INDIRECT RETAINERS

Learning Objective

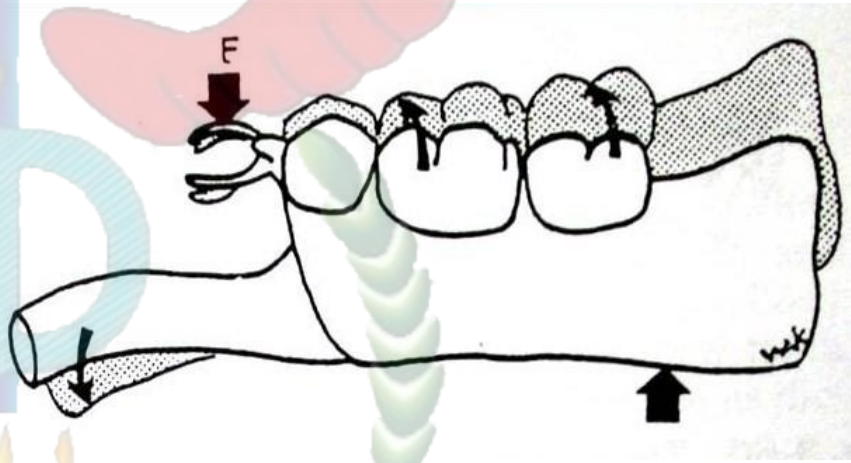
By the end of this session students should know about the form, functions and importance of indirect retainers and removable partial denture.

CONTENTS

- Introduction
- Definition
- Need for indirect retention
- Principle
- Lever and fulcrum
- Rotation of the denture base
- Review of literature
- Functions of the indirect retainer
- Forms of indirect retainer
- Advantages
- Problems of indirect retainer
- Design considerations
- Summary.
- References.

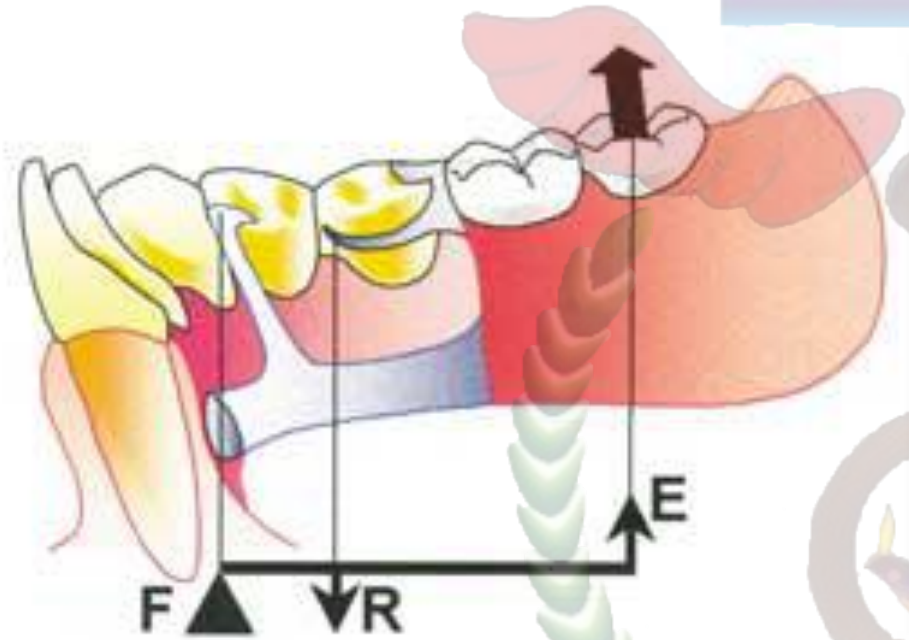
Retention

- Retention is defined as the quality inherent in the prosthesis acting to resist the forces of dislodgement against the path of placement.
- One of the most important biomechanical principle





- This saddle has an occlusal rest and a clasp on the abutment tooth, and sublingual bar as the major connector
- When sticky foods displace the saddle in an occlusal direction the tips of the retentive clasps engaging the undercuts on the abutment teeth provide the only mechanical resistance to the movement.
- The saddle thus pivots about the clasp tips.
- In the maxilla this movement of the saddle away from the ridge may also be caused by gravity.



- If the design is modified by placing a rest on an anterior tooth, this
- rest (indirect retainer) becomes the fulcrum of movement of the saddle in an occlusal direction causing the clasp to move up the tooth, engaging the undercut and thus resist the tendency for the denture to pivot.

Indirect Retainer

- *CUMMER* advanced the idea of indirect retention
- Definition:

  "The component of a removable partial denture that assists the direct retainer(s) in preventing displacement of the distal extension denture base by functioning through lever action on the side opposite of the fulcrum line when the denture base moves away from the tissues in pure rotation around the fulcrum line."

  The Academy of Prosthodontics (1999). *Glossary of Prosthodontic Terms (7th ed).* St. Louis: Mosby.

Indirect Retention

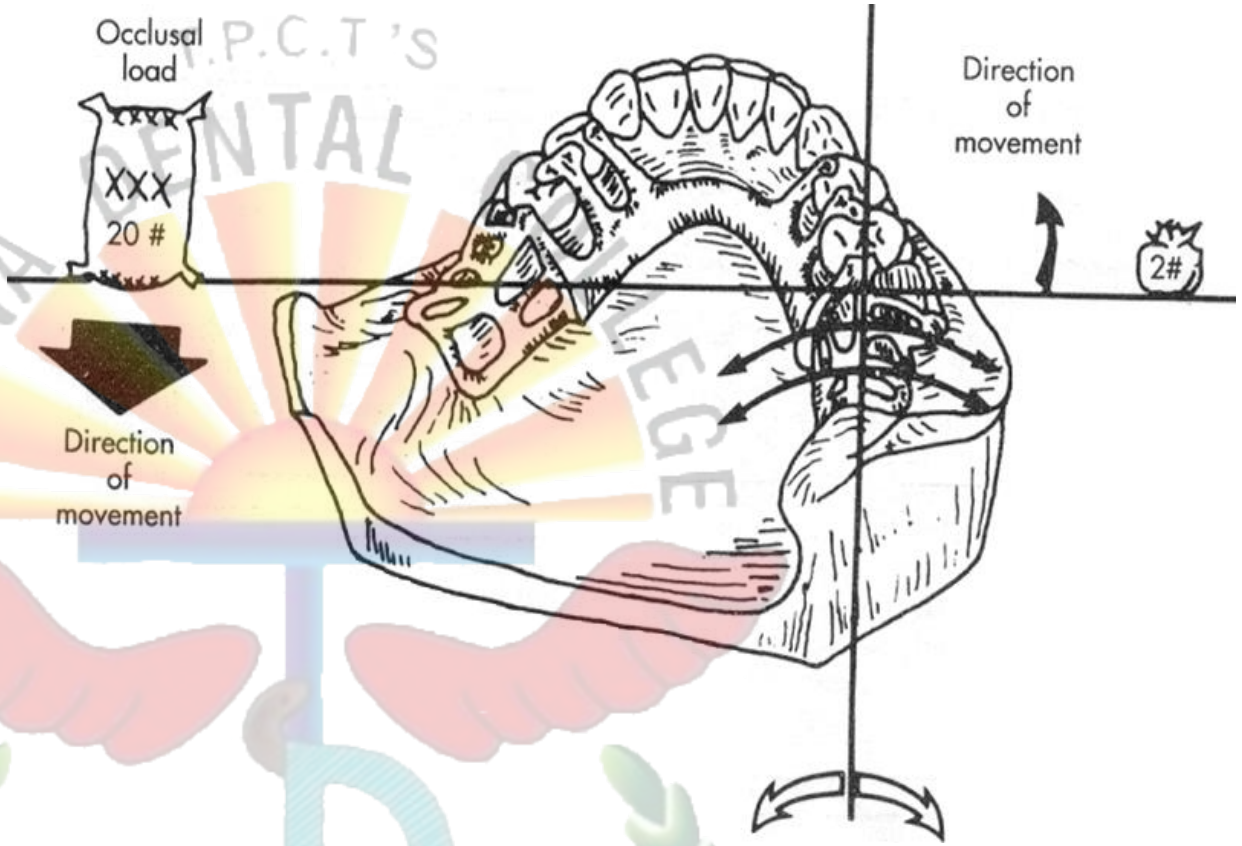
- Definition

  The effect is achieved by one or more indirect retainer of a partial removable denture prosthesis that reduce the tendency for a denture to move in occlusal direction or rotate about fulcrum line”

Biomechanics of RPD

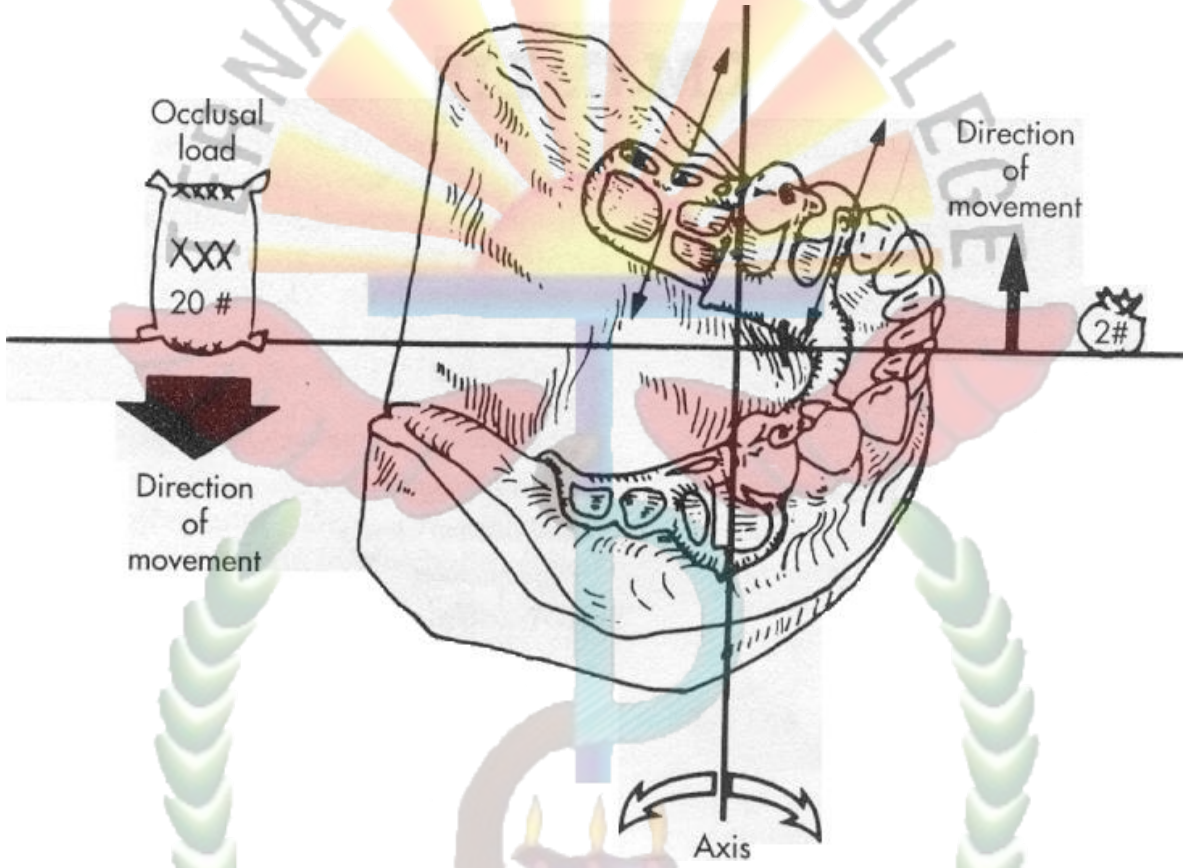
- Forces will tend to rotate the prosthesis around an axis of rotation.
- There are three axis of rotation to which removable partial prosthesis is subjected:
  - Horizontal
  - Vertical
  - Longitudinal

Horizontal axis



The movement of the prosthesis around this axis can either be toward the ridge or away from it on the vertical plane. The control of the forces on the abutment teeth from their axis of rotation is governed by occlusal outline form of the intracoronal semi precision rest system or by the placement of the shallow occlusal rest when clasp retainer system is employed.

Vertical axis



Longitudinal axis:



Need for indirect retention

Entirely Tooth supported edentulous area



Tooth supported at one end only



Principle

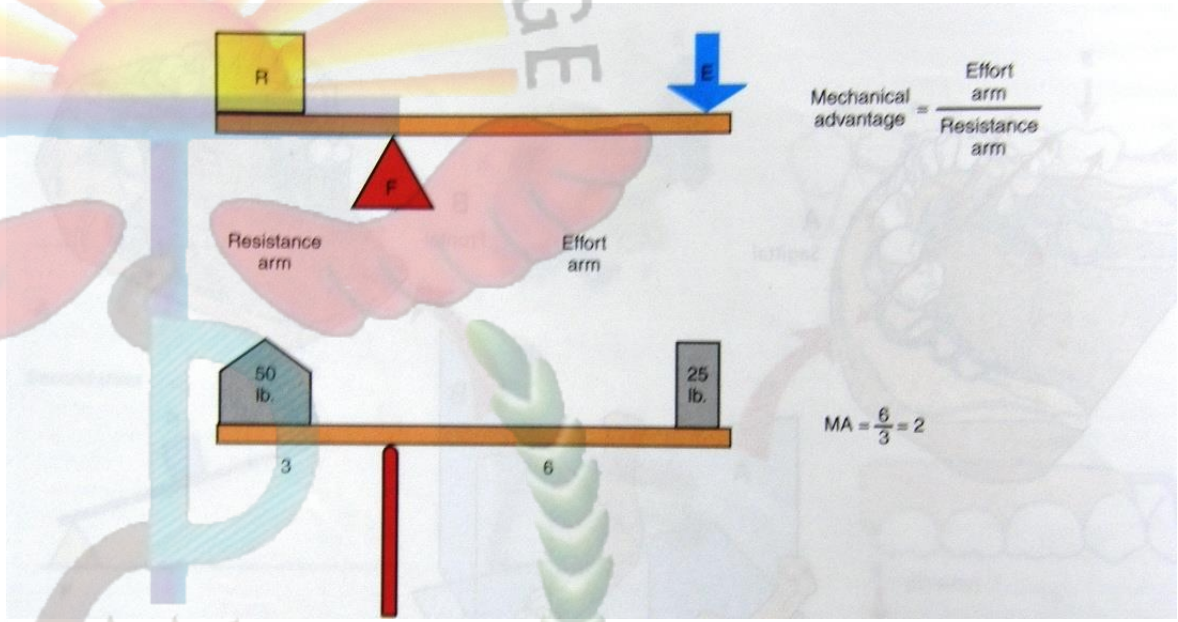


- The pile of bricks prevents downward movement of that end of see-saw

Lever and Fulcrum Principle

- What is a Lever ?

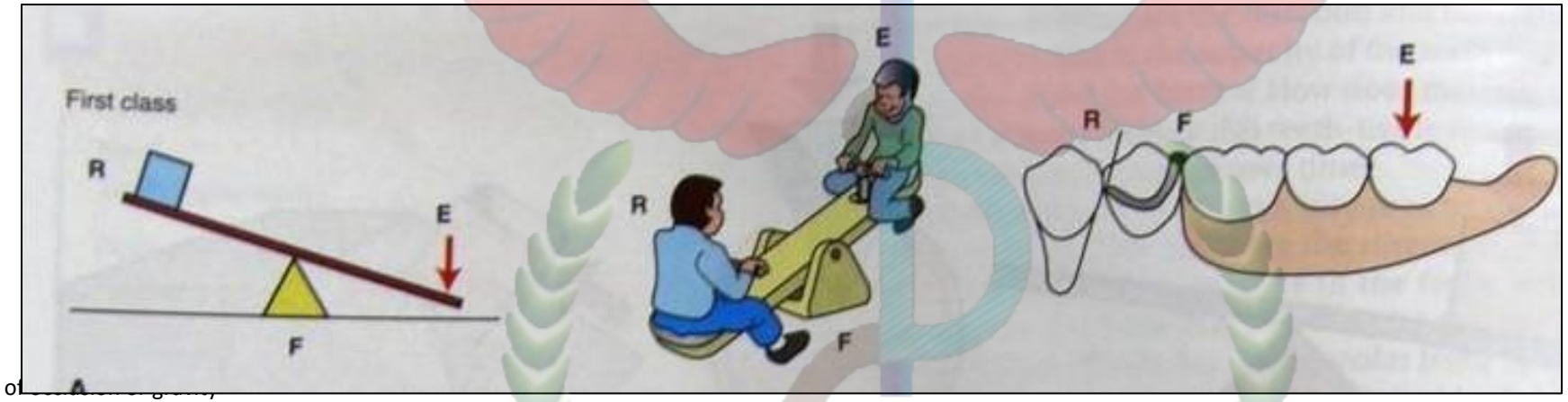
  It is a rigid bar supported somewhere along its length. The support point is called fulcrum & lever can move around the fulcrum.



