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# Basic principles of clasp design of Cr Co RPD

A Project submitted to the Council of College of dentistry at the University of Baghdad in partial fulfillment of the requirement for
B.D.S degree.

BY

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بِسْمِ اللهِ الرَحمٰن الرحيم

قَالَ الَّذِي عِنْدَهُ عِلْمٌ مِنَ الْكِتَابِ أَنَا آتِيكَ بِهِ قَبْلَ أَنْ يَرْتَدَّ
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وَمَنْ كَفَرَ فَإِنَّ رَبِّي غَنِيٌّ كَرِيمٌ {٤٠}

صدق الله العظيم
النمل {٤٠}

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# DECLARATION

I certify that this undergraduate dissertation entitled

‘Basic Principles of Clasp Design of Cr-Co RPD’ was prepared by Lina Ali under my supervision at the College of Dentistry\ University of Baghdad in partial fulfilment of the requirement for B.D.S degree.

**Ass. Lec. Dr. Ghasak H. Jani**

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| | |
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| RPD | Removable Partial Denture |
| FPD | Fixed Partial Denture |
| Cr-Co | Chrome-Cobalt |
| ADA | American Dental Association |

# Introduction

Numerous treatment options exist to restore the partially edentulous mouth including traditional removable partial dentures (RPDs), teeth/implant fixed partial dentures (FPDs), and teeth/implant over dentures **(Yee A,2020)**.
Removable partial dentures assist with mastication (chewing food), help maintain phonetics (speech) and help with aesthetically pleasing to blend in naturally when teeth are missing **(Kash Qureshi 2020)**.
RPDs have numerous benefits, affordability, and ease of fabrication and repair, conventional RPDs have been used frequently to restore function and esthetic **(Köroğlu A, İşısağ, 2015)**.
Several types of polymers and alloys could be used in the constriction of RPDs.
Clasps are the most commonly used direct retainers for the RPDs and they are frequently made from the same material as the framework material. The clasp assembly as acts as a stabilizer for a prosthesis by partially encompassing an abutment tooth by the flexible clasp tip engages the undercut of the abutment in order to provide retention. The components of any clasp assembly must fulfill at least six biomechanical requirements, namely retention, stability, support, reciprocation, encirclement and passivity. In addition, the clasp assembly must ideally not affect aesthetics adversely **(Khan and Geerts, 2005)**.
The most commonly used alloys for RPDs are cobalt-chromium (Co-Cr), gold and titanium alloys, although they are not aesthetically pleasing; since their commercial launch 80 years ago. Co-Cr alloys have undergone several modifications, so the Co-Cr alloy bending properties after several modifications has fulfill ADA specification No.14 for satisfactory clinical performance **(J dent, 1995)**.

Co-Cr alloys can be generally described as alloys that have high strength, are heat resistance and non-magnetic, have favorable resistance to wear, corrosion and tarnish **(Al Jabbari and Youssef, 2014)**.They possess excellent biocompatibility and corrosion and tarnish resistance, while high modules of elasticity (E) provides the requisite of strength and rigidity without the need for heavy cross-sections, thus reducing the weight of metal substructures **(Viennot et al, 2005)**.

# Aim of The Study:

The aim of study is to review the principles of clasp design as part of having appropriate removable partial denture design for partial edentulous patient.

# CHAPTER ONE

# REVIEW OF LITERATURE

## 1.1. Cr-Co Removable Partial Denture

A prosthesis that replaces one on more, but not all of the natural teeth and supporting structure. It is supported by teeth and\or the mucosa.

The Cr-Co RPDs can be removed and replaced in the mouth by the patient.

## 1.1.1. Components of Cr-Co Removable Partial Denture:

a) **Major connector:** The unit of removable partial denture that connects the parts of one side of the dental arch to those of the other side. Its principle functions are to provide unification and rigidity to the denture.
b) **Minor connector:** A unit of partial denture that connects the other components (i.e. direct retainer, indirect retainer, denture base, etc.) to the major connector. The principle functions of minor connectors are to provide unification and rigidity to the denture.
c) **Direct retainer:** A unit of the partial denture that provides retention against dislodging forces. A direct retainer is commonly called "clasp" or "clasp unit" and is composed of four elements, a **rest**, a **retentive arm**, a **reciprocal arm** and a **minor connector**.
d) **Indirect retainer:** A unit of Class I or II partial denture that prevents or resists movement or rotation of the bases away from the residual ridge. The indirect retainer is usually composed of one component, a **rest**.
e) **Denture base:** The unit of a partial denture that covers the residual ridges and supports the denture teeth.

