approaching clasp might also increase the risk of root caries.
5. **Occlusion:** already explained.
6. **Coverage:** tooth surface coverage with circumferential clasp is more than bar clasp because of its occlusal origin.

Modifications of circumferential clasp

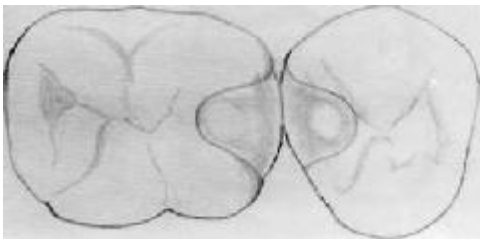
1. **Ring clasp:** it encircles nearly all of a tooth from its point of origin. It is used when a proximal undercut adjacent to edentulous area cannot be approached by other means. For example, when a mesiolingual undercut on a lower molar abutment or a mesiobuccal undercut of maxillary molars cannot be approached directly because of its proximity to the occlusal rest area and cannot be approached with a bar clasp arm because of lingual inclination of the tooth, the ring clasp encircling the tooth allows the undercut to be approached from the distal aspect of the tooth .the ring clasp should always be used with a supporting strut on the non-retentive side (because it is free to open and close as a ring), with or without an auxiliary occlusal rest on the opposite marginal ridge. The advantage of an auxiliary rest is that further movement of a mesially inclined tooth is prevented by the presence of a distal rest. The supporting strut should be regarded as a minor connector from which the flexible retentive arm originates. Reciprocation then comes from the rigid portion of the clasp lying between the supporting strut and the principal occlusal rest. Aesthetics need not be considered on such a posteriorly located tooth. A ring-type clasp may be used in reverse on an abutment located anterior to a tooth-bounded edentulous space. This clasp covers an excessive amount of tooth surface and can be aesthetically objectionable in such teeth. So in such cases, the only indication for its use is when a distobuccal or distolingual undercut cannot be approached directly from the occlusal rest area and/or tissue undercuts prevent its approach from a gingival direction with a bar clasp arm.



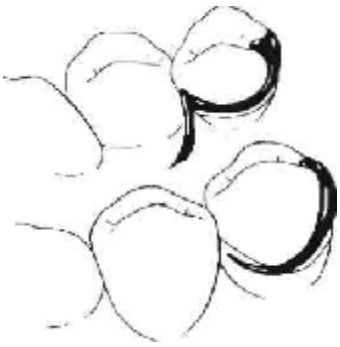
2. **Emdrasure clasp:** used in an unmodified Class II or Class III partial denture in the quadrant where no edentulous area exists. It has two rests, two retentive arms, and two bracing arms. Rest seat preparations are extended **both buccally and lingually to** accommodate retentive and reciprocal clasp arms.

Buccal

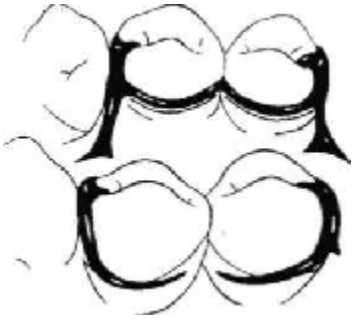
Lingual



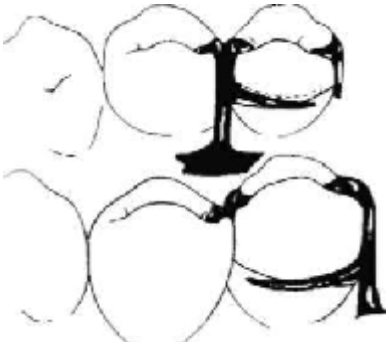
3. **Back-action clasp:** The back-action clasp is a modification of the ring clasp. An occlusal rest always should be attached to some rigid minor connector and should never be supported by a clasp arm alone. If the occlusal rest is part of a flexible assembly, it cannot function adequately as an occlusal rest.



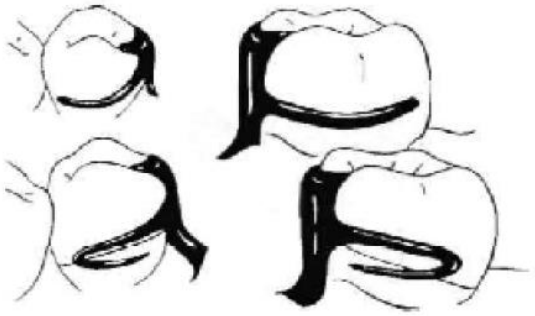
4. **Multiple clasp:** The multiple clasp is simply two opposing circumferential clasps joined at the terminal end of the two reciprocal arms. It is used when additional retention and stabilization are needed, usually on tooth-supported partial dentures. It may be used for clasping the partial denture which replaces an entire half of the dental arch. It may be used as an alternative to an embrasure clasp when the only available retentive areas are adjacent to each other. Its disadvantage is that two embrasures are used rather than a single common embrasure for both clasps.



5. **Half-and-half clasp:** it consists of a circumferential retentive arm arising from one direction and a reciprocal arm arising from another. The reciprocal arm must arise from a second minor connector with or without an auxiliary occlusal rest. Reciprocation arising from a second minor connector can usually be accomplished with a short bar or with an auxiliary occlusal rest. Its design is applied only to unilateral partial denture design.



6. **Reverse-action clasp.** The **reverse-action**, or **hairpin,** clasp arm is designed to permit engaging a proximal undercut which lies below point of origin of clasp. Other methods of accomplishing the same result are with a ring clasp or with a bar clasp. However, 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. Although the ring clasp may be preferable, lingual undercuts may prevent the placement of a supporting strut without tongue interference. In this limited situation, the hairpin clasp arm serves adequately.

Cast suprabulge clasps should be used in most tooth borne cases. Exceptions to this rule include:

1. **Esthetic concerns.** We can use wrought-wire clasps as alternative which can be placed into greater undercuts (0.5mm) than cast clasps (0.25mm). They can be placed at lower level on teeth, allowing better esthetics in some cases. Infrabulge clasps are also less visible.
2. Where a **posterior abutment is mobile or of questionable prognosis,** the treatment plan should use the stress-breaking qualities of a wrought clasp on the anterior abutment. This would allow the prosthesis to be converted into a distal extension type if the weak posterior abutment should be lost.
3. Where **abutments are mobile,** the tooth borne segment is extensive, the use of the Stress-breaking clasps should be considered.