

DIRECT RETAINERS

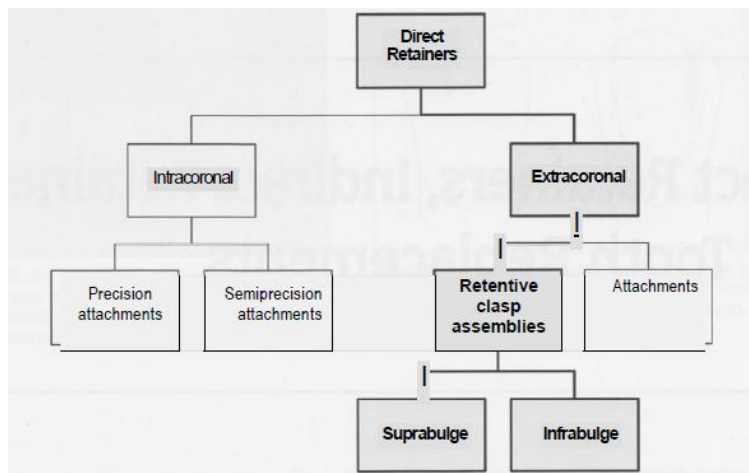
DEFINITIONS

- Direct retainer is a component of removable partial denture that prevents the movement of denture away from the tooth or tissue.
- This provides effective retention to the prosthesis and reduced the transmission of harmful forces to the abutments and supporting structures.

CLASSIFICATION

There are two types of direct retainers:

1. Intracoronal direct retainers
2. Extracoronal direct retainers.



1. Intracoronal direct retainers

- Introduced by Herman E. S. Chayes in 1906.
- These intracoronal retainers reside within the normal anatomical contour of the abutment teeth stabilizing the denture.
- Consists of two components:
- Matrix - Present within the normal tooth or extended contours of fixed restoration
- Patrix - Attached to the removable prosthesis
- In cases of multiple intracoronal attachments in a single prosthesis, it has to be made sure that matrix and patrix components are parallel thus providing retention effectively.

Based on method of fabrication and tolerance of fit between components, they are divided into :

Precision attachments	Semiprecision attachments
<ul style="list-style-type: none"> • Fabricated in metal. • Manufactured with high precision techniques, tolerance under 0.01 mm. • Long parallel walls with best adaptation. 	<ul style="list-style-type: none"> • Fabricated by wax or plastic patterns and then casted into metal, subjected to dimensional changes. • More tolerance compared to precision attachments. • Tapering walls with less intimate adaptation.

Advantages	Disadvantages	Contraindications
<ul style="list-style-type: none"> • Eliminates visible components of RPD. • Provides horizontal stability. • Stimulates underlying tissues. 	<ul style="list-style-type: none"> • Need to prepare tooth and restorations. • Complex clinical and lab process. • Loss of retention due to wear. • Difficulty in repair. • Cost 	<ul style="list-style-type: none"> • Presence of large pup that may lead to pulp exposure. • Short tooth length may not be sufficient.

2. Extracoronal direct retainers

Introduced by Henry R Boos in early 1900's and were modified by F. Ewing Roach in 1908.

Provides retention by placing the components outside the normal contour of the abutment tooth.

They are classified as:

- a) Prefabricated Attachments
- b) Retentive Clasp assemblies.

Retentive Clasp Assemblies:

Most commonly used for extracoronal direct retention and the prosthesis is called as clasp retained partial denture..

First described by Dr. W. G. A. Bonwill in 1899.

General considerations

- Principle is that a clasp should be engaged to an undercut area of abutment in relation to a path of insertion and removal of prosthesis.
- In 1916, Prothero described the basis of clasp retention in his *cone theory*. According to him the crown shape of premolars and molars (posterior teeth) is equivalent to two cones sharing a common base, in which upper cone is similar to occlusal half and lower cone is similar to cervical half of crown.
- Part of the clasp that ends in cervical half resists occlusal movements due to forces of sticky foods or gravity, hence the degree of resistance to deform limits the clasp retention.
- According to Kennedy (in 1928) the line at which the two cones meet is called as *height of contour*. It represents the greatest circumference of the tooth (crown).
- If the proposed path of insertion is altered due to tipping or tilting of cast during surveying, it alters the height of contour.
- According to Devan, the area occlusal to height of contour is called as *suprabulge area* and the area below is called as *infrabulge area*.
- As an extension of Devan's concept, there are two categories of retentive clasp assemblies
 - Circumferential or suprabulge direct retainers
 - Vertical projection or bar type or infrabulge direct retainers.