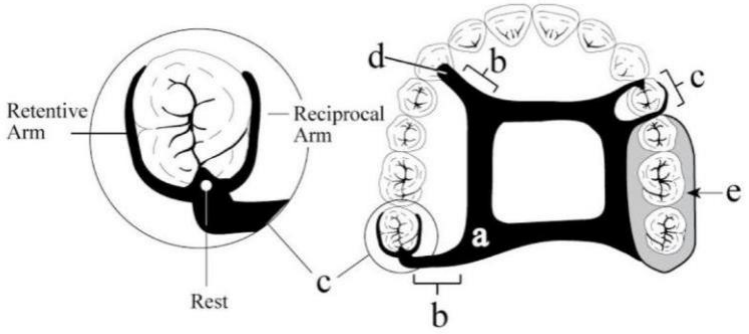


**Figure 1.1 component of Cr-Co RPD (Loney, 2011).**

## 1.2. Clasp Retainer

A direct retainer is a unit of the 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 **(Loney, 2011)**.

The clasp is the component of the clasp assembly that engages a portion of the tooth surface and either enters an undercut for retention or remains entirely above the height of contour to act as a reciprocal element.

The part of the clasp assembly that enters an undercut for retention is frequently called retentive clasp arm **(Louis and Mosby, 1994).**

## 1.2.1. Structure of Clasp Assembly

To function effectively, a retentive arm must be accompanied by other structural elements, when combined; these structural elements form a clasp assembly.

A properly designed clasp assembly has the following parts: (1) a rest, (2) a retentive arm, (3) a reciprocal element, and (4) one or more minor connectors **(Phoenix et al, 2003)** (figure 1.2).

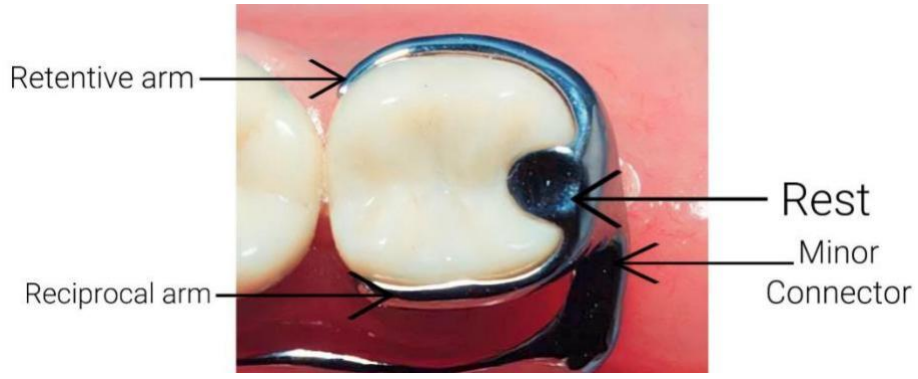


**Figure 1.2 clasp assembly: -retentive arm, -reciprocal arm, -rest and – minor connector. (Shenay, 2016).**

**1) Retentive arm:** The retentive arm is the only portion of a removable partial denture that contacts with the surface of an abutment apical to the height of contour **(Phoenix et al, 2003)** (figure 1.3).

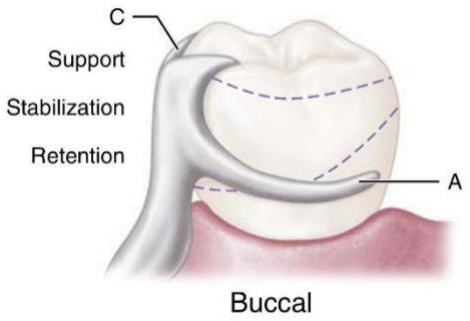


**Figure 1.3 (A) Retentive arm, (C) supporting occlusal rest. The terminal portion of the retentive arm is flexible and engages measured undercut (Alan B.Carr, 2016).**

**2) Reciprocal element:** The component of clasp assembly that braces an abutment during prosthesis insertion and removal. Regardless of form, reciprocal element must contact the abutment tooth at or occlusal to the height of contour. **(Phoenix et al,2003)** (figure 1.4).

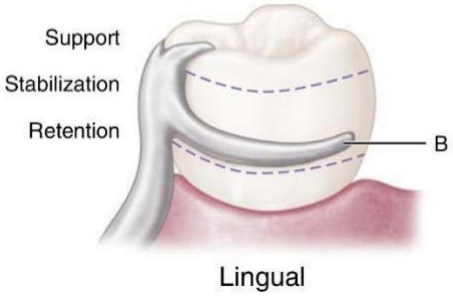


**Figure 1.4 The rigid stabilizing reciprocal arm (Alan B.Carr, 2016).**

**3) Rest:** The component of a clasp that provides vertical support for the prosthesis is called a rest; the portion of the abutment prepared to receive the rest is rest seat. Properly prepared rest seats and the corresponding rests serve to:

**a)** Resist displacement of the prosthesis toward supporting tissues.

**b)** Transmit functional forces parallel to the long axes of the abutment.

Since forces acting on a removable partial denture may be substational, the structural integrity of each rest is critical.