Classes of Lever in Removable denture.

Class 1

Mechanical advantage can be greater/less than 1



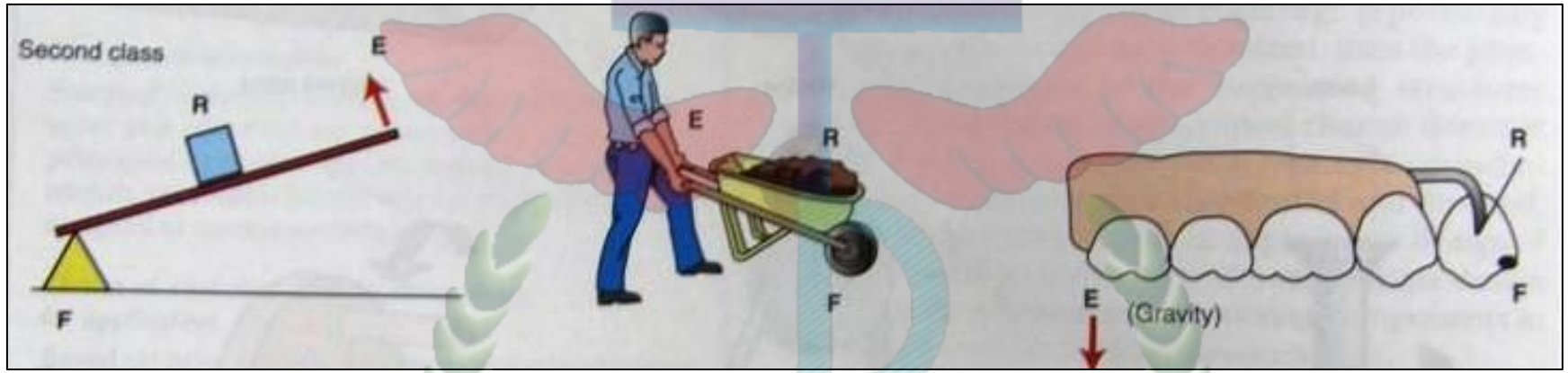
E – Force of [illegible]

R – resistance provided by Direct Retainer or Guide plane

F – Rest seat

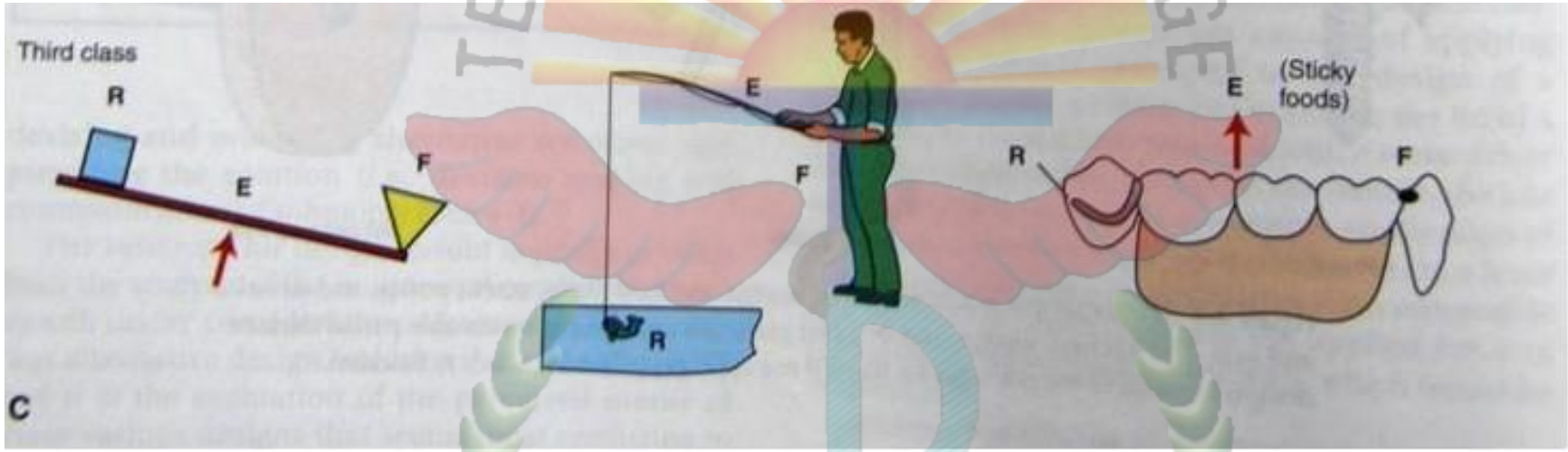
Class II

mechanical advantage is always greater than 1



Class III

mechanical advantage is always less than 1



INDIRECT RETENTION & CLASS 2 LEVER

- Indirect retention is the application of class 2 levers. The tooth surface on which indirect retainer rests is the fulcrum. The retentive part of the direct retainer clasp becomes the resistance and the power is represented by the force that tends to move the denture base away from the underlying tissues.

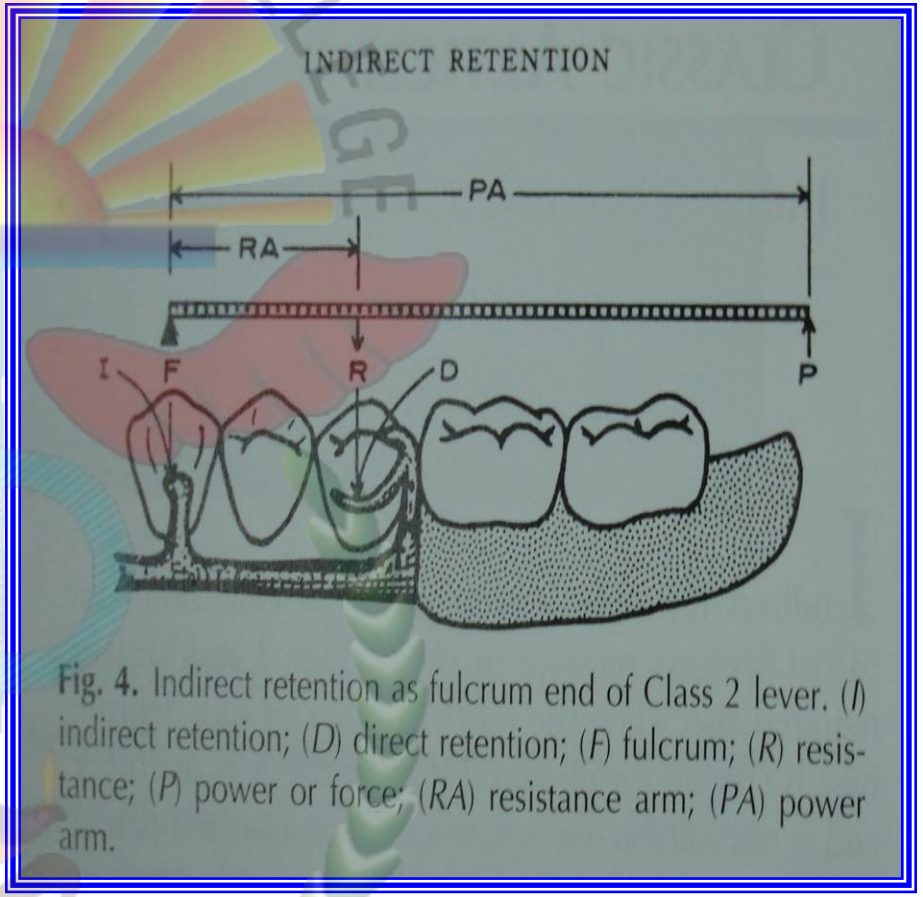
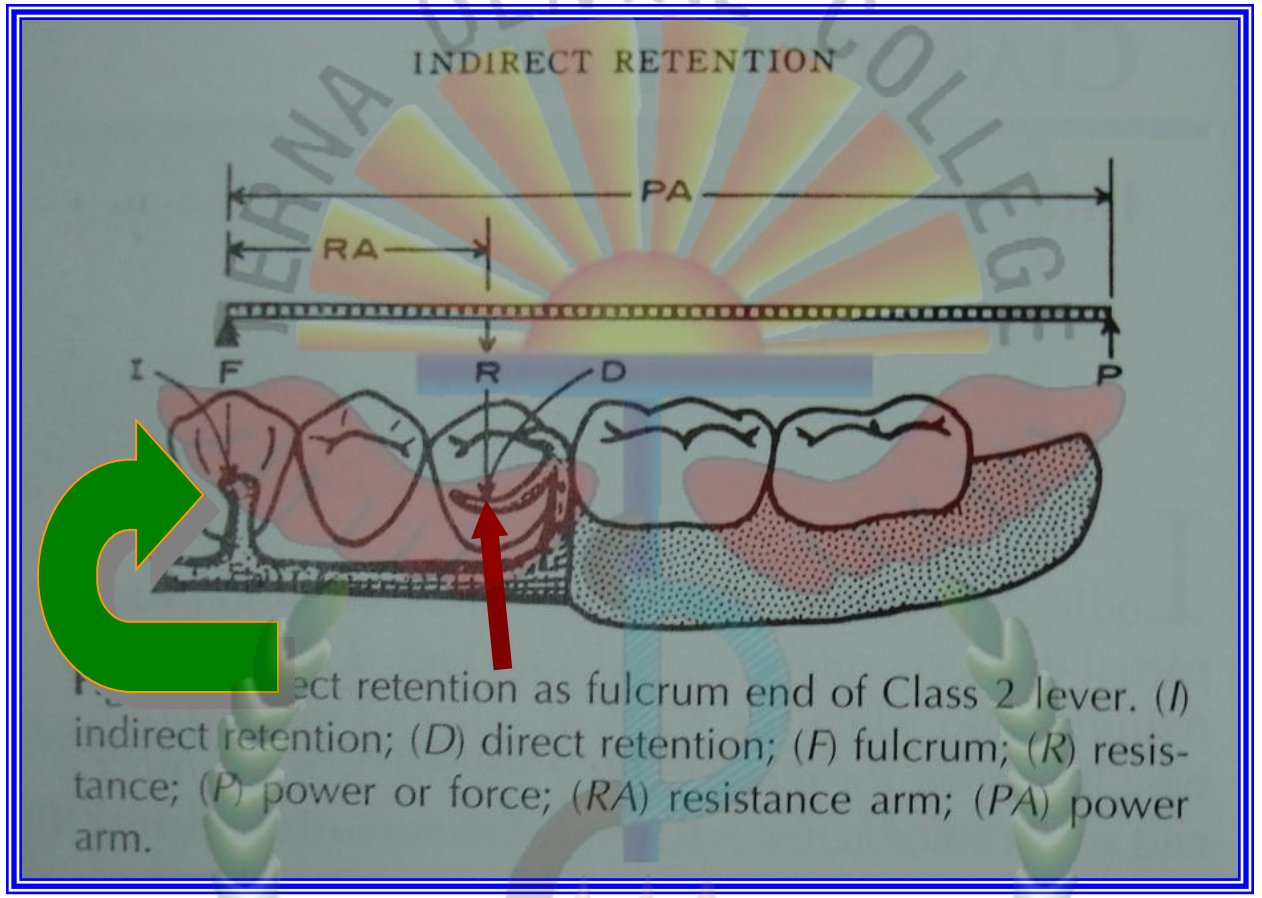
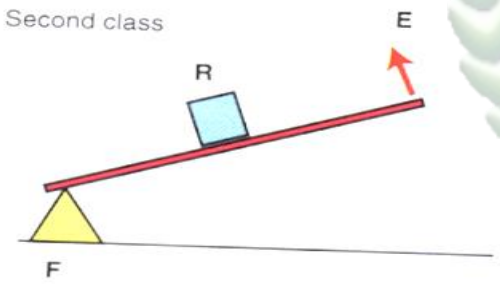


Fig. 4. Indirect retention as fulcrum end of Class 2 lever. (*I*) indirect retention; (*D*) direct retention; (*F*) fulcrum; (*R*) resistance; (*P*) power or force; (*RA*) resistance arm; (*PA*) power arm.

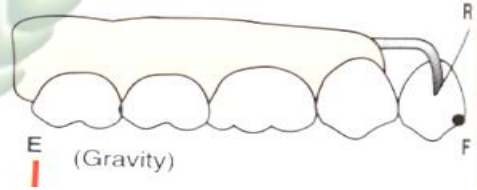
Indirect retention is an application of a Class 2 lever



ect retention as fulcrum end of Class 2 lever. (*I*) indirect retention; (*D*) direct retention; (*F*) fulcrum; (*R*) resistance; (*P*) power or force; (*RA*) resistance arm; (*PA*) power arm.





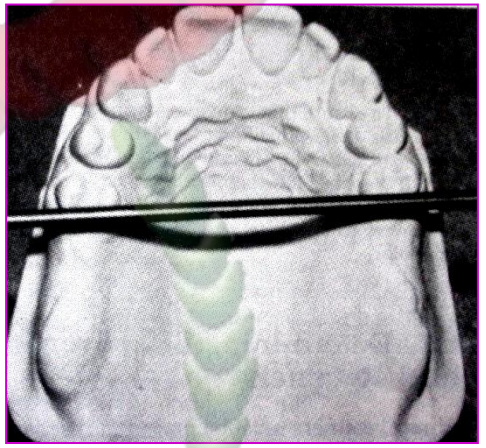


PRINCIPLE OF INDIRECT RETAINER

- It works on the principles of counter balance. An indirect retainer is so called because it retains in position some part of a denture remote from itself.

Fulcrum line

Termed by prothero “An imaginary line connecting occlusal rests around which partial removable dental prosthesis tends to rotate under masticatory forces.”



- The determinants for fulcrum line are usually cross arch rests located adjacent to tissue borne components.

- The primary fulcrum line on the distal extension partial denture is the imaginary line passing through the most distal rest seat of the tooth on each side of the arch.
- If the denture extends mesially the primary fulcrum line passes through the most mesial rest seat on each side of the arch.