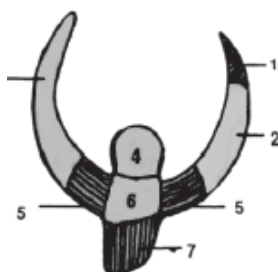


Structure of a clasp assembly

Clasp assemblies are composed of (AIPG-03)

1. Rest

- It is a rigid part of the clasp assembly that lies on the occlusal, incisal, or lingual surface of the tooth and prevents the tissue ward movement of the denture by ensuring that retentive terminal of the clasp arm remains in the planned position of the undercut.
- Transmits forces along the long axis of abutment.



1. Retentive terminal
2. Retentive clasp arm
3. Reciprocal arm
4. Occlusal rest
5. Shoulder
6. Body
7. Minor connector

2. Retentive arm

- It is the only part of the prosthesis that contacts the surface of tooth cervical to the height of contour when denture is fully seated.

Consists of three parts

a) Retentive terminal

- Terminal third of the clasp, flexible, engages well in the undercut.
- Should always point towards the occlusal surface (MAHE-2K).

b) Body

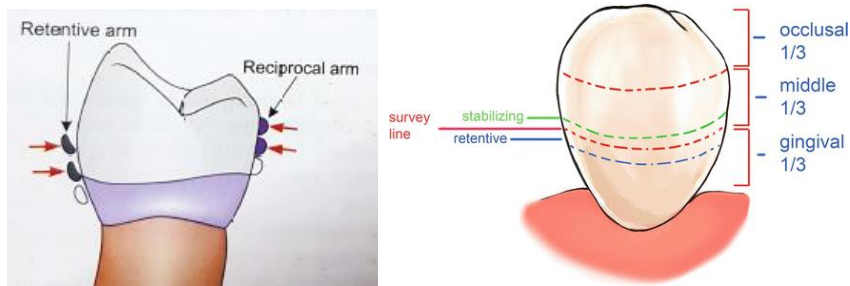
- Part of the clasp that connects the rest and shoulders of the clasp to the minor connectors.
- Must be rigid and above the height of contour.
- Contacts guide planes during insertion and removal.

c) Shoulder

- Middle third of the clasp assembly, limited flexibility, minimal engagement to the undercut.
- Provides stability to horizontal forces.

3. Reciprocal arm (AIIMS-90, AIPG-93, AP-99)

- A rigid clasp arm placed above the height of contour on the side opposite to the retentive clasp arm.
- Resists forces exerted by retentive arm.
- Must contact the tooth before retentive term arm glides over the height of contour.
- Contributes to vertical support and indirect retention.



4. Approach arm

- A minor connector that projects from the framework runs along the mucosa and turns across the gingival margin of the abutment.

5. Minor connector

- Part that joins body of the clasp to the remainder of the RPD framework

REQUIREMENTS OF A DIRECT RETAINER

All the clasps should be designed with the following functional requirements

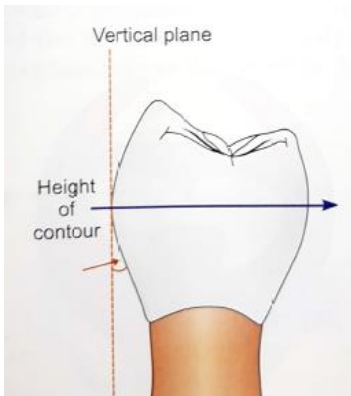
1. Retention

- It is the quality of denture to resist the vertical occlusal forces and prevent dislodgement. Eg., Gravity, adhesiveness of food, forces involved while opening and closing of mouth.
- The most important activity of clasp (retentive arm) is to provide retention to the prosthesis.