**4) Minor Connector:** Minor connector often join elements of a clasp assembly to the other components of a removable partial denture hence, it must be rigid. Depending on the philosophy of design, a minor connector may serve as

**a)** A guiding plate to direct insertion and removal of RPDs.

**b)** A reciprocal element to counteract non-axial forces produced by a retentive clasp.

**c)** An approach arm for an infrabulge clasp **(Phoenix et al, 2003).**

## 1.3. Clasp Design

### 1.3.1. Basic Principle of Clasp Design

The clasp assembly serves as a similar function for a removable partial denture that a retainer crown serves for a fixed partial denture; both must encircle the prepared tooth in manner that prevents movement of the tooth separate from the retainer. To borrow from a fixed prosthodontics term, limiting the freedom of displacement refers to the effect of one cylindrical surface (the framework encircling the tooth) on another cylindrical surface (the tooth). It implies that the curve that defines the framework is properly shaped if it prevents movement at right angle to the tooth axis.

This basic principle of clasp design offers a two-way benefit.

**First,** it ensures the stability of the tooth position because of the restrain from encirclement.

**Second,** it ensures stability of the clasp assembly because of the controlled position of the clasp in three dimensions.

Therefore, the basic principle of clasp design referred to as the principle of encirclement, means that the clasp assembly must engage more than 180 degrees in the greatest circumference of the tooth, passing from diverging axial surface to the converging axial surfaces **(Alan B.Carr, 2016)** (figure1.5).

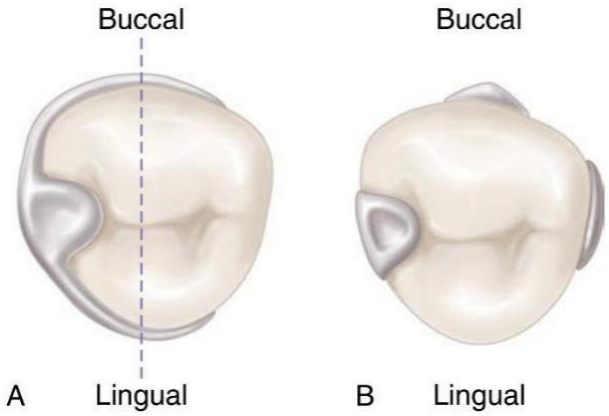


**Figure 1.5 A Dashed line drawn through the illustration represents 180 degrees of greatest circumference of abutment from the occlusal rest. Unless portions of the lingual reciprocal arm and the retentive buccal arm are extended beyond the line, the clasp would not accomplish its intended purpose. If respective arms of the retainer were not extended beyond the line, the abutment tooth could be forced away from the retainer through torqueing action of the clasp, or the removable partial denture could move away from the abutment. B, Bar-type clasp assembly engagement of more than 180 degrees of circumference of the abutment is realized by the minor connector for the occlusal rest, the minor connector contacting the guiding plane on the distal proximal surface, and the retentive bar arm. (Alan B.Carr, 2016).**

The engagement can occur in the form of continuous contact, such as in a circumferential clasp, or discontinuous contact, such as in the use of a bar clasp. Both provide tooth contact in at least three areas encircling the tooth:

(1) The occlusal rest area.

(2) The retentive clasp terminal area.

(3) The reciprocal clasp terminal area.

In addition to encirclement, other basic principles of clasp design are as follows:

1- The occlusal rest must be designed to prevent movement of the clasp arms toward the cervical.

2- Each retentive terminal should be opposed by a reciprocal component capable of resisting any transient pressures exerted by the retentive arm during placement and removal. Stabilizing and reciprocal components must be rigidly connected bilaterally (cross arch) to realize reciprocation of the retentive elements (figure 1.6).

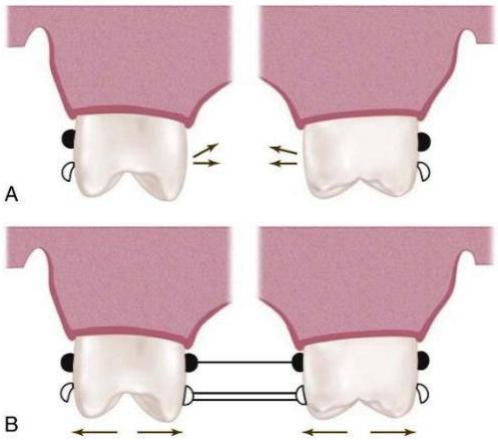


**Figure 1.6 A, Flexing action of the retentive clasp arm initiates medially directed pressure on the abutment teeth as its retentive tip springs over the height of contour. B, Reciprocation to medially directed pressure is counteracted by rigid lingually placed clasp arms contacting the abutments simultaneously with the buccal arms, or by rigid stabilizing components of the framework contacting the lingual guiding planes when the buccal arms begin to flex. (Alan B.Carr, 2016).**

3-Clasp retainers on abutment teeth adjacent to distal extension bases should be designed so that they avoid direct transmission of tipping and rotational forces to the abutment. In effect, they must act as stress-breakers, either by their design or by their construction. This is accomplished through proper location of the retentive terminal relative to the rest, or by the use of a more flexible clasp arm in relation to the anticipated rotation of the denture under functional forces.