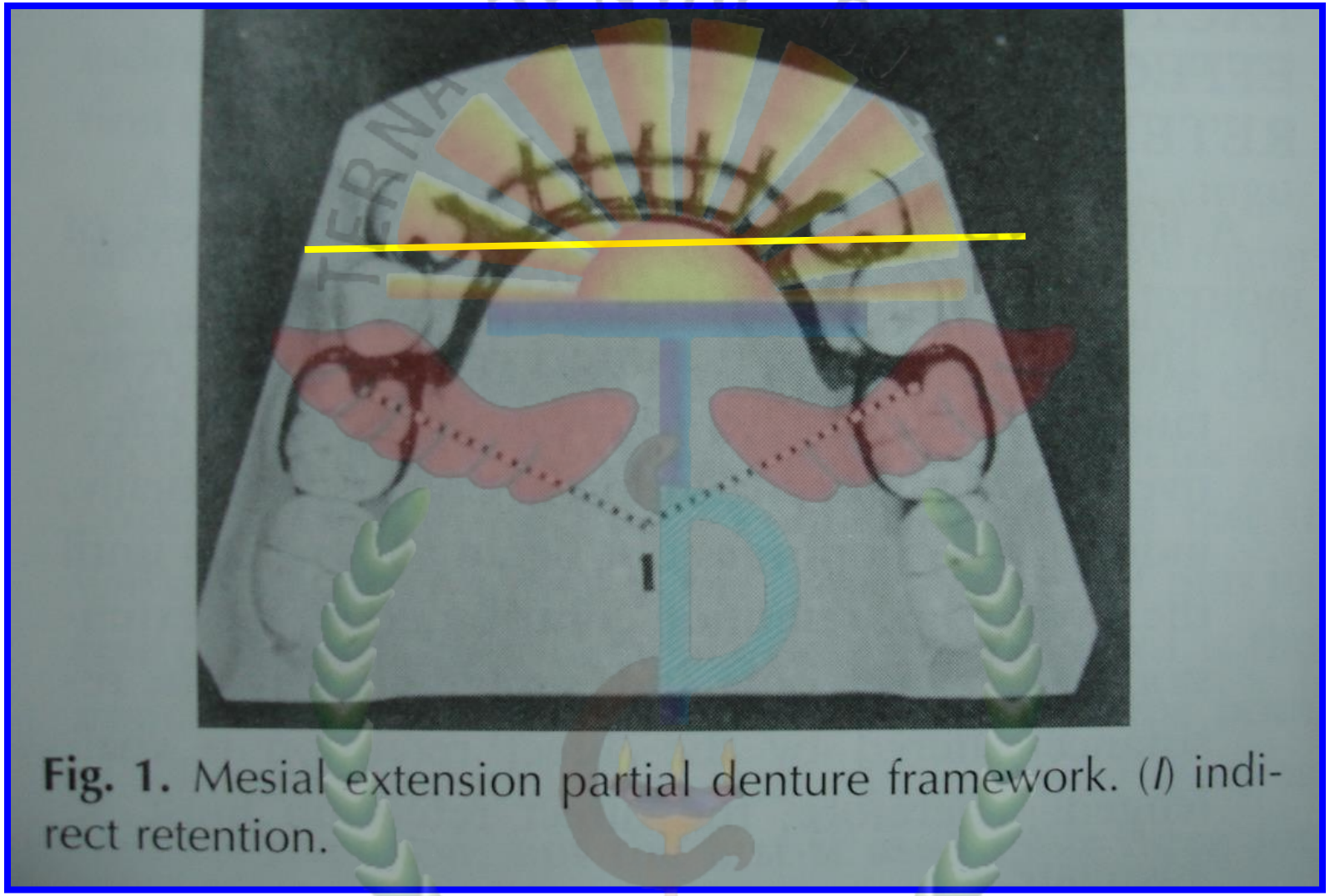


Fig. 1. Mesial extension partial denture framework. (*I*) indirect retention.

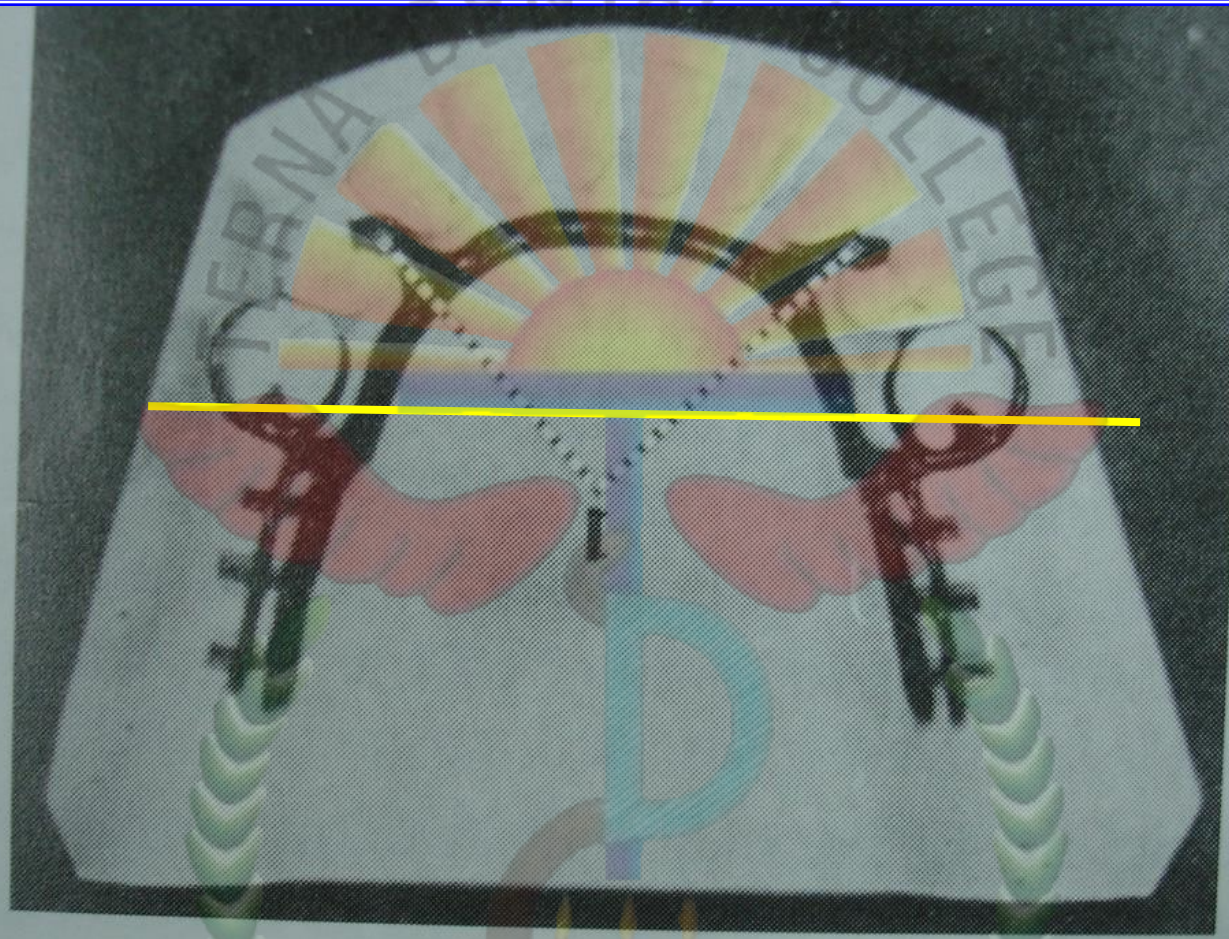


Fig. 2. Distal extension partial denture framework. (*I*) indirect retention.

- When the second fulcrum line is produced by the indirect retention the prosthesis rotates about the primary fulcrum line .

T.P.C.T'S



Fig. 11. Distal extension partial denture framework showing 2 fulcrum lines. (*P*) primary fulcrum line; (*S*) secondary fulcrum line.

terna
KNOWLEDGE TO EMPOWER

- If the denture base is moved tissue ward and about the secondary fulcrum line the denture is lifted off the tissue. However if the secondary fulcrum line is not produced then the prosthesis rotates about the primary fulcrum line whether forces move the denture base towards or away from the tissues.

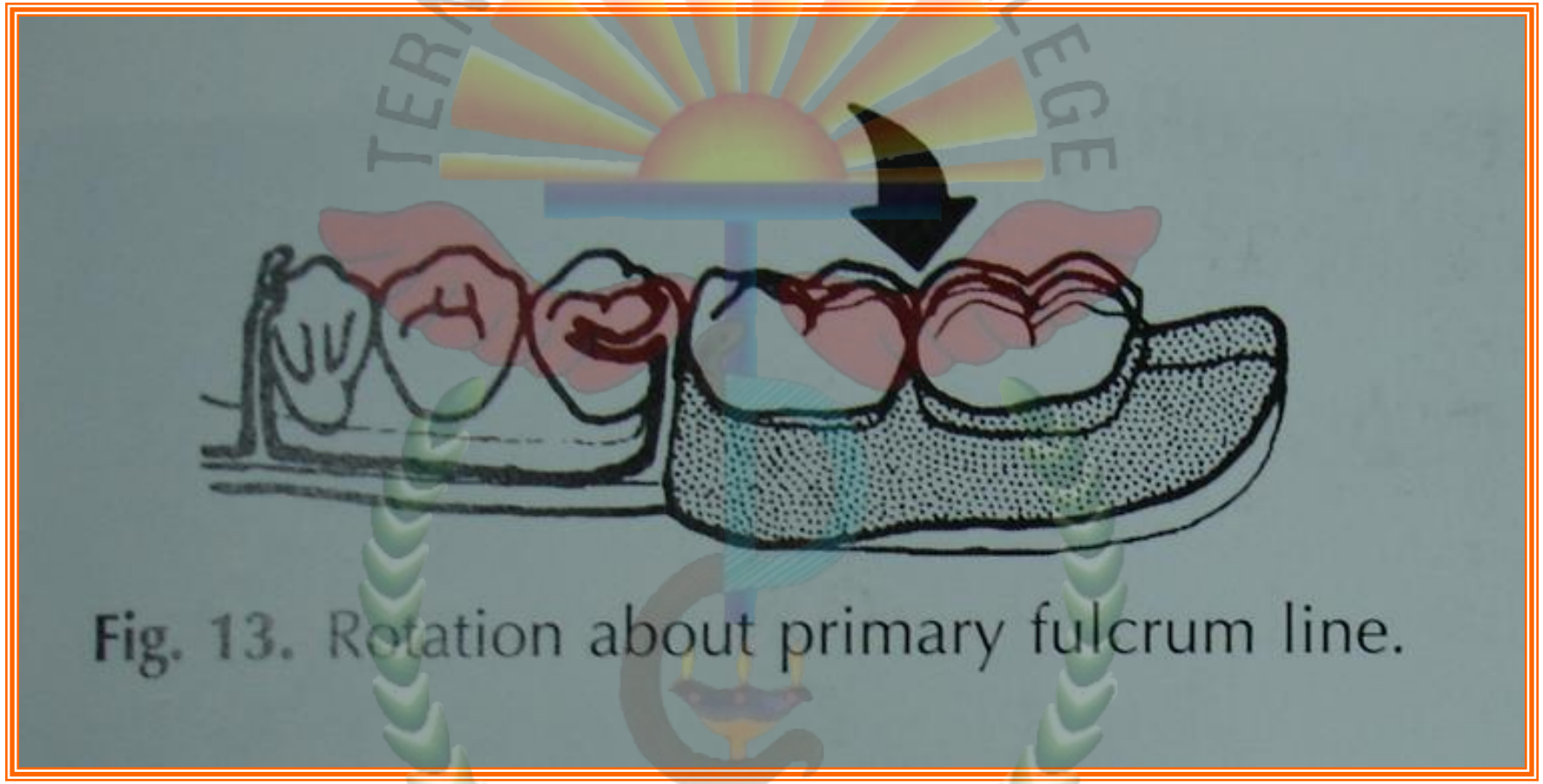


Fig. 13. Rotation about primary fulcrum line.

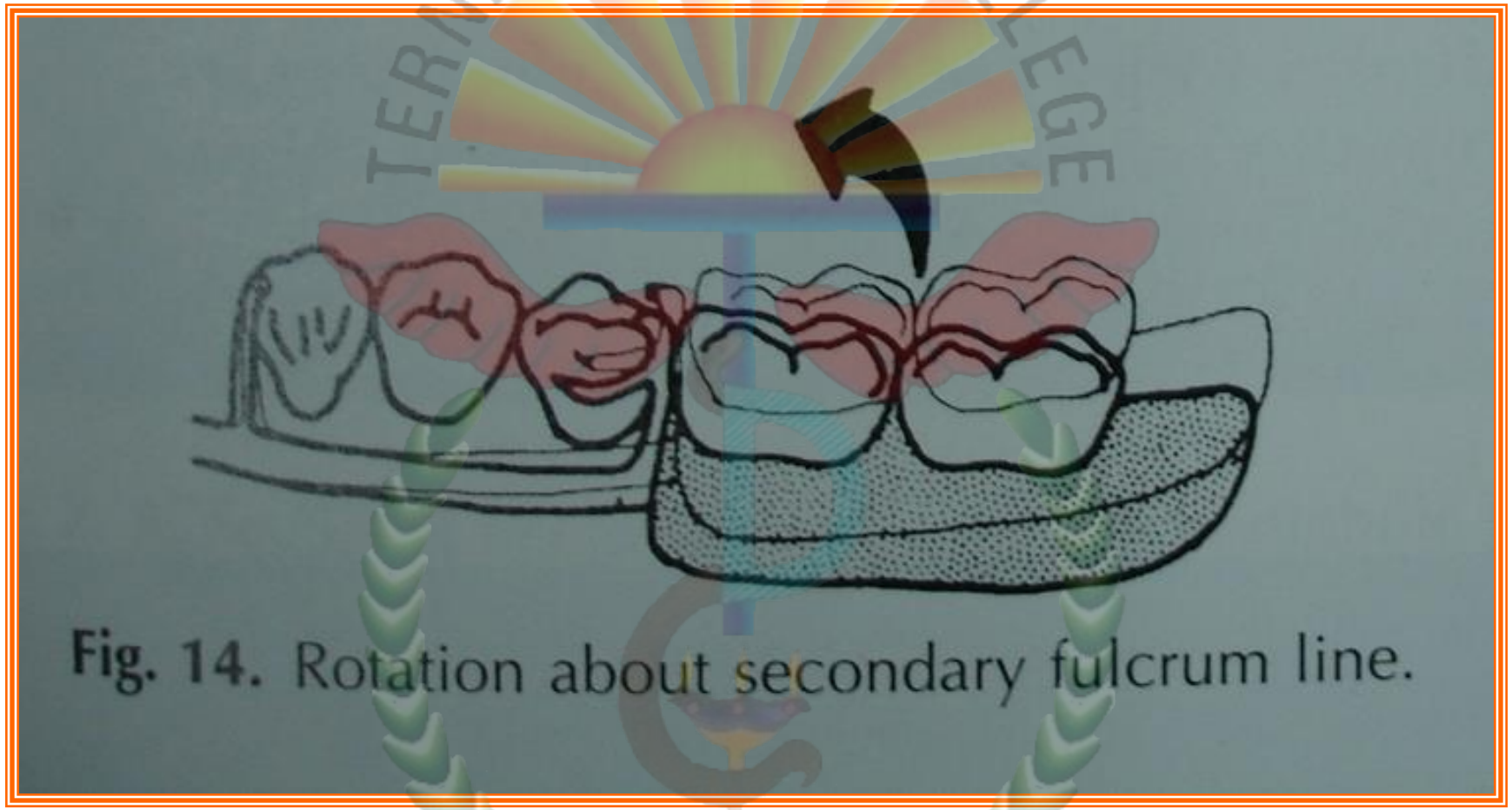
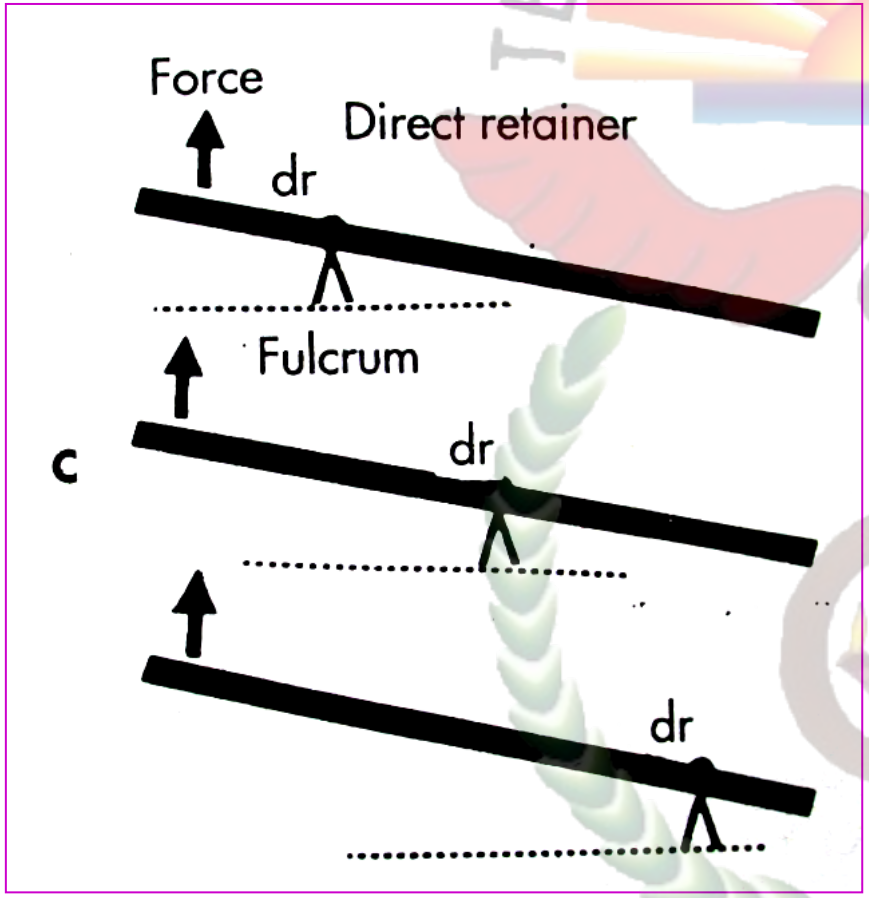