Factors affecting the retention are


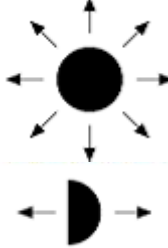
- Dimension of the retentive undercut:**
 - Undercut for retentive arm has three dimensions

Buccolingual depth	Distance between height of contour and retentive tip	Mesiodistal length
<ul style="list-style-type: none"> • Also called as <i>angle of gingival convergence</i> • Measured using an undercut gauze of surveyor. • Lesser the angle - greater is the distance between retentive tip and height of contour - better the retention 	<ul style="list-style-type: none"> • It changes the length of clasp arm and in parallel affects the flexibility. • Not a very important factor 	<ul style="list-style-type: none"> • Longer the mesiodistal length - greater the flexibility



Angle of convergence: it is the angle formed by surface of the tooth below height of contour with vertical plane, when the occlusal plane of tooth is oriented parallel to horizontal.

ii. **Flexibility of clasp arm:** Flexibility of clasp arm depends on following factors (MAHE-95, AP-03)

Length of clasp	Diameter of clasp	Cross sectional form	Clasp material
<ul style="list-style-type: none"> Flexure $\propto (\text{length})^3$ Greater the length - greater is the flexibility - lesser the stress transmitted to the abutment To achieve this clasps should be designed in a curved manner rather than a straight line 	<ul style="list-style-type: none"> Flexibility $\propto \frac{1}{\text{Diameter}}$ Taper should be uniform, retentive tip should have a width half as at its origin 	<ul style="list-style-type: none"> Round in cross section is more flexible than half round, as it tends to flex in all planes. Wrought wire has greater flexibility than cast clasp 	<ul style="list-style-type: none"> Higher the modulus of elasticity (eg., Chrome alloys) - lesser the flexibility. (AI-94) Based on undercut depth, metal alloy is chosen to obtain similar degree of retention. 0.010 inch: Chrome alloy 0.015 inch: Gold alloy 0.020 inch: Wrought alloy

iii. **Type of clasp**

- Gingivally approaching clasp (push type) produces better retention than occlusally approaching clasp (pull type).

2. Stability

- It is the quality to resist displacement of prosthesis due to horizontal, rotational and functional forces and to be firm and stable.
- Except retentive terminal, all the components contributes to this function
- Cast circumferential clasp with rigid shoulder offers better stability than combination and bar clasps.

3. Support

- It is the property that resists the displacement of prosthesis towards the basal tissue or underlying supporting tissues.
- Components like occlusal, incisal or incisal rests provides this property.

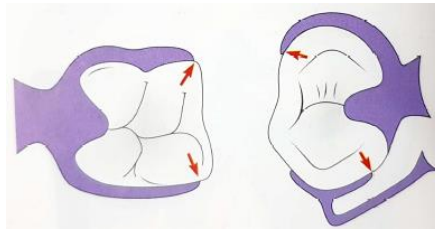
4. Reciprocation (AIIMS-89)

- It is a mechanism which counteracts the forces generated by retentive arm passing over height of contour, by reciprocal arm that passes along the guiding plane.

5. Encirclement

- It is the property of clasp assembly to encompass more than 180 degree of the abutment tooth either by continuous (circumferential clasp) or broken (bar clasp) contact to prevent dislodgement during function.

- It also avoids the tooth from moving out of arch.



6. Passivity

It is a quality of being in a stage of inactive or rest by the teeth, supporting tissues and denture when a prosthesis is in place and not under any load (eg., masticatory forces)

Retentive property should be passive completely except during application of dislodging forces.