4-Unless guiding planes will positively control the path of removal and will stabilize abutments against rotational movement, retentive clasps should be bilaterally opposed (i.e., buccal retention on one side of the arch should be opposed by buccal retention on the other, or lingual on one side opposed by lingual on the other). In Class II situations, the third abutment may have buccal or lingual retention. In Class III situations, retention may occur bilaterally or may be diametrically opposed.

5- For the prosthesis to require clasp engagement with the resistance to deformation that is retention, the path of escapement for each retentive clasp terminal must be different from the path of removal.

6-The amount of retention should always be the minimum necessary to resist reasonable dislodging forces.

7-Reciprocal elements of the clasp assembly should be located at the junction of the gingival and middle thirds of the crowns of abutment teeth. The terminal end of the retentive arm is optimally placed in the gingival third of the crown; these locations permit better resistance to horizontal and torqueing forces caused by a reduction in the effort arm **(Alan B.Carr, 2016)** (figure 1.7).

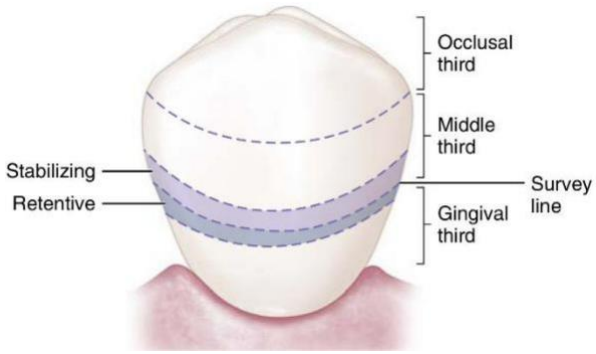


**Figure 1.7 Simple mechanical laws demonstrate that the nearer stabilizing reciprocal and retentive elements of direct retainer assemblies are located horizontal to the axis of rotation of the abutment, the less likely it is that physiologic tolerance of the periodontal ligament will be exceeded. The horizontal axis of rotation of the abutment tooth is located somewhere in its root. (Alan B.Carr, 2016).**

## 1.4. Classification of Clasp

## 1.4.1. According to the clasp location on tooth:

**1) Suprabulge Clasps (occlusally approaching or circumferential clasp):** Is defined as a retainer that encircles a tooth by more than 180 degree, including opposite angles, and which generally contacts the tooth throughout the extent of the clasp with at least one terminal located in an undercut area **(Prakash et al, 2017)** (figure 1.8)

**Figure 1.8 suprabulge clasp (circumferential clasp type) (Alan B.Carr,2016).**

**2) Infrabulge clasps (gingivally approaching or bar clasp):**

Gingivally approaching or bar clasp is defined as a clasp retainer whose body extends from a major connector or denture base, passing adjacent to the soft tissue and approaching the tooth from gingiva-occlusal direction **(Prakash et al, 2017)** (figure 1.9)

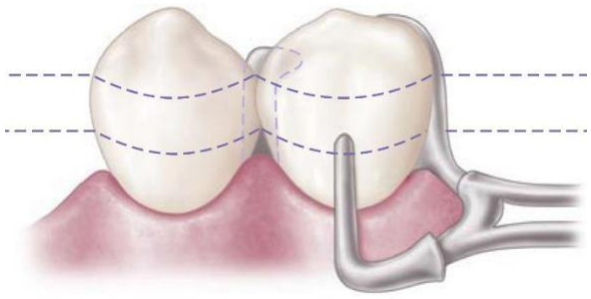

**Figure 1.9 infrabulge clasp (Buccal I bar clasp) (Alan B. Carr,2016).**

For Chrome-Cobalt clasps, only the terminal one-third of the clasp should by engaged in an undercut; something that will determine if a mesial facing or distal facing (three-aimed) or (ring clasp) or gingivally approaching clasp will be used.

The horizontal depth of the undercut must be also considered; engaging an inappropriate metal in too deep undercut can lead to difficulties removing a clasp or lead to strain and permanent deformation of the clasp **(Mba, 2015**).

Premolars have less mesiodistal width than molars (about 7mm), so clasp on premolars will not be so long as they are on molars.