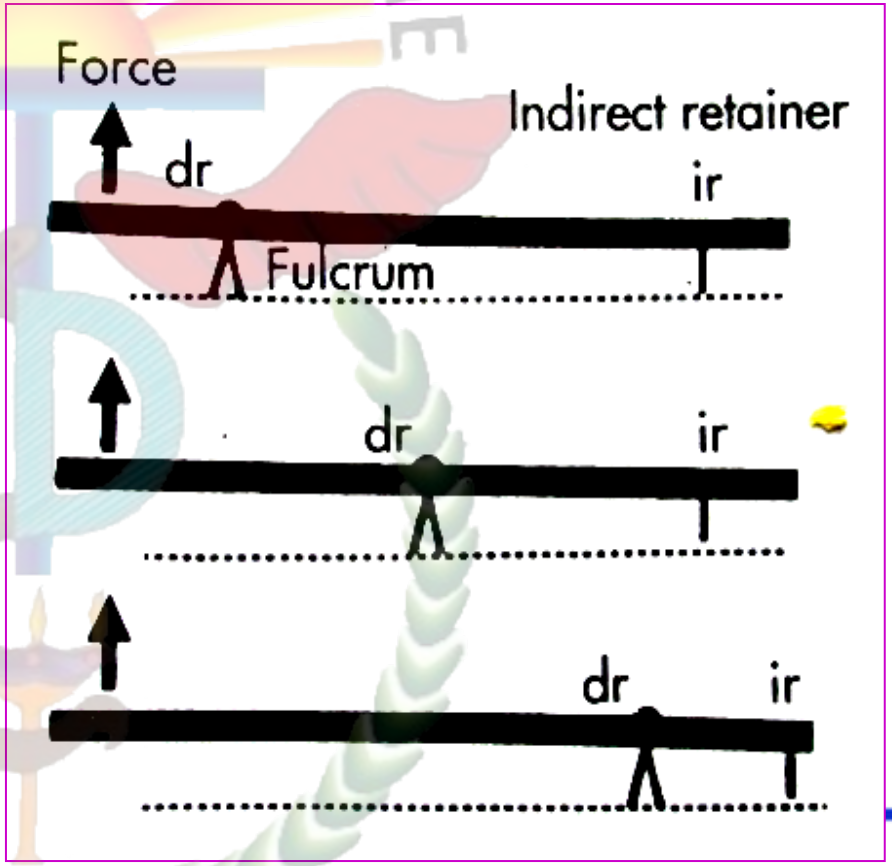
Fig. 14. Rotation about secondary fulcrum line.

LOCATION OF INDIRECT RETAINER

- The ideal position for the indirect retainer is the longest right angle projection from the fulcrum line ending in a definite seat on a suitable tooth.
- An indirect retainer can be effective only if it is placed some considerable distance anterior to the direct retainers.

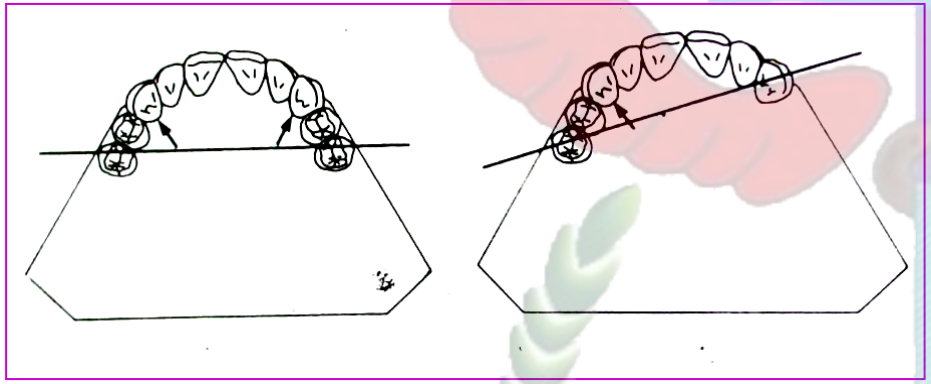
Indirect retainer uses the mechanical advantage of leverage by moving fulcrum line farther from the force.



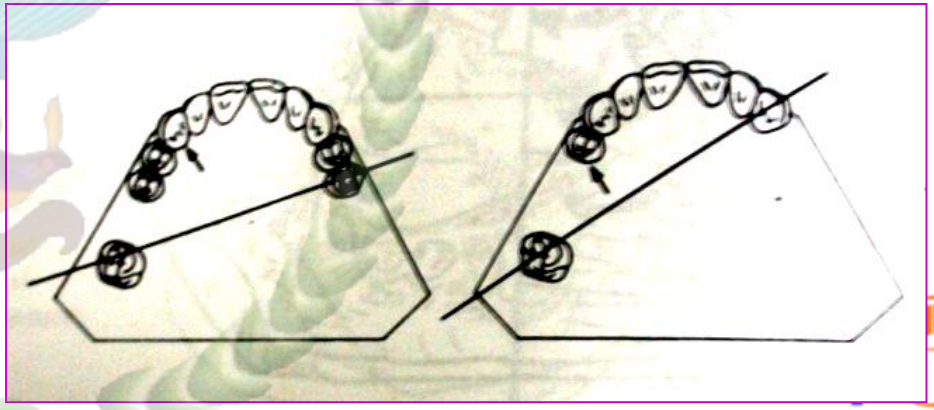


Location of fulcrum lines for different classes of partial denture

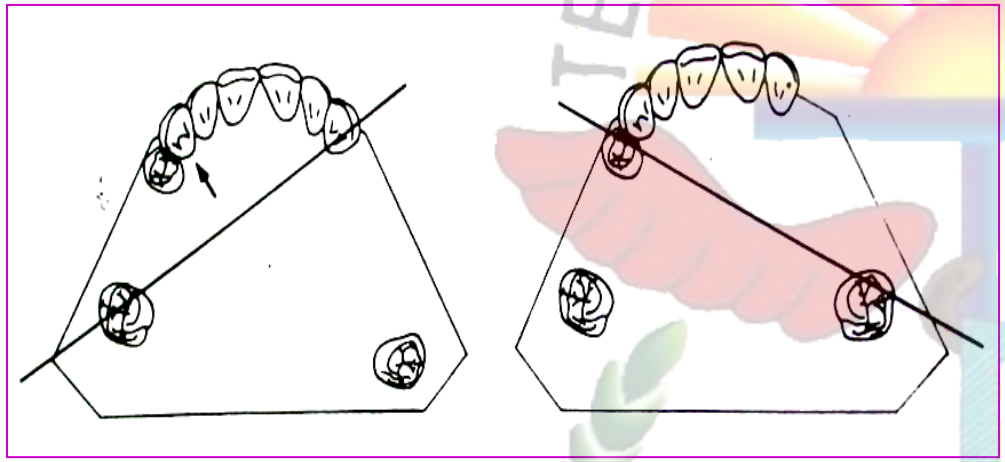
Class I



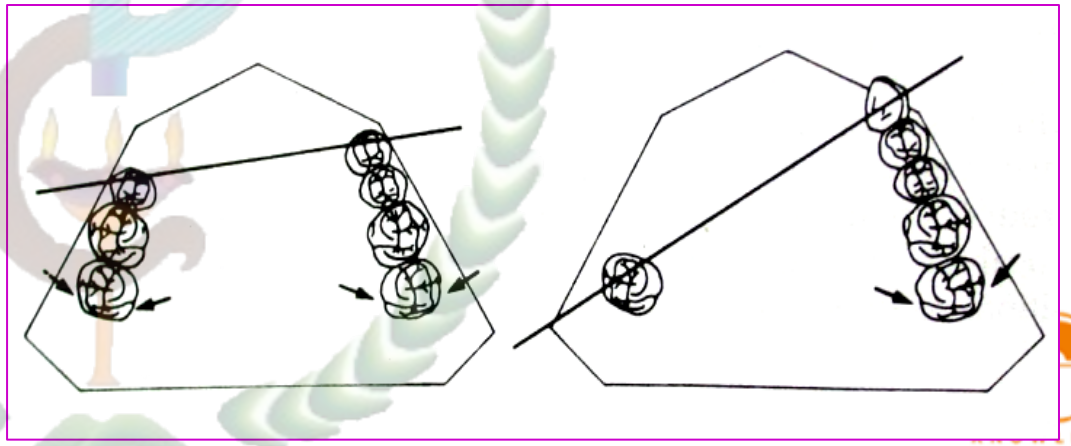
Class II

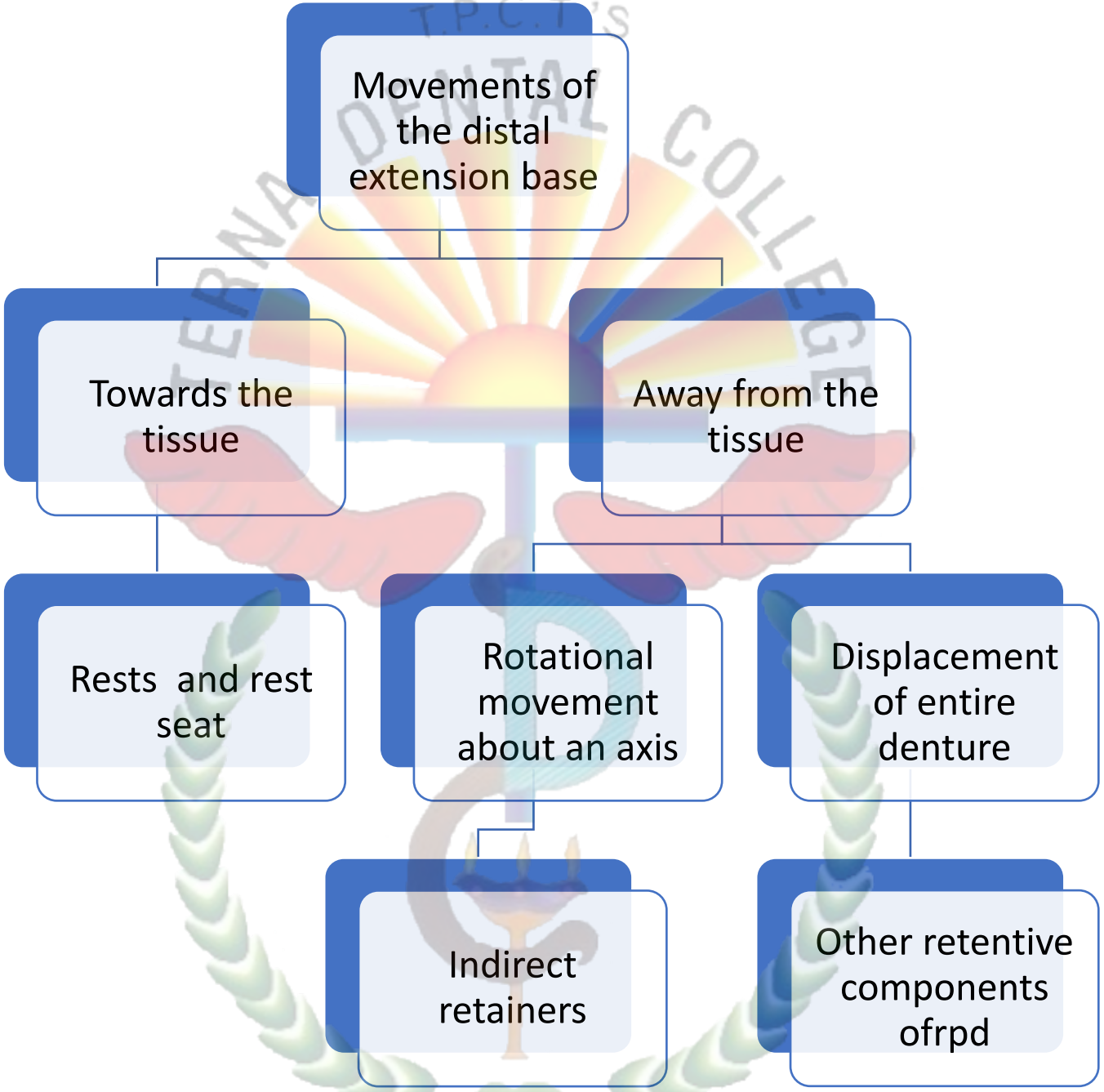


Class III



Class IV

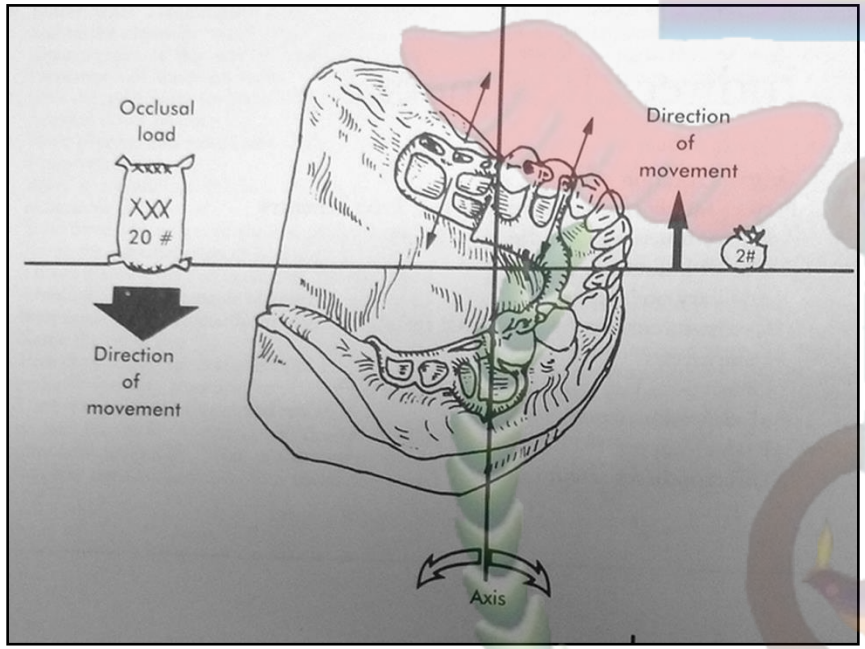



Movements of the distal extension base
Towards the tissue
Away from the tissue
Rests and rest seat
Rotational movement about an axis
Displacement of entire denture
Indirect retainers
Other retentive components ofrpd