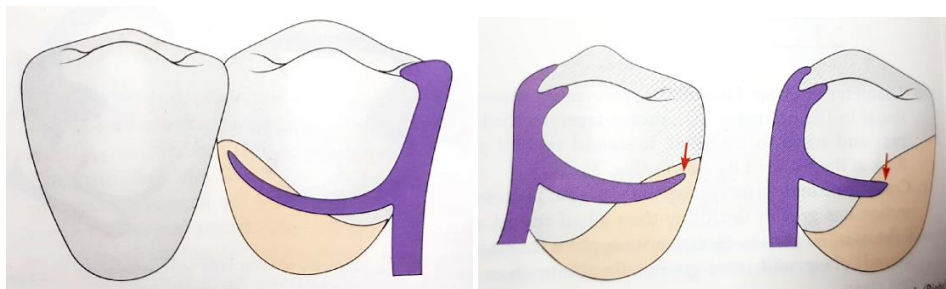
If the prosthesis is not seated at the clasp assembly, retentive terminal will not sit in the planned undercut depth, hence a constant force is applied on tooth leading to pain.

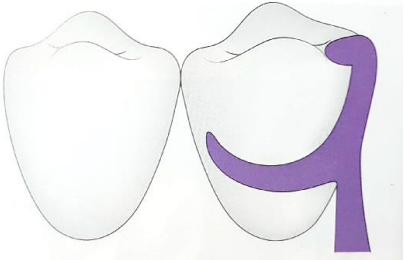
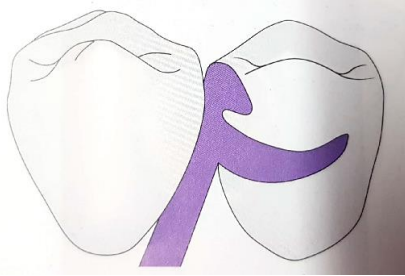
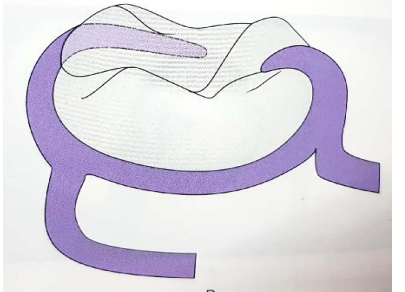
TYPES OF CLASPS

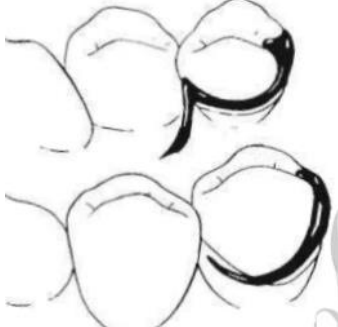

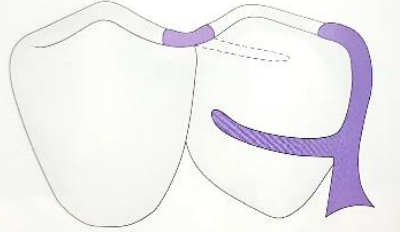

1. *Supra bulge (Aker's, Circumferential)* – approaches undercut from above the height of contour. (MAHE-98, 99, AIPG-06)
2. *Infra bulge (Roach or bar)* – approaches undercut from under the height of contour.
3. *Combination clasp* – combination of cast reciprocal arm and a retentive clasp made of wrought wire.

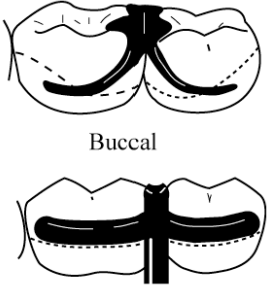
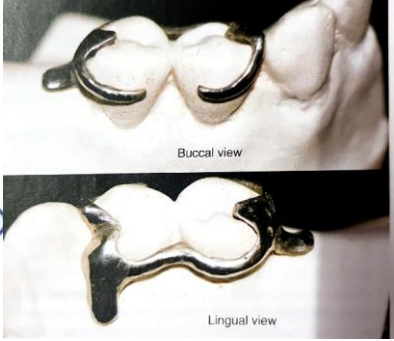
CAST CIRCUMFERENTIAL CLASP

Design considerations	Advantages	Disadvantages
<ul style="list-style-type: none"> • Components made of cast alloy. • Retentive terminals should begin above the height of contour and terminate below it. • Retentive terminal should always point up towards the occlusal surface. • Retentive should end in proximal (distal or mesial) line angles of tooth and never on the axial surface (buccal or lingual). • Clasp arm should be maintained low in position to gain mechanical advantage against lever action of tooth. 	<ul style="list-style-type: none"> • Easy to design, fabricate and repair. • Excellent support, bracing and retention. • Ideal choice for tooth supported prosthesis • Less food retention 	<ul style="list-style-type: none"> • More coverage of tooth is present leading to decalcification or caries. • Alters the morphology of tooth affecting the normal food flow, leading to damage of supporting periodontal tissues. • If not positioned or seated completely, it may rise the occlusal table leading to more forces on tooth. • Difficult to adjust.