Cr-Co alloy is very rigid especially if it is very short so occlusally approaching clasps made of Cr-Co alloy will not be of enough length or flexibility nor retention when placed on premolars.

For molars, we can go for occlusally approaching clasps. For premolars, we can go for either gingivally approaching or wrought wire claps **(Davenport,2001)**.

## 1.4.2. With or Without Movement Accommodation:

### A) Clasps Designed Without Movement Accommodation:

**1) <u>Circumferential Clasp:</u>** The circumferential clasp is usually the most logical clasp to use with all tooth-supported partial dentures because of its retentive and stabilizing ability.

The basic form of the circumferential clasp is a buccal and lingual arm originating from a common body. The correct form of this clasp has only one retentive clasp arm, opposed by non-retentive reciprocal arm on the opposite side. A common error is to use this clasp improperly by making both clasp terminals retentive. This not only is unnecessary, but also disregards the need for reciprocation and bilateral stabilization **(Alan B.Carr, 2016).**

## Characteristics and Design:

**a)** The most simple (The 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 being above the height of contour and curves and tapers to its terminal tip; in the gingival third of the tooth, well away from the gingiva.
**d)** The bracing arm is in the middle third of the tooth **(Loney, 2011)** (figure 2.1)

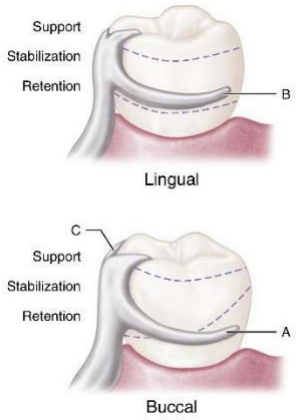


**Figure 2.1 Extracoronal circumferential direct retainer on mandibular premolar. Support is provided by the occlusal rest; Stabilization is provided by the occlusal rest, proximal minor connector, lingual clasp arm and rigid portion of the buccal retentive clasp arm occlusal to the height of contour (Alan B.Carr, 2016).**

## Indications:

- The most logical clasp to use with all tooth-supported partial dentures because of its retentive and stabilizing ability.
- On free end extension when minimal undercut is utilized.

## Contraindications:

- When the retentive undercut may be approached better with a bar clasp arm.
- When esthetics will be enhanced by using bar clasp arm.

**Advantages:**

1- Excellent bracing qualities.
2- Easy to design and construct.
3- Less potential for food accumulation below the clasp compared to bar clasps **(Loney, 2011).**

**Disadvantages:**

**1-** More tooth coverage than bar clasp.
**2-** More metal is displayed than with bar or combination clasps.
**3-** Adjustments are difficult or impossible due to the half-round nature of the clasp **(Loney, 2011).**

## 2) Ring clasp:

**Characteristic and Design:**

**a)** Encircles nearly the entire abutment tooth.
**b)** Usually used with mesially and lingually tilted mandibular molars or mesially and buccally tilted maxillary molars.
**c)** The undercut is one 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.
**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 **(Loney, 2011)** (figure 2.2).

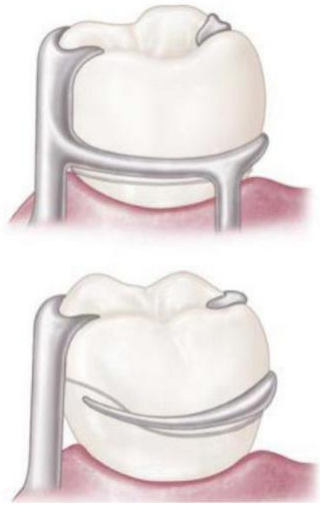

**figure 2.2 Ring Clasp**

**(Alan B.Carr, 2016).**

**Indications:**

- It is used when the proximal undercut cannot be approached by other means.
- It may be used in reverse on abutment anterior to a tooth-bounded edentulous space 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. (Figure 2.3)

**Figure 2.3 Ring clasp may be used in reverse on the abutment located anterior to the tooth-bound edentulous space (Alan B.Carr, 2016).**

**Contraindications:**

**1-** Excessive tissue undercuts prevent the use of supporting strut.

**Advantages:**

**1-** Excellent bracing (with supporting strut).
**2-** Allows use of an available undercut adjacent to dentulous area. **(Loney, 2011)**

**Disadvantages:**

**1-** Covers a large area of tooth surface.
**2-** Very difficult to adjust.
**3-** The lower bracing arm should be at least 1mm from the free gingival margin and relieved to prevent impingement. **(Loney, 2016)**

### 3) Embrasure (Double Akers)

**Clasp: Characteristics and Design:**

**a)** Used in quadrant where no edentulous area exists, or where a distal approach clasp cannot be used on the most posterior tooth.
**b)** Two rests, two retentive arms and two bracing arms.
**c)** Double rests with definite shoulders to prevent weakening of clasp arms, separation of teeth and food impaction.
**d)** Buccal and lingual proximal areas must be opened.
**e)** Use minimum retention – prone to distortion.
**f)** Use with discretion – use another clasp if possible.