Rotation of the denture base

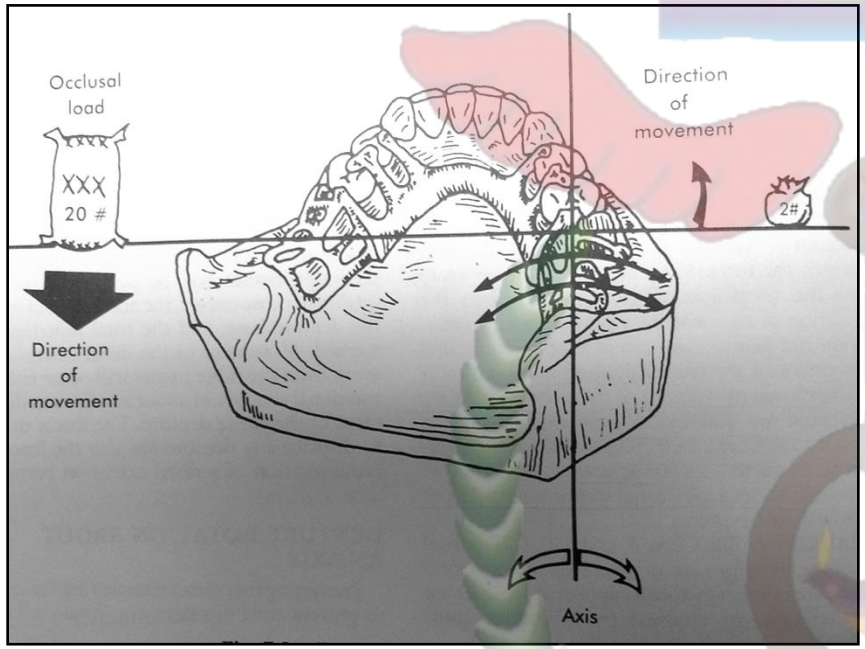
- During function, the denture is subjected to various rotational forces that cause rotation of denture in three planes.
- In order to understand the application of indirect retainer we must understand these movements

Movement 1



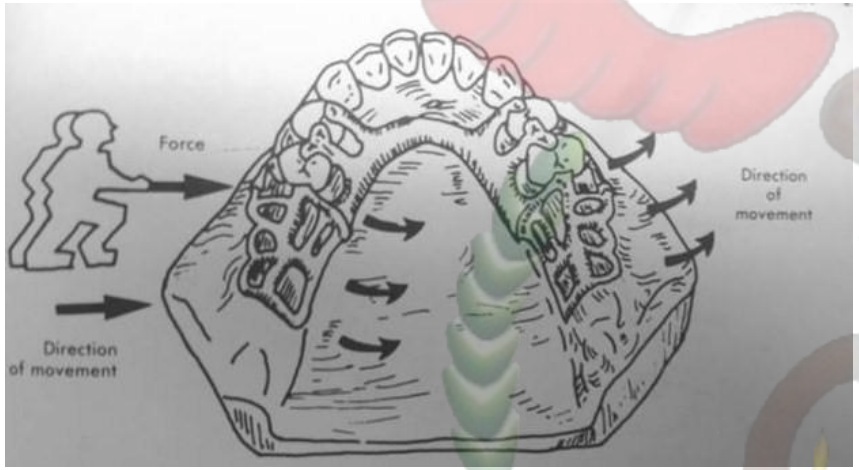
- Rotation about an axis through the most posterior abutment – fulcrum line.
- Towards the tissue or away form it

Movement 2



- Rotation about longitudinal axis as distal extension moves in rotation about residual ridge.
- Resisted by rigidity of major and minor connectors.

Movement 3



- Movement due to diagonal or horizontal forces about an imaginary vertical axis located near center of dental arch.
- Resisted by stabilizing components.

Primary function

- Primary function- It shifts the fulcrum line away from the point of application of the force, there by counteracting the lifting force and stabilizing the denture

Auxiliary functions

- It tends to reduce anteroposterior tilting leverage on principle abutments.
- Contact of its minor connector with axial tooth surfaces aids in stabilization against horizontal movement of the denture.
- Anterior teeth supporting aids against lingual movement.

- It may act as an auxiliary rest to support a portion of the major connector.
- It may provide first visual indication for the need to reline
- When final impression is to be made with framework as a support for the impression tray, it aids in accurate repositioning

EFFECTIVENESS OF INDIRECT RETAINERS

- Effectiveness of direct retainers
    - If the rests are held in their seats, rotation around an axis should occur, that activates indirect retainers.
    - If total displacement of rests occur, no rotation around fulcrum line
- Rigidity of connectors supporting the Indirect retainer.
- Effectiveness of supporting tooth surface.

- Distance from the fulcrum line

1. Length of the extension base

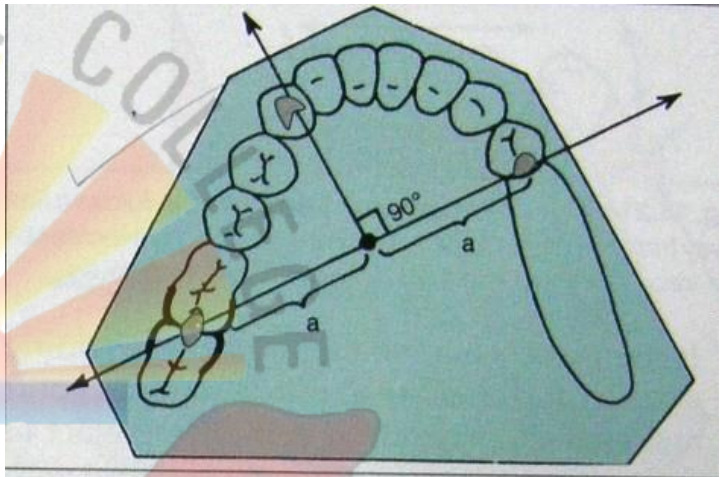


Fig. 18.212: Maximum function of an indirect retainer obtained when it is placed at a point perpendicular to tl midpoint of the axis of rotation

2. Distance from the fulcrum line

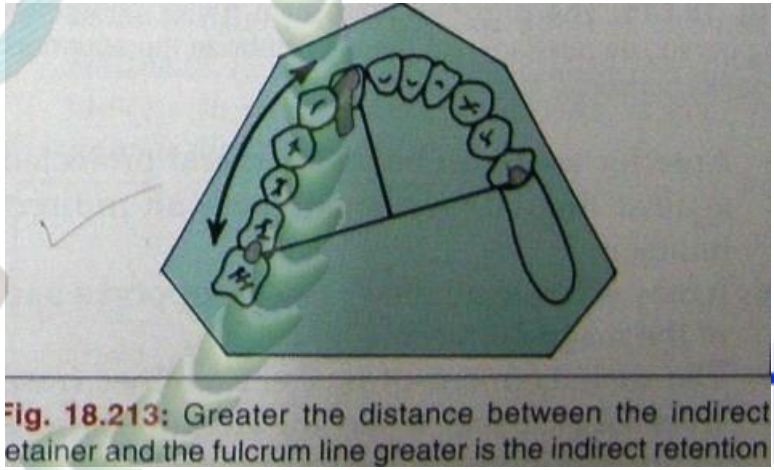
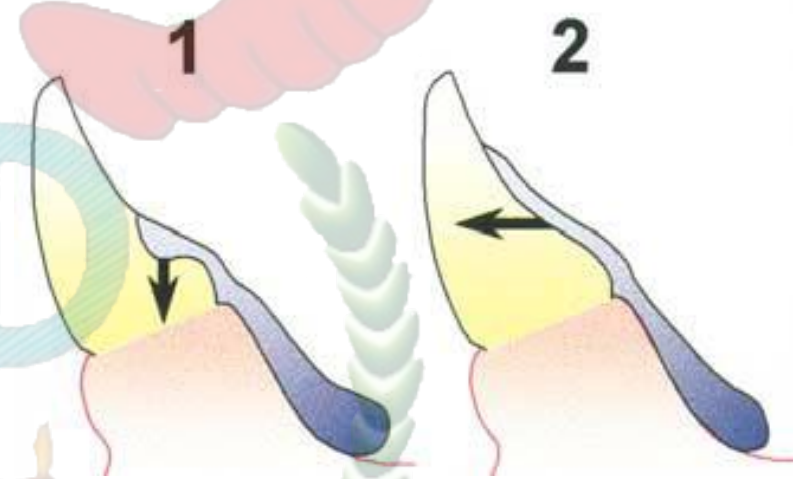


Fig. 18.213: Greater the distance between the indirect etainer and the fulcrum line greater is the indirect retention

Design considerations for tooth support

- When possible, the indirect retainer should rest on a surface at right angles to its potential path of movement.
- If it rests on an inclined tooth surface, movement of the tooth might occur with resulting loss of support for the indirect retainer

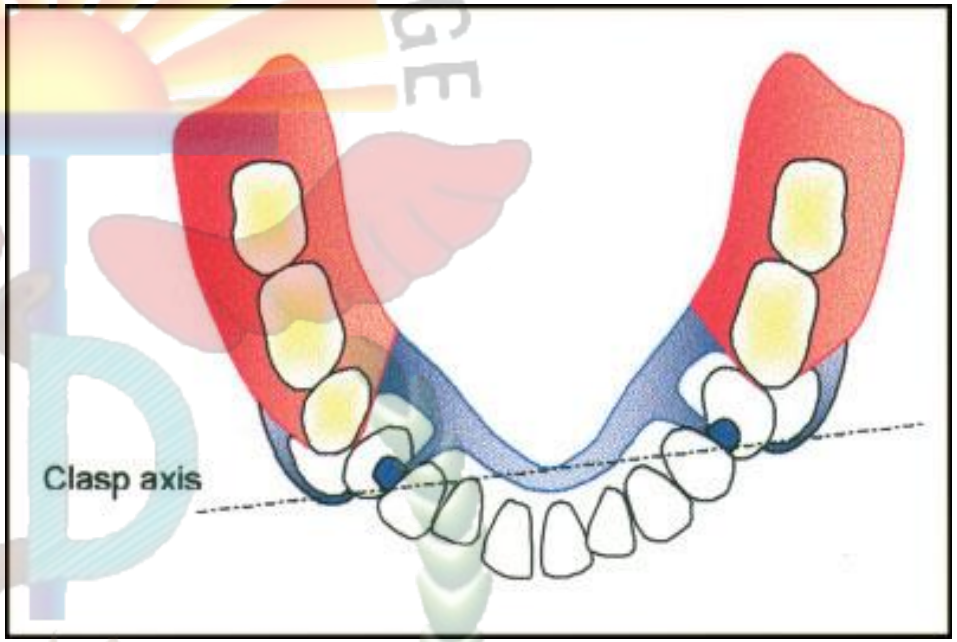


Forms of indirect retainers

- Auxillary occlusal rest.
- Canine extension from occlusal rests.
- Canine rests.
- Continuous bar retainers and lingual plates.
- Modification areas.
- Rugae support.

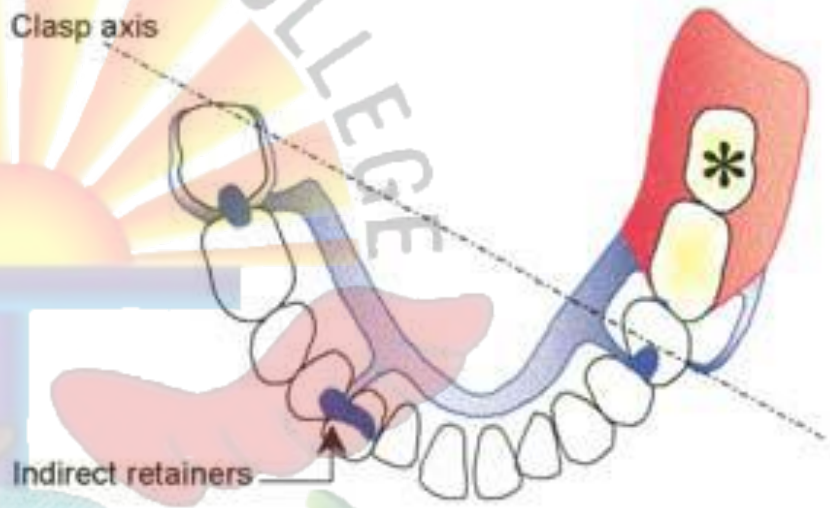
Auxillary occlusal rest.

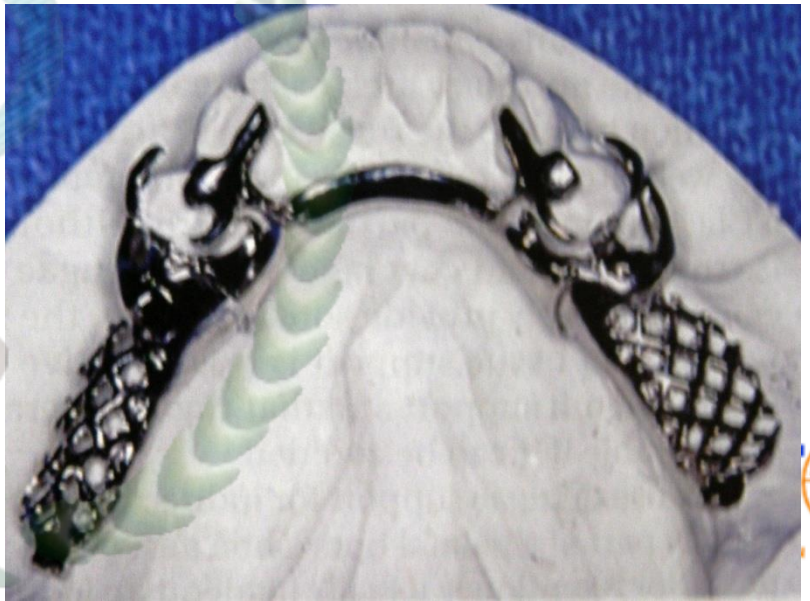
- Most frequently used
- Located on occlusal surface faraway from distal extension base
- Ideal location would be central incisors but since they are weak bilateral mesio-occlusal rests on first premolars are used their added advantage being they do not interfere with tongue movements



Canine extension from occlusal rests.

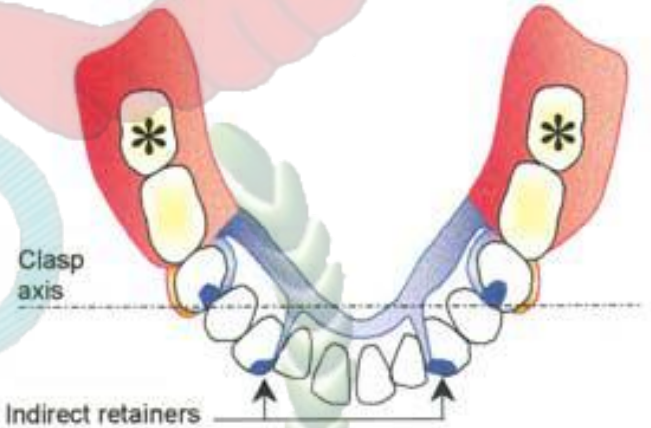
- Increased effect of indirect retention by increasing the distance of resisting element from fulcrum line.
- Finger extension from premolar rest on prepared lingual slop of adjacent canine tooth
- Though extension rest on prepared surface, it is used in conjunction with terminal rest on mesial marginal ridge of PM.
- Tipping leverage on canine is avoided.





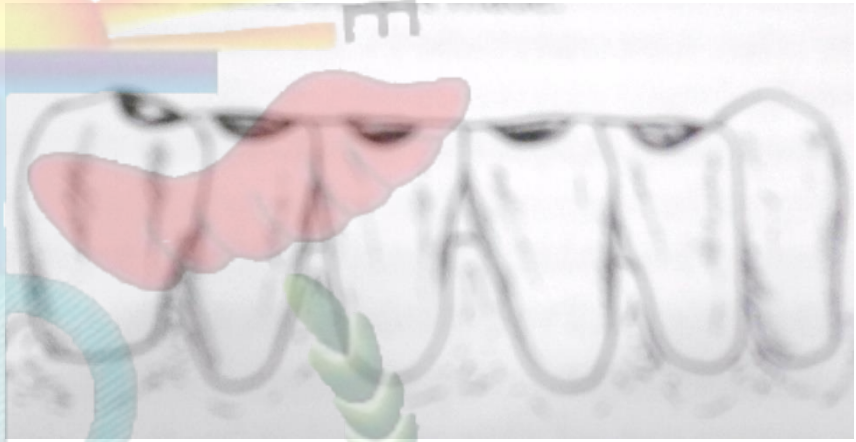
Canine rests.