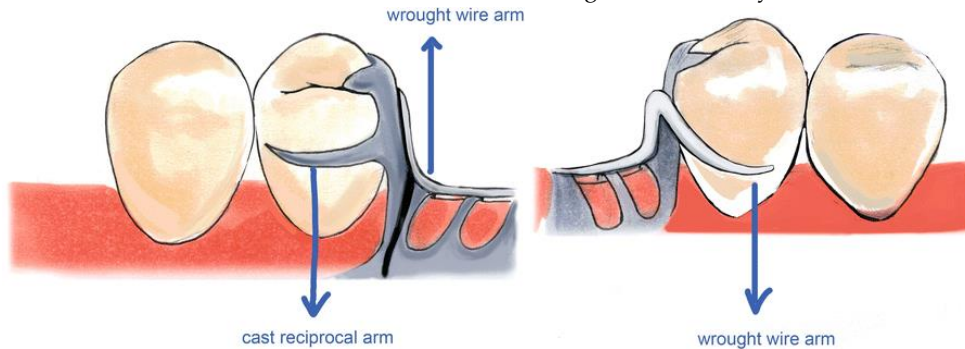
Clasp	Indications	Advantages	Disadvantages	
Simple circlet clasp <ul style="list-style-type: none"> Originated from edentulous side and engages the mesiobuccal undercut of tooth 	<ul style="list-style-type: none"> Tooth born partial denture (removable bridge) On distal extensions where undercut is so small that longer clasp arms may not be retentive 	<ul style="list-style-type: none"> Good support and bracing Simple design Dose not distort easily Easy to adjust Contacts minimal area of the tooth Good esthetics 	<ul style="list-style-type: none"> May traumatize abutments when used incorrectly on free-end extension 	
Reverse circlet clasp <ul style="list-style-type: none"> Engages the distobuccal undercut of tooth adjacent to the edentulous space from mesio occlusal rest 	<ul style="list-style-type: none"> Distal extension cases where bar clasps are contraindicated. Contraindicated in esthetic zone (eg premolars) 	<ul style="list-style-type: none"> Engages the undercut more effective during masticatory forces 	<ul style="list-style-type: none"> Poor esthetics due to its origin from mesial side Obtaining enough clearance for the rest is difficult Should place additional rest to protect the marginal ridge Wedging may occur interdentally. 	
Ring Clasp <ul style="list-style-type: none"> Originates adjacent to edentulous side encircling the entire tooth to terminate into distolingual undercut 	<ul style="list-style-type: none"> Indicated on tipped molars with undercut present adjacent to edentulous side High muscle (buccinator) attachment may encroach the bracing arm 		<ul style="list-style-type: none"> It covers large area of the tooth making it unaesthetic, so it used only in posterior teeth 	