**Figure 2.4 Embrasure clasp**

**Indications:**

**2-** In an unmodified Class II or Class III partial denture, where there are no edentulous space on the opposite side of the arch in aid of clasping.

**Advantages:**

Allows placement of direct retainer where none could otherwise be placed (especially contralateral to the edentulous span on a Class II case) **(Loney, 2011).**

**Disadvantages:**

**1-** Extensive interproximal reduction is usually required.
**2-** Covers large area of tooth surface- hygiene considerations **(Loney, 2011).**

**4) "C" Clasp (Hairpin or Reverse**

**Action): Characteristics and Design:**

**a)** The retentive area (undercut) is adjacent to the occlusal rest.

**b)** The upper arm is a minor connector giving rise to tapered lower arm. Therefore, only the lower part of the arm should be flexible.

**c)** The bend that connects the upper and lower parts of the arm should be rounded to prevent stress accumulation and fracture of the arm at the bend (**Loney, 2011)** (figure 2.5).

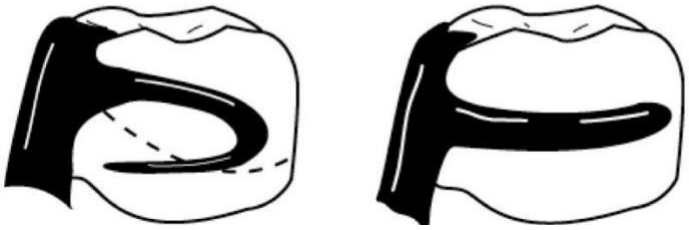

**Figure 2.5 Hairpin or C Clasp (Loney,2011).**

**Advantages:**

Allows use of undercut adjacent to edentulous space.

**Disadvantages:**

**1-** Almost impossible to adjust.
**2-** Non-esthetic.
**3-** Difficult to fabricate so the upper portion of the retentive arm clears the opposing occlusion.
**4-** Covers extensive tooth surface and acts as a food trap.
**5-** Insufficient flexibility on short crowns due to insufficient clasp arm length **(Loney,2011).**

**Disadvantages of suprabulge clasps in summary:**

- Clasp assembly covers large amount of tooth.
- Some clasps can be ineffective on teeth tilted buccally or lingually.
- Poor esthetics in anterior region.

# B) Clasps Design to Accommodate Functional Movement:

Two strategies are adapted to either:

**A.** Change the fulcrum location and subsequently the 'resistance arm' engaging effect (mesial rest concept clasp assemblies).

**B.** Minimize the effect of the lever by use of 'flexible arm' (wrought-wire retentive arm).

## A. change the fulcrum location and subsequently the 'resistance arm' engaging effect: mesial rest concept clasp assemblies (RPI, RPA and Bar clasp):

These are proposed to accomplish movement accommodation by changing the fulcrum location to prevent harmful tipping or torqueing of the abutment tooth and prevent more denture base movement. This is concept include **RPI** and **RPA** clasps.

### 1) Bar Clasp:

**Characteristics and Design:**

**a)** The bar clasp is 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)** (figure 2.6)

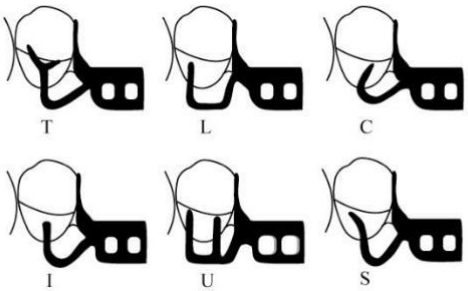


**Figure 2.6 several shapes of retentive terminal (Loney, 2011)**

**c)** The shape is unimportant as long as the direct retainer is mechanically and functionally stable; covers minimal tooth structure with minimum tooth structure with minimum display.

**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 I clasp with a longer horizontal component. The U-shaped clasp is same as an L-shaped clasp with 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.

**Indications:**

**1-** Smaller undercuts in the cervical third.
**2-** Distal extension cases.

**Contraindications:**

**1-** Deep undercuts or soft tissue undercuts.
**2-** Pronounced frenal attachments in area.
**3-** Insufficient vestibular depth.

**Advantages:**

- Easier for the patient to insert.
- Aesthetically superior.
- Less prone to caries.

**Disadvantage:**

- Tendency of food impaction.

**2) <u>R-P-I Clasp:</u>**

The components of this clasp assembly are:

'R' – rest (always **mesial**).