- Used when mesial marginal ridge of first premolar is too close to the fulcrum line
- When the teeth are overlapping and the fulcrum line is not accessible
- Rest can be more effective by placing the minor connector more anterior to the canine



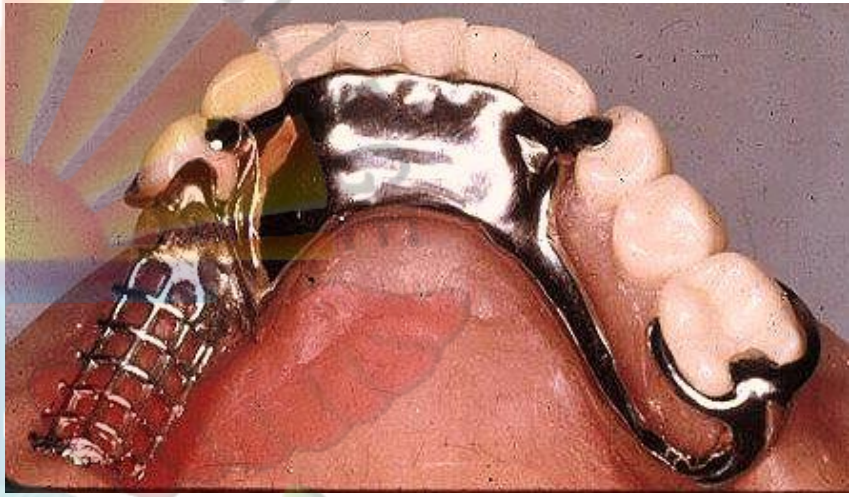
Incisal rests

- Longest perpendicular to the fulcrum line is in the vicinity of incisors , which are too weak and have lingual surfaces too perpendicular to support rest.
- If incisor teeth are to be used for an indirect retainer, it should be as a group and not individually as they are not capable of withstanding pushing forces individually.
- The rest seats are prepared on enamel surface or on prepared crown

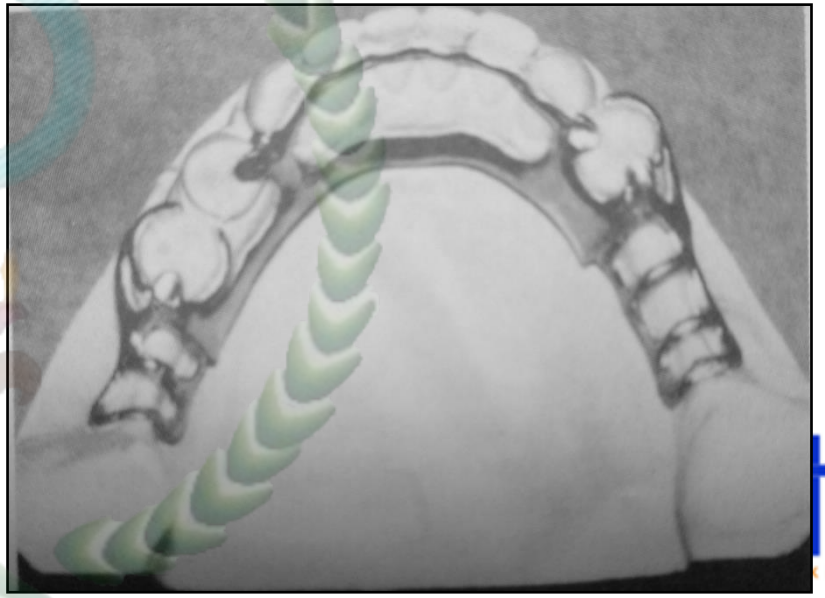


Continuous bar retainers and lingual plates.

- Continuous bar retainer or Linguoplate are not indirect retainer as they rest on unprepared lingual inclines of anterior teeth.



- Terminal rests in the form of occlusal or canine rest are actual indirect retainer



- In class I or II partial denture Continuous bar retainer or Linguoplate increase the effect of indirect retainer if used along with terminal rest

- Continuous bar retainer or superior border of Linguoplate never placed above the middle third of the teeth so orthodontic movement during rotation is avoided, especially in narrow tapering arch.

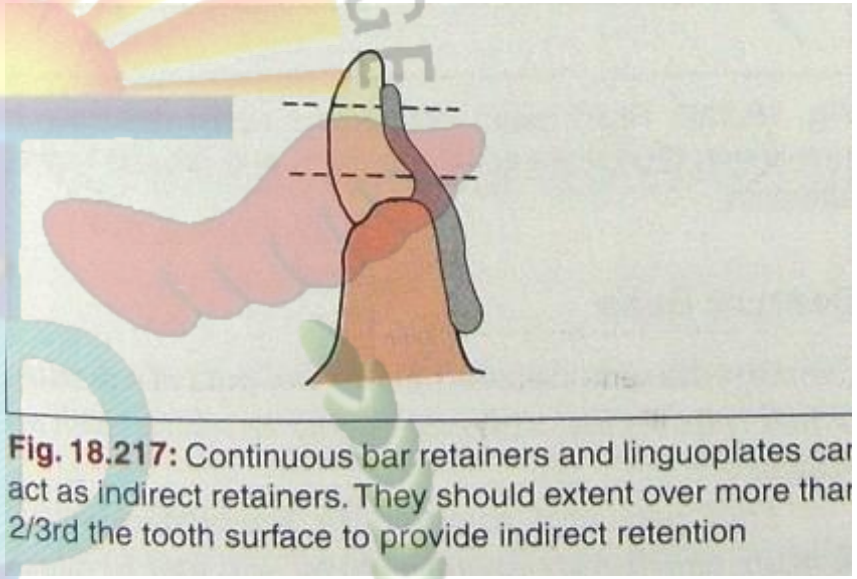
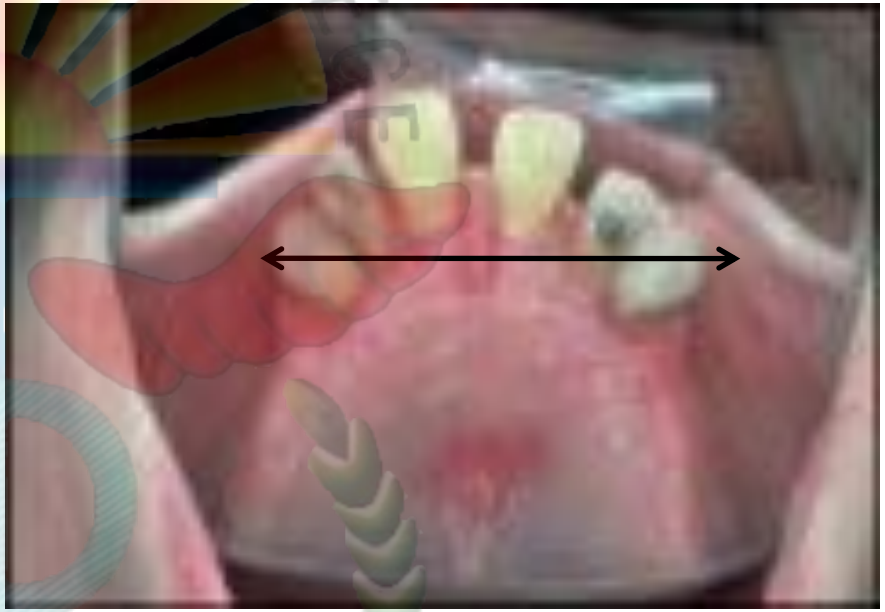


Fig. 18.217: Continuous bar retainers and linguoplates ca act as indirect retainers. They should extent over more tha 2/3rd the tooth surface to provide indirect retention

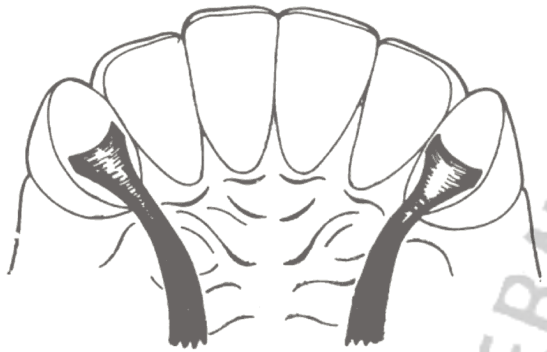
- Full palatal plate or closed horse shoe, also act as Indirect retainer due to their anterior extension on lingual surfaces of incisors

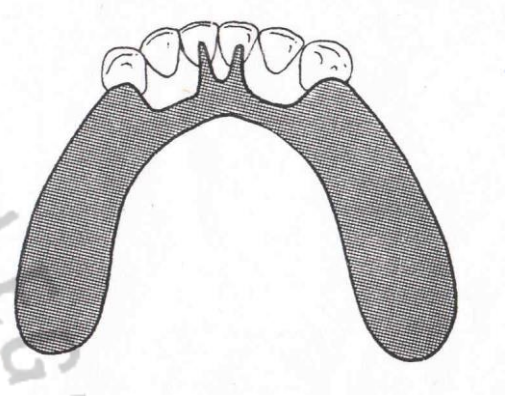
- If the distance from the fulcrum line is no greater at the midline of the arch than at the cuspid location, the advantage of extending indirect retainer to that area is nullified

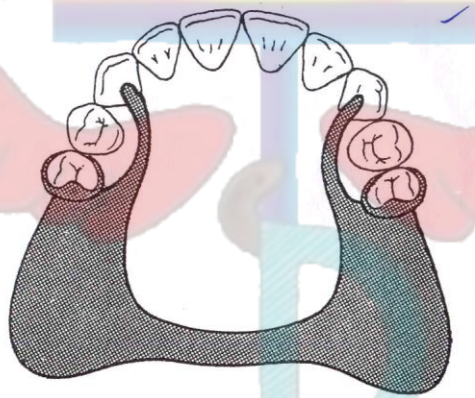


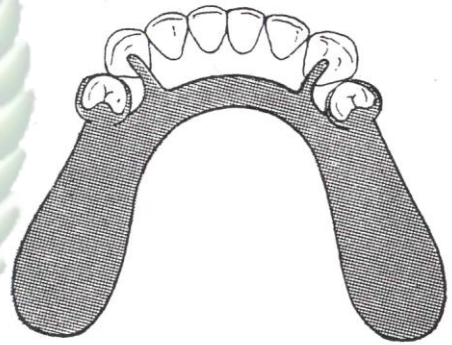
THE CUMMER ARM

- It consists of an arm, which extends forward from the saddle or palatal bar to rest on the anterior tooth. They are primarly indirect retainers, and should not be used to give support unless the teeth they rest on are strong. The effect of a cummer arm which bears heavily on an incisor tooth may well be to loosen it, and for this reason it is best to fit these components to canine where possible









ANTERIOR PALATAL BAR



Modification areas

- Occlusal rest on secondary abutment in class II partial denture acts as Indirect retainer if it lies far enough form fulcrum line.
- Support and retain one end of tooth-born segment as well as add horizontal stabilization to the denture.
- Dual function --- tooth support for one end of modification, support for indirect retainer

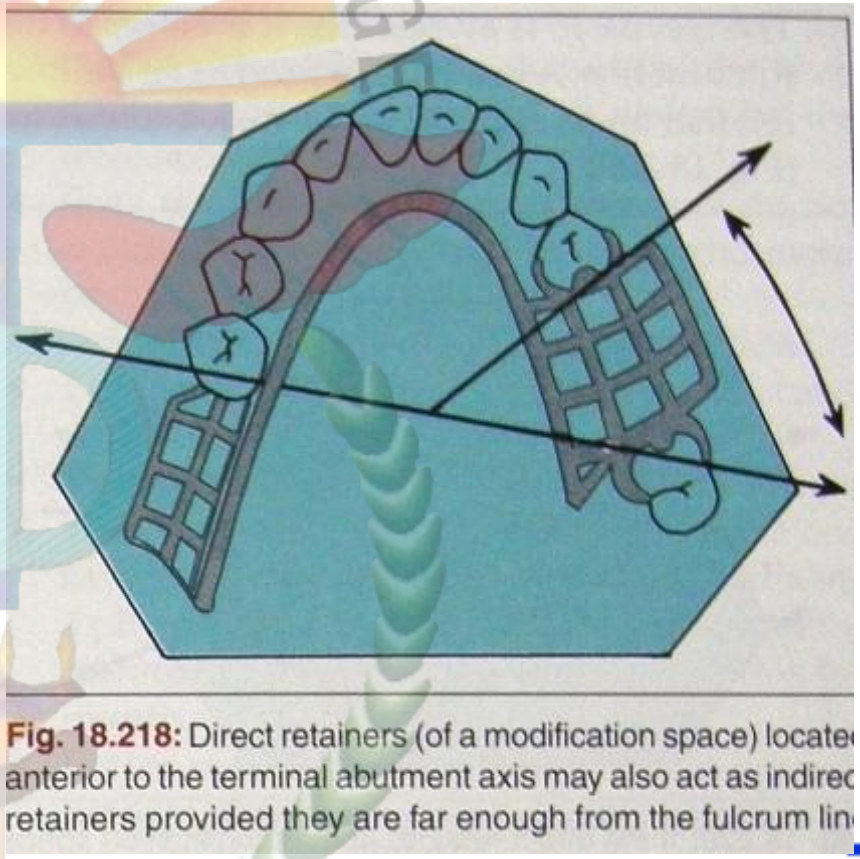


Fig. 18.218: Direct retainers (of a modification space) locate
anterior to the terminal abutment axis may also act as indire
retainers provided they are far enough from the fulcrum lin

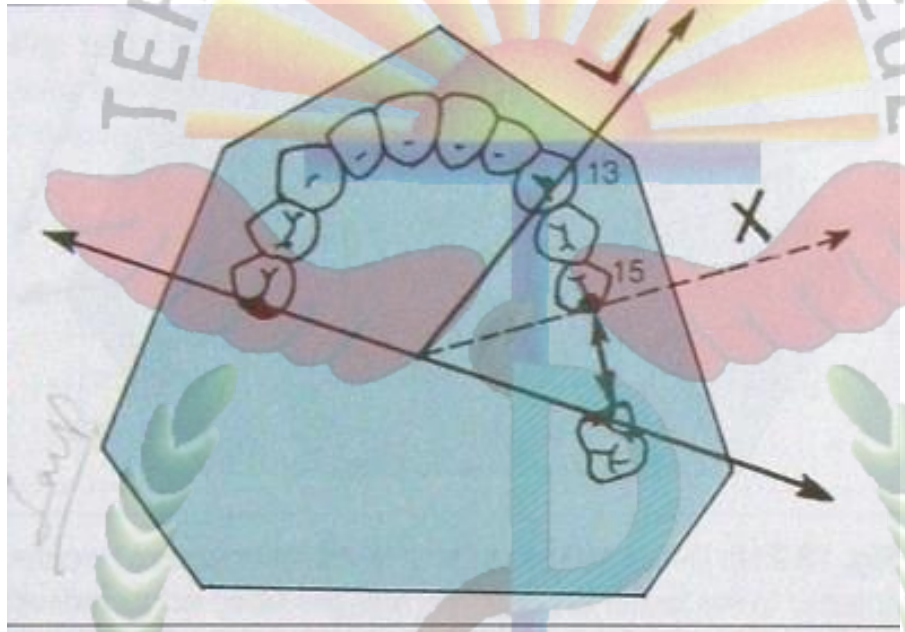
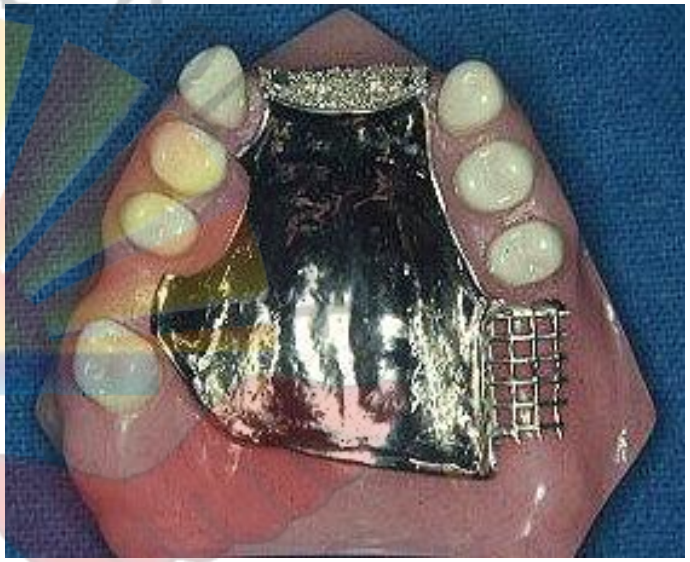
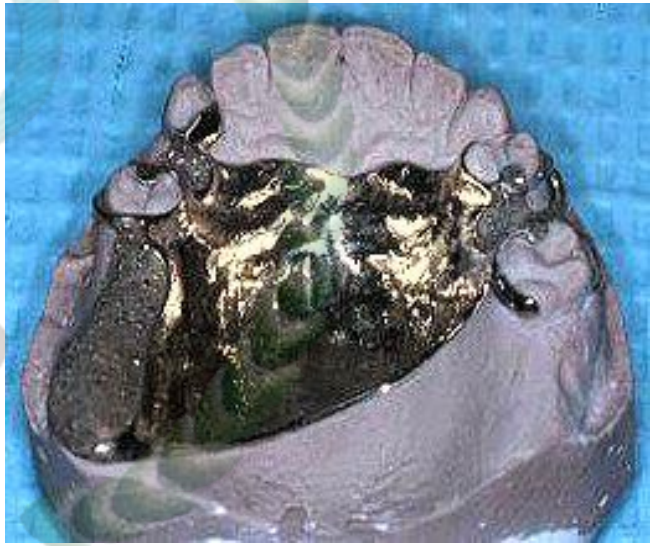


Fig. 18.220: If the direct retainer in the modification space does not have sufficient distance from the fulcrum line to act as an indirect retainer. Separate auxiliary rests should be placed as far anterior as possible away from the fulcrum line to act as indirect retainers

Rugae area

- Coverage of Rugae Areas of maxillary arch is means of indirect retention for class I RPD.
- Since it is firm & well situated.
- Tissue support is less effective than tooth support
- Usually for Indirect retention of a Palatal Horse Shoe design, as posterior retention is inadequate & requirement is more.