<p>Back Action Clasp</p> <ul style="list-style-type: none"> • Modification of ring clasp with minor connector attached lingual side 	<ul style="list-style-type: none"> • Premolar and canine abutments on free-end extension with mesiobuccal undercut 	<ul style="list-style-type: none"> • Can use small undercut areas • Length of clasp 	<ul style="list-style-type: none"> • Undergoes distortion because of length • Difficult in adjusting • Large tooth area covered • Design produces "food trap" between lingual minor connector and major connector 	
<p>Reverse Back Action Clasp (KAR-PGET-03)</p> <ul style="list-style-type: none"> • Similar to back action clasp except the minor connector is positioned buccally 	<ul style="list-style-type: none"> • Abutments inclined lingually adjacent to distal extension condition 		<ul style="list-style-type: none"> • Crosses soft tissue • Lack of occlusal rest support, makes it ineffective 	
<p>Half & Half Clasp</p> <ul style="list-style-type: none"> • Consists of retentive arm originating from one direction and reciprocal arm from another 	<ul style="list-style-type: none"> • Used in distal extension bases with premolar and molar as abutment 	<ul style="list-style-type: none"> • Dual retention in unilateral distal extension • Good esthetics 	<ul style="list-style-type: none"> • Food trap may be introduced between lingual arm and major connector if not constructed properly 	
<p>Hairpin, C Clasp & Fish hook</p>	<ul style="list-style-type: none"> • When a <i>proximal undercut</i> must be used to a posterior teeth and high tissue undercut prevents the use of a bar clasp • <i>Distobuccal undercut</i> on canines and premolars when a sharp tissue undercut contraindicates the use of bar-type clasp 	<ul style="list-style-type: none"> • Undercut adjacent to edentulous area may be utilized without having minor connector cross soft tissue • Good bracing and support 	<ul style="list-style-type: none"> • Poor esthetics • Large surface area is covered • Possible food trap 	

<p>Embrasure Clasp/ Modified crib clasp</p> <ul style="list-style-type: none"> • Two simple circlet clasps joined at body. 	<ul style="list-style-type: none"> • Used on dentulous side of the arch • Kennedys class II and Class III without modifications • Provides cross arch stability by bilateral bracing 		<ul style="list-style-type: none"> • Insufficient tooth preparation may cause fracture of clasp 	 <p>Buccal</p> <p>Lingual</p>
<p>Multiple circlet Clasps (KCET-08)</p> <ul style="list-style-type: none"> • Two opposing circumferential clasps joined at the terminal end of the two reciprocal arms 	<ul style="list-style-type: none"> • Used when multiple clasping is needed 	<ul style="list-style-type: none"> • In case of periodontally compromised abutment, it shares the retention features with other tooth 		 <p>Buccal view</p> <p>Lingual view</p>
<p>Onlay Clasp</p> <p>It is an extension of occlusal rest with buccal and lingual clasp arms</p>	<p>Indicated if occlusal surface of abutment is lower than occlusal plane</p>	<p>Metal in occlusal surfaces of onlay can be lined with tooth colored acrylic resins which reduces the wear of opposing tooth</p>		

COMBINATION CLASP (COMEDK-04)

- It is a circumferential clasp that consists of cast reciprocal arm and a retentive arm made of wrought wire.
- The name is derived based on the combination of wrought and cast alloy.



Design considerations:

- In cases with distal extension base, a simple circlet clasp is not advised to engage with mesiobuccal undercut because of its inability to hold the retentive arm within the undercut during function leading to added stress on the abutment.
- Hence use of a wrought wire which has the ability to flex greater than cast alloy in all the three planes is used to dissipate the stresses.

Indications	Advantages	Disadvantages
<ul style="list-style-type: none"> • Abutments with mesiobuccal undercut adjacent to the distal extension base. 	<ul style="list-style-type: none"> • Greater flexibility • Easy to adjust • Aesthetically acceptable, can be used in canines & premolars. • Line contact only with tooth 	<ul style="list-style-type: none"> • Complexity in fabrication • Can distort easily and prone to damage (PGI-08) • Resistance to horizontal stability is poor

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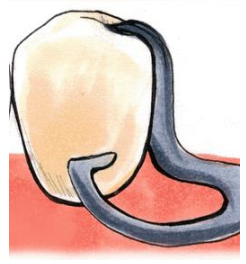
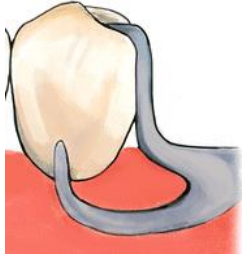

BAR CLASP (AIIMS-98, 99, AP-04)

- Also called as vertical projection or Roach or Gingivally approaching clasp .
- It is a clasp whose body extends from major connector or denture base, adjacent to soft tissue and approaching the tooth in a gingivo occlusal direction.