'P' – proximal plate

'I' – I-bar (retentive arm)

**Characteristics and Design:**

Basically, this clasp assembly is consist of:

**a)** A mesio-occlusal rest with a minor connector placed into the mesio-lingual embrasure, but not contacting the adjacent tooth.

**b)** The proximal plate, in conjunction with the minor connector supporting the rest; provide the stabilizing and reciprocal aspects of the clasp aeembly.

**c)** I-bar should be located in the gingival third of the buccal or labial surface of the abutment in 0.01-inch (0.25mm) undercut. The whole arm of I-bar should be tapered to its terminus, with no more than 2mm of its tip contacting the abutment. The retentive tip contacts the tooth from the undercut to the height of contour. This area of contact along with the rest and proximal plate contact provide stabilization through encirclement.

**d)** The horizontal portion of the approach arm must be located at least 4mm from the gingival margin and even further if possible **(Alan B.Carr, 2016)** (figure 2.7) (figure 2.8)

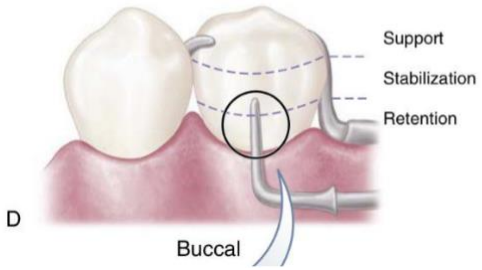


**Figure 2.7 Buccal view of RPI Clasp clasp**

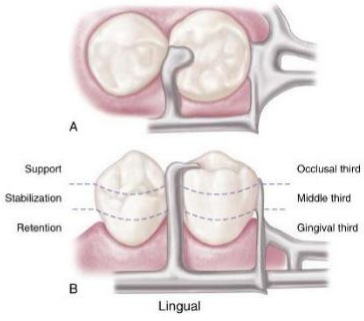


**Figure 2.8 Occlusal and Lingual view of RPI**

**Indications:**

**1-** Small degree of undercut exist in the cervical third.
**2-** Tooth supported removable partial dentures.
**3-** Distal extension cases.
**4-** Esthetic concern.

**Contraindications:**

**1-** Insufficient depth of vestibule.
**2-** No labial or buccal undercut on the abutment.
**3-** Severe soft tissue undercut.
**4-** Disto-buccal undercut (less than 180-degree encirclement).

### 3) R-P-A 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 mesio-buccal undercut. It is used when there is insufficient vestibule depth or when a severe tissue undercut exists **(Loney, 2011)** (figure 2.9)

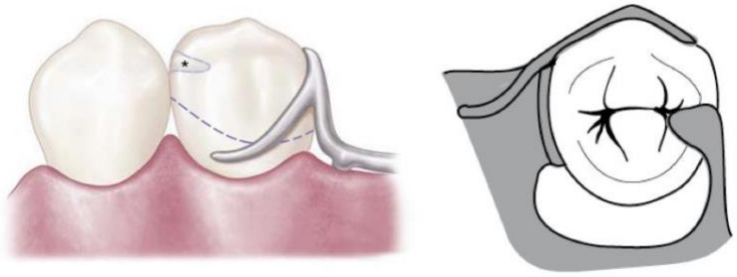

**Figure 2.9 RPA Clasp; Rest, proximal plate and Akers clasp is indicated when a bar-type clasp is contraindicated, and a desirable undercut is located in the gingival third of the tooth away from extension base area (Alan B. Carr,2016).**

## B. Minimize the effect of the lever by use of a flexible arm (wrought-wire retentive arm):

### 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 chrome-cobalt alloy) **(Loney,2011)** (figure 3.1).

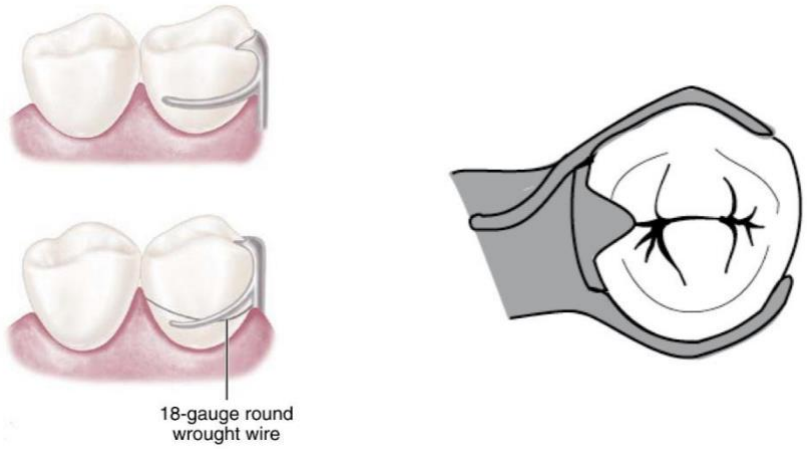


**Figure 3.1 A combination clasp consist of a reciprocal arm and a tapered, round wrought wire retentive clasp arm. (Alan B.Carr, 2016).**

# 1.5. Functional Requirement of Clasp

There are six factors that are required of clasp assembly **(John D. Jones,2009).**

1. Retention: Provides resistance to vertical dislodgment.

2. Stability: Provides resistance to horizontal forces.

3. Support: Provides resistance to vertical seating.

4. Reciprocation: Provides resistance to horizontal forces exerted on a tooth by an active retentive clasp.

5. Encirclement: Engages the tooth greater than 180° to prevent horizontal tooth movement from within the confines of a clasp assembly.