Direct-indirect retention

- Sometimes the reciprocal arm of a direct retainer located anterior to the fulcrum line may also act as indirect retainer

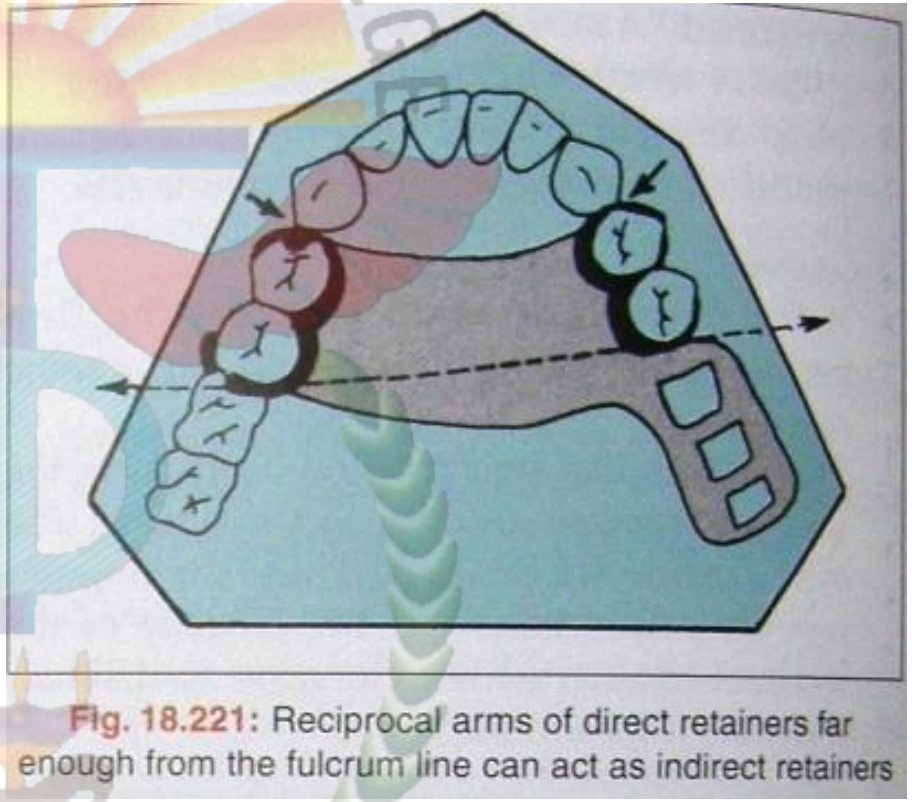


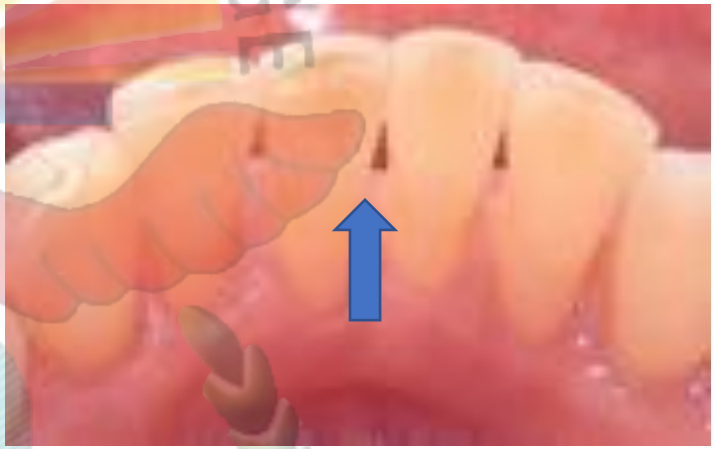
Fig. 18.221: Reciprocal arms of direct retainers far enough from the fulcrum line can act as indirect retainers

Advantages

- The main advantage of the indirect retainer is that the overworked abutment tooth is spared of the added work load
- Effective reduction in the base movement with much less stress applied to the tooth giving this support

Problems of indirect retainer

- Inclinations of supporting structures especially in lower incisors

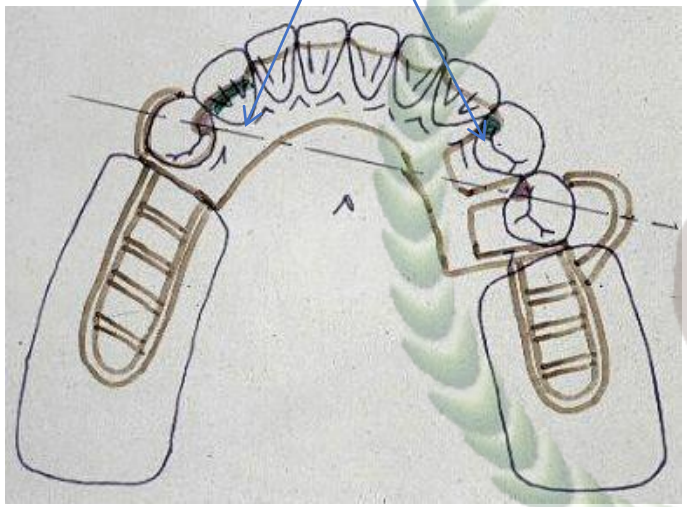


- Support from an anterior fixed bridge
- Gravitational pull of maxillary appliance
- Displacement forces from cheek and tongue

Design considerations with different classes and abutments

Class I mandible-premolar abutments

Linguoplate as indirect Retainer with rests

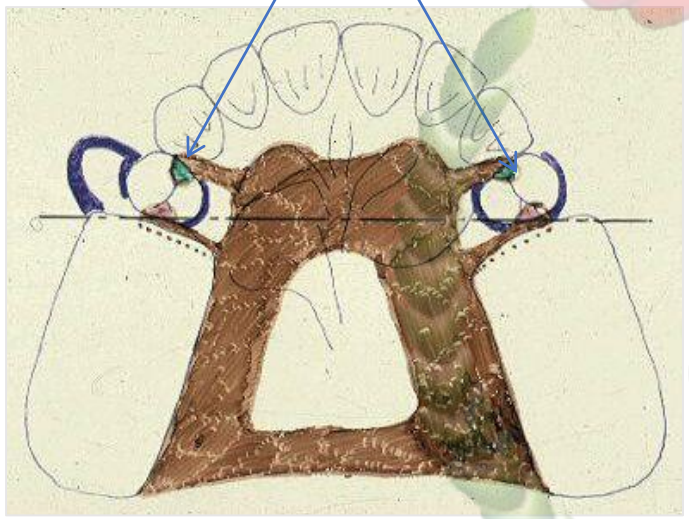


Indirect retainer rests on canines

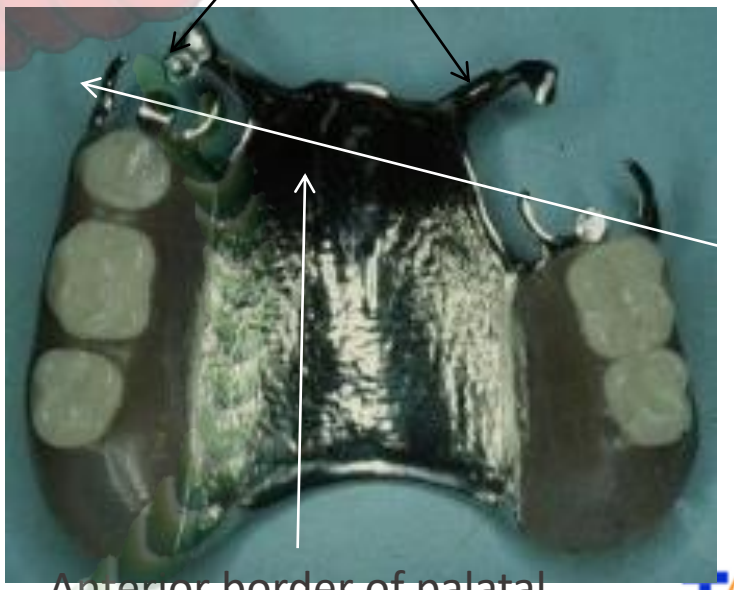


Class I
maxilla-premolar abutments

Indirect retainer rests



Indirect retainers



Anterior border of palatal plate ending in valley of rugae

Class I mod 1
maxilla-premolar abutments

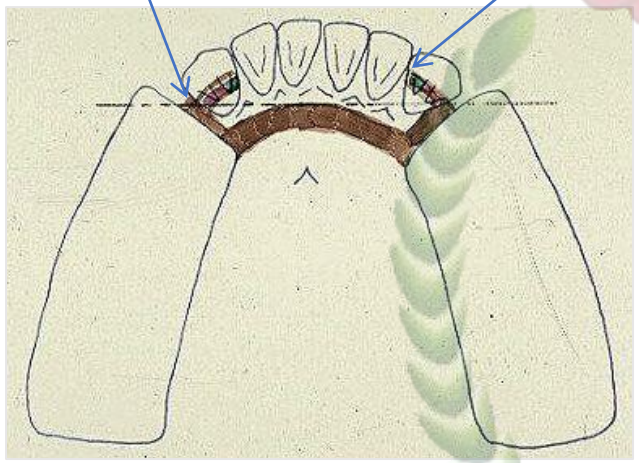
Secondary rests on laterals to support base in modification space and provide indirect retention

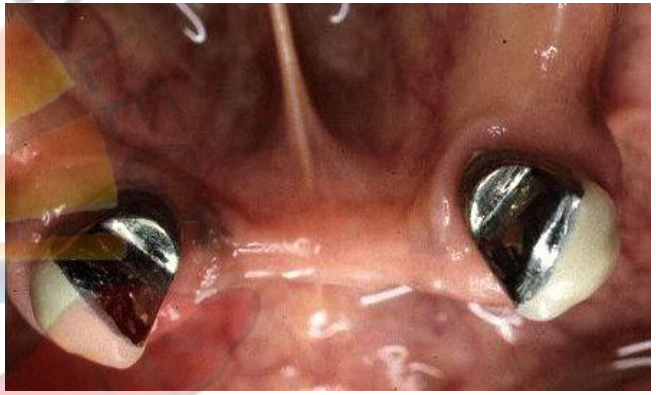


Class I mandible-canine abutments

Primary rests provided by first portion of long rest

Indirect retention provided by mesial portion of long rest





PFM crowns with raised cingulum rests

A lingual plate covers the rests



Class I – Canine abutment - Mandible

Lingual plate major connector with incisal notch rests



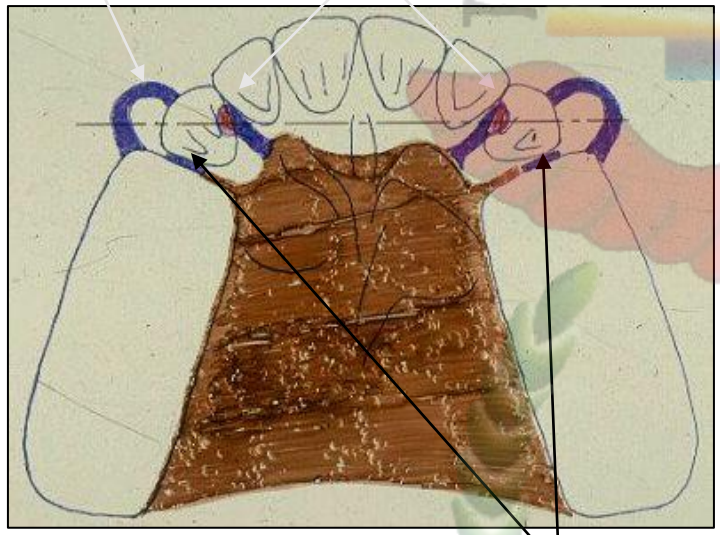
Rotated canines make incisal notch the rest seat of choice



Class I maxilla-canine abutments

Clasps appropriate for tooth

Primary rests



Indirect retention provided by proximal plates which bind against guide planes when rotation away from tissues occurs





Class I – Canine, lateral and premolar abutments – maxilla and mandible

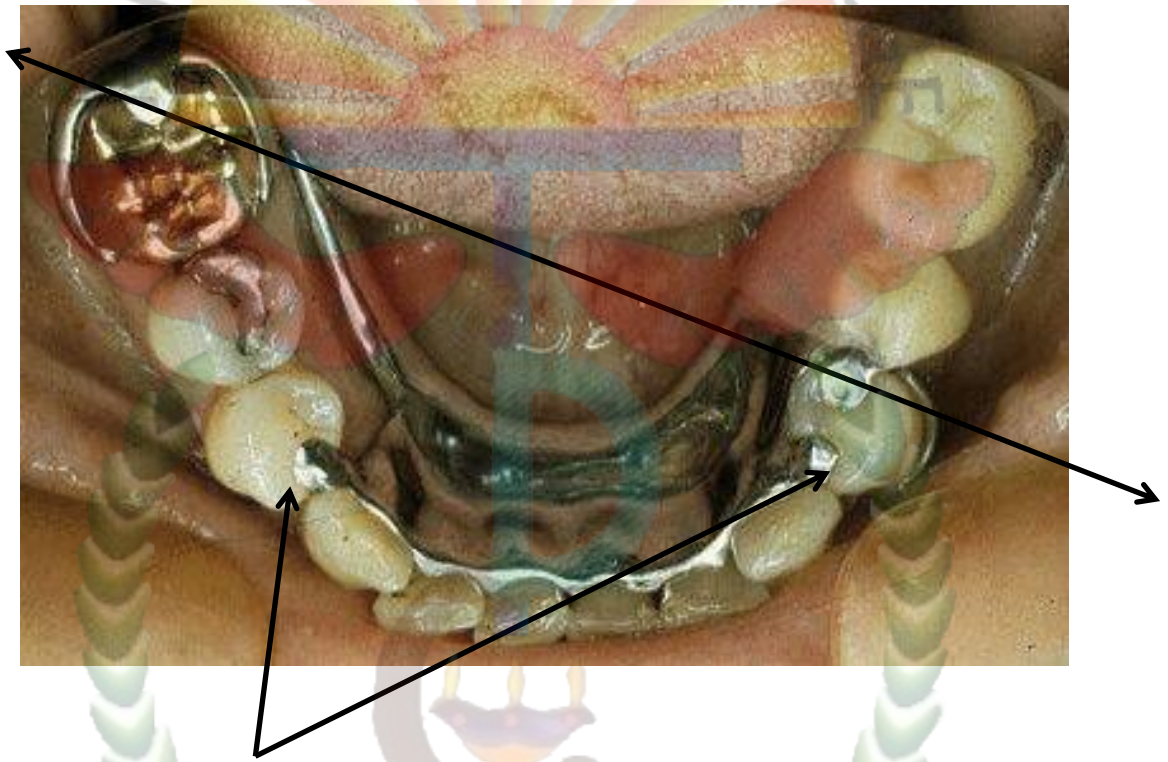








Class II mandible



Lingual plate along with MO rest for indirect retainer

Class II mod 1

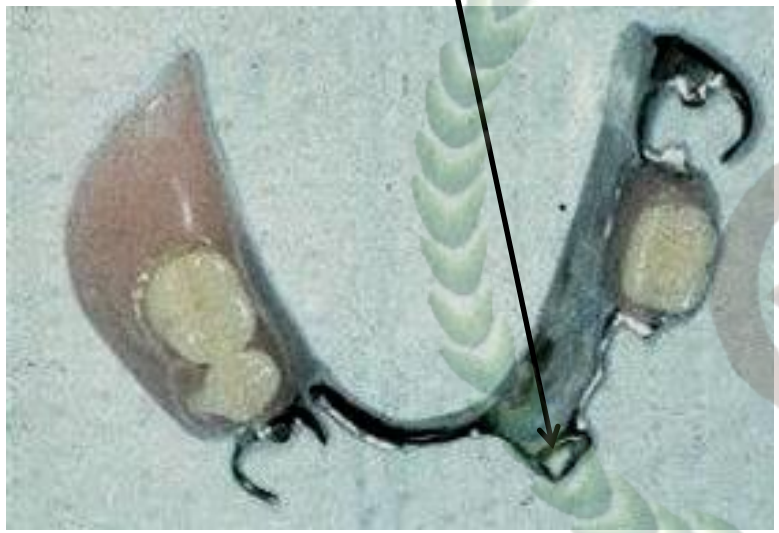


Indirect retainers:
plate and rests

Class II mod 2

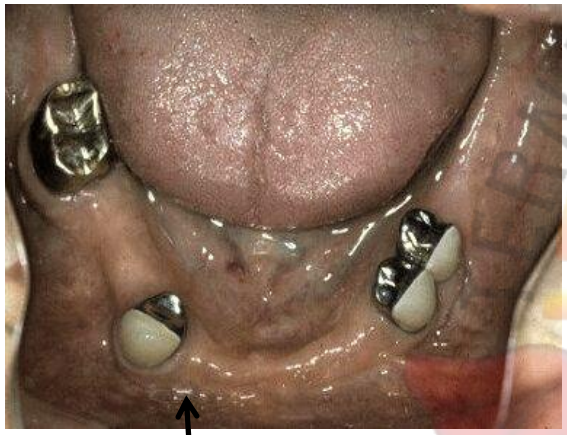


raised cingulum rest on LL3





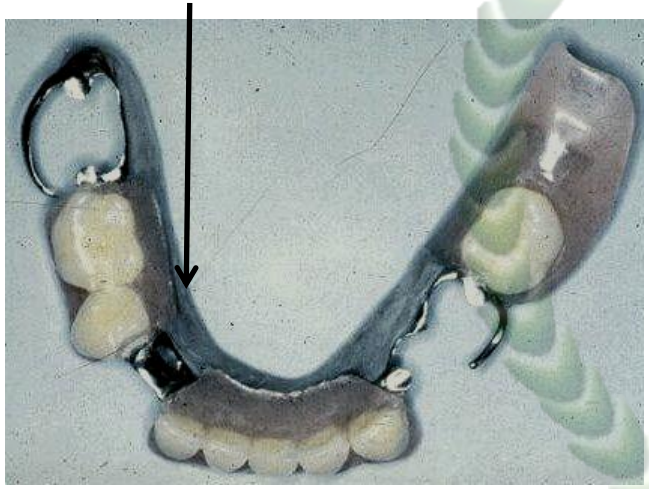
Class II mod 2

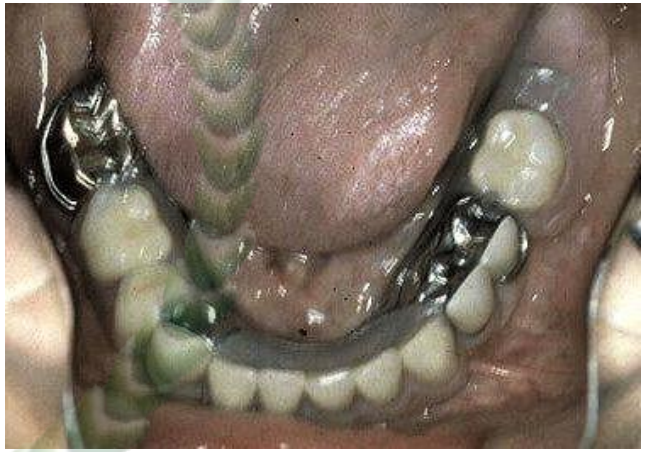


LR3– PFM crown, raised cingulum

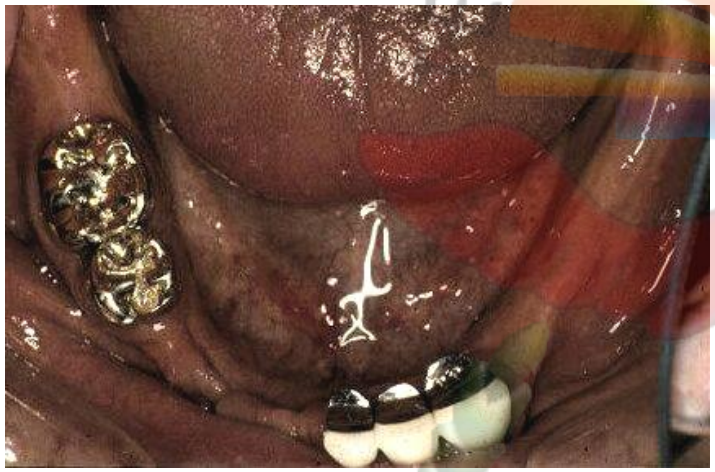


Indirect retention provided by teeth in modification space and rests

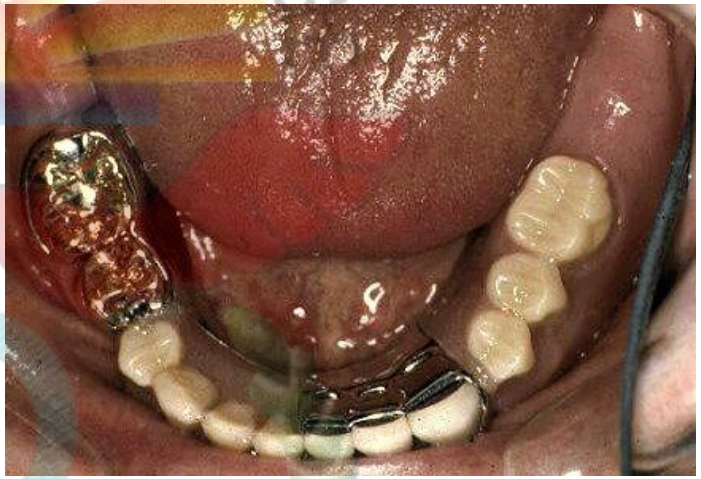




Class II MOD 2

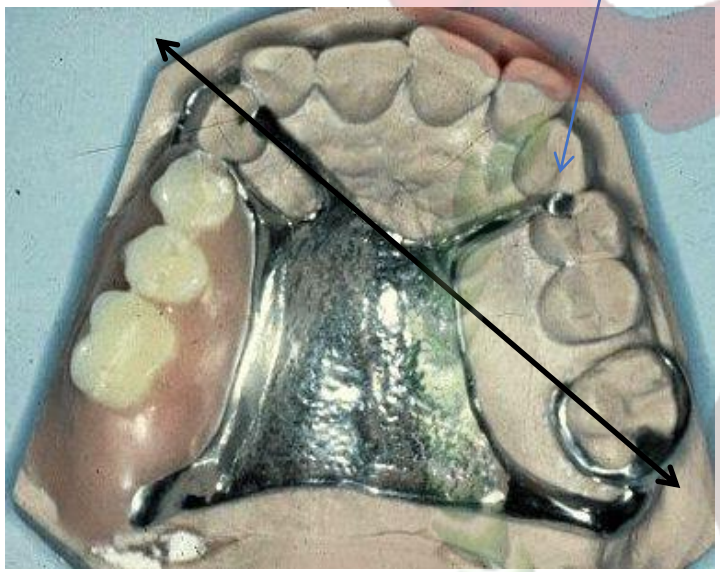


LL123 PFM crowns; raised cingulums



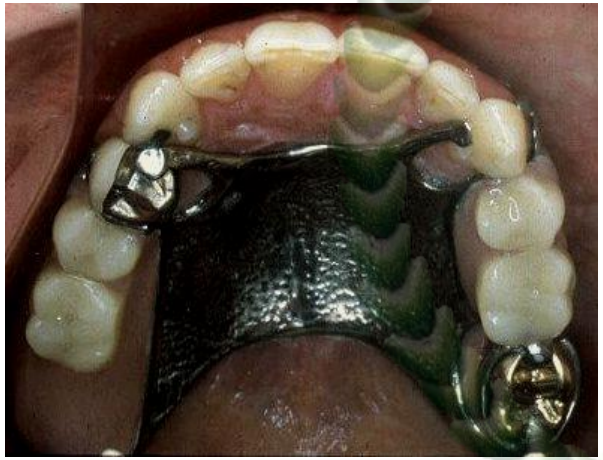
Lingual plate, indirect retainer with rest

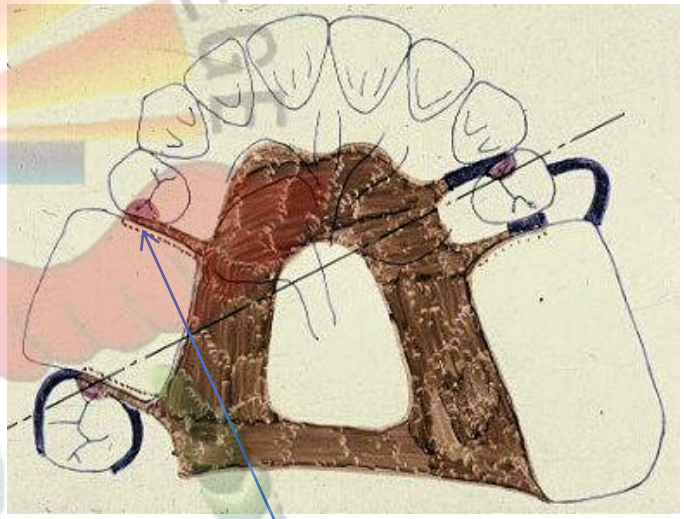
Class II maxilla



Maxilla Class II mod 1







secondary rest seat to support modification base is also the indirect retainer rest

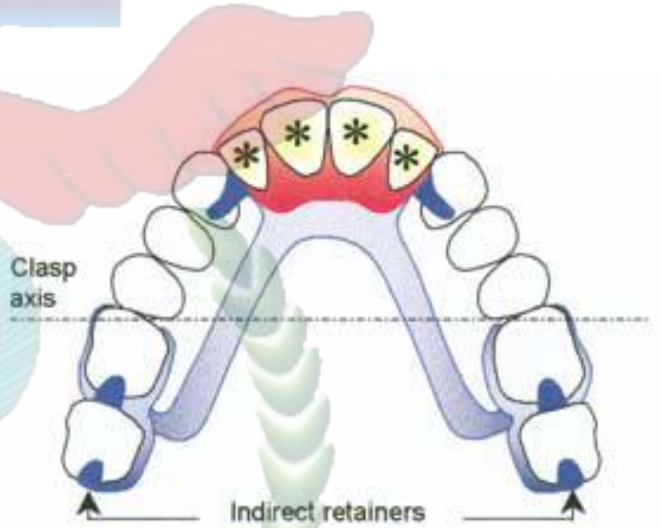
Class III

- *Kennedy III:* In the case of a bounded saddle there is the potential for direct retention from both abutments.
- indirect retention is not required.

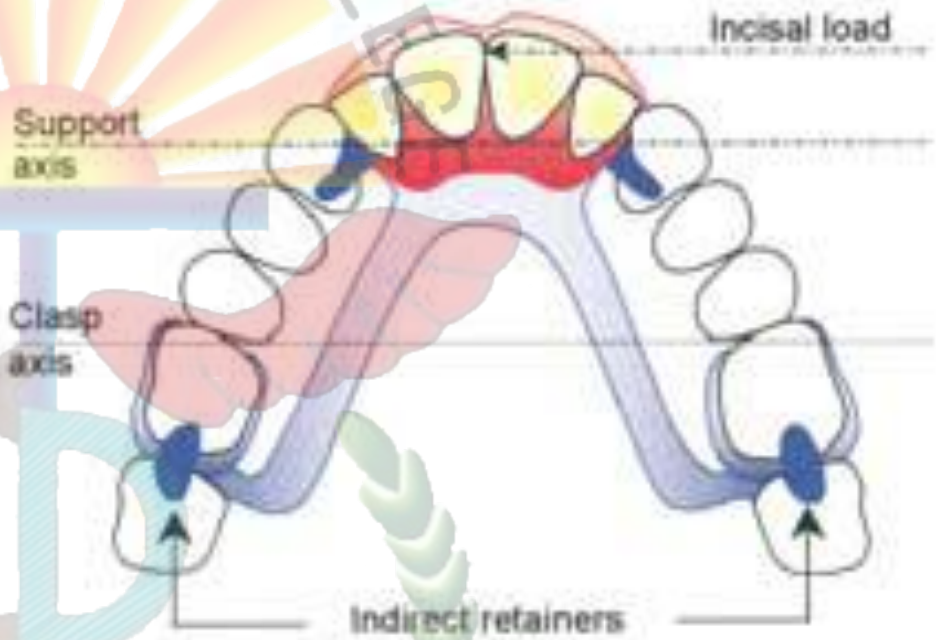


Class IV

- In a maxillary denture it is sometimes difficult to achieve much separation of the clasp axis and indirect retainers. In this example indirect retention has been achieved by placing the rests on UR7 (17) and UL7 (27) as far posteriorly as possible.



- In this instance the indirect retainers will be relatively close to the clasp axis and therefore their effectiveness will be limited. However, some direct retention is already likely to have been obtained for the anterior saddle by the saddle contacting guide surfaces on the abutment teeth and by the labial flange engaging undercut on the ridge.



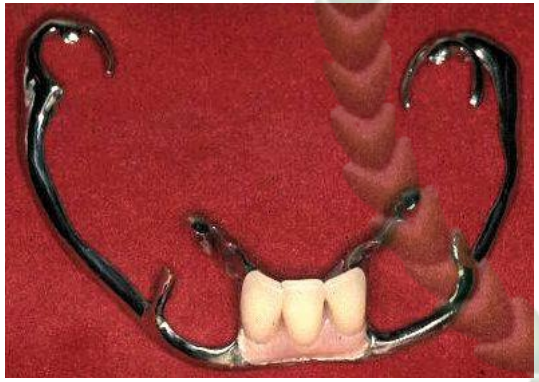
Class IV mandible



lingual inclination of all molars precludes using a conventional major connector



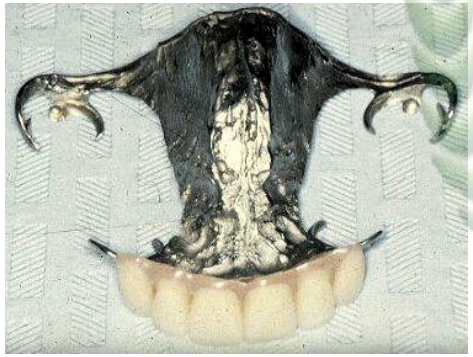
Lingual plate imparts rigidity