Design considerations

- Provides a push type retention as it approaches from gingival direction towards the undercut
- Approach arm should be smooth and should not impinge the soft tissue
- It should cross the marginal gingiva at 90 degrees
- Minor connector that joins the occlusal rest to major connector should be rigid
- Retentive arm tip should be directed upwards occlusally
- Clasp should be placed low to avoid leverages.

Indications	Contraindications	Advantages	Disadvantages
<ul style="list-style-type: none"> • Abutments with undercut of (small) 0.01 inch in cervical third. • Abutments adjacent to distal extension edentulous space with distobuccal undercut. • Indicated in tooth supported partial dentures, and where aesthetics are concerned 	<ul style="list-style-type: none"> • Tissue undercuts. • Abutments with deep cervical abutments. • Abutments with buccal or lingual tilt. • Shallow vestibule. • Should not engage mesiobuccal undercut. 	<ul style="list-style-type: none"> • Easy to insert. • More aesthetic. • Various designs to improve adaptability in all conditions. 	<ul style="list-style-type: none"> • Difficulty in removal. • Food accumulation. • More flexible, hence less bracing and stability to prosthesis

T clasp	Modified T clasp	I clasp	Y clasp
<ul style="list-style-type: none"> • Approach extends till height of contour • Retentive terminal engages the undercut and other end of arm is positioned above height of contour 	<ul style="list-style-type: none"> • It is a T clasp without a non retentive finger (mesial). • Good aesthetics. • Indicated in premolars and canines • Compromise on 180 degree encirclement. 	<ul style="list-style-type: none"> • Indicated in canines with distobuccal undercuts. • Compromise on 180 degree encirclement and stability to horizontal forces. • Also used in RPI concept. 	<ul style="list-style-type: none"> • Indicated if the height of contour of the abutment is high in mesial and distal surfaces, but low at the centre of buccal side. 

RPI CONCEPT

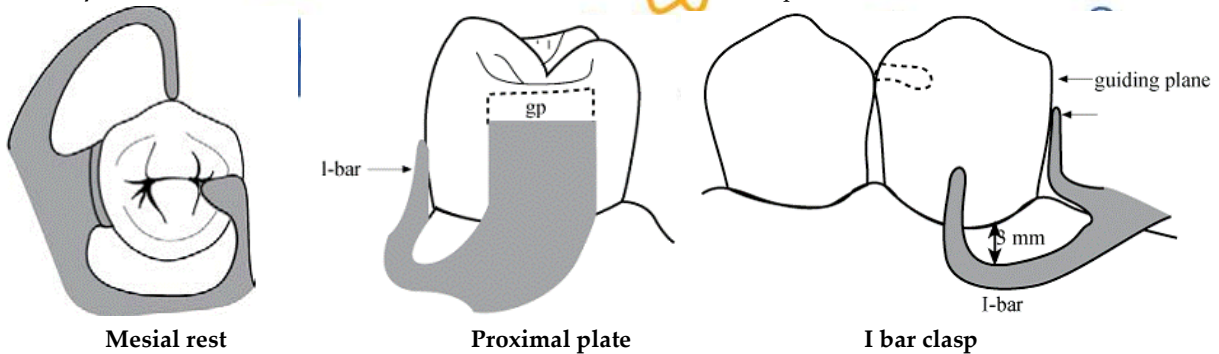
- This concept is introduced by Krol (1973) to reduce the amount of tooth preparation, coverage and stress
- Consists of Rest, Proximal plate, I bar clasp

Rest: Mesial rest with less preparation with minor connector located on mesio lingual embrassure.

Proximal plate: Preparation of guide plane with 2 - 3mm dimensions and with a contacts only 1 mm of gingival portion.

Relief is given at tooth tissue junction

I bar clasp: Placed on mesiobuccal surface on canine and buccal surface on premolar



Contraindications

- Shallow vestibule
- Absence of buccal undercuts on abutment
- Deep soft tissue undercut
- Presence of distobuccal undercut

RPA CONCEPT

Proposed by Krol (1976) as a modification of RPI concept in cases with tilted abutments and soft tissue undercuts.

In this concept distal rest (eliminates the space between abutment and artificial tooth) and wrought wire circumferential clasp (Produces stress breaker effect).