6. Passivity: Puts no active force on a tooth when a clasp is in place.

## 1.6. Length and Diameter of the Clasp

**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 **(Loney, 2011)** (figure 3.2)

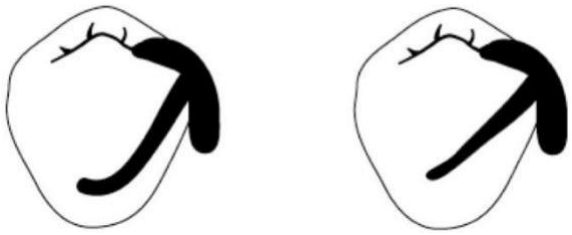

**Figure 3.2 curvature of the retentive arm**

**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 determined flexibility regardless of average diameter **(Loney, 2011)** (figure 3.3).


**Figure 3.3 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 (Loney,2011).**

## 1.7. Prosthodontics Opinion on Clasp Designer

The experts comment on these principles have been incorporated into the discussions that follow:

1- A clasp should always be supported by rest to maintain its vertical relationship to the tooth, without such support the clasp will tend to move gingivally.
2- The modification of tooth contour with composite resin is a conservative, simple and effective way of creating undercut for clasping where no or inadequate undercut exist.
3- A retentive clasp should be at least 15mm in length if it is constructed in Chrome-Cobalt alloy.
4- Occlusally approaching retentive clasp should be restricted to molar teeth if constructed in Chrome-Cobalt alloy.
5- Retentive clasp should usually be placed lingually on lower molar teeth.
6- Retentive clasp should usually be placed buccally on lower premolar or canine teeth.
7- Gingivally approaching clasp should be used if a retentive cast Chrome-Cobalt clasp is required on premolar or canine tooth, assuming that sulcus anatomy is favorable.
8- Rather than making a design statement this section poses a question:

'What is preferred number of clasps for RPDs restoring each of the Kennedy Classes of Partially denture arch?'

Prosthodontists preferring 2,3 or 4 clasp for each of the Kennedy classes.

For all of the Kennedy classes the use of **two** clasps is the most popular choice for RPD retention.

Two clasps are advantageous because:

a) Simple denture designs are often better tolerated and minimize tissue coverage.
b) A pair of clasps create a clasp axis that can be positioned to bisect the denture and allow indirect retention to be obtained **(Davenport et at, 2001).**

## 1.8. The Effect of Clasp Design on Gingival Health

A comparison has been made of the effects on the gingiva of occlusally and gingivally approaching clasps.

The effect on the gingiva has been assessed by measuring plaque accumulation, crevicular temperature and microbial distribution in patients and students wearing appliances.

It was concluded that the gingivally approaching clasp is potentially damaging **(Bazigran, 1986).**

While in Periodontally involved tooth, ideally only the terminal third of the occlusally approaching clasp should be below the survey line.

Unfortunately, in most on the cases clasp will be below the survey line and this will lead to displacing forces and harmful effect on the abutment tooth.

This is why we prefer gingivally approaching clasps over occlusally approaching ones when we have Periodontally involved teeth, because in gingivally approaching clasps only the tip contacts the tooth and this leads to less displacing forces on the abutment tooth **(Davenport et al, 2001).**

The frequency of hygiene recalls should be tailored to the individual patient's needs and ability to keep plaque under control. A very important aspect of recall appointments is prosthetic maintenance.

Ill-fitting dentures or malocclusion can alter the function of the RPD and cause undesirable stress and pressure on the remaining teeth and soft tissues.
**(Yeung, 2000).**

# CHAPTER TWO

# CONCLUSION

# Conclusion

**1-** There are several modalities that provide valuable treatment for the partially edentulous patient.

**2-** Cr-Co clasp has been used for several years and has provided its efficiency.

**3-** There are many types of clasps that have their own advantages and disadvantages so the selection of the type will be according to the case.

**4-** Learning clasp design is very important to have appropriate retention and eventually a good denture for the patients.

**5-** Patient expectations need to be established before treatment as component of RPD can be visible and may not be acceptable to the patient.

# CHAPTER THREE

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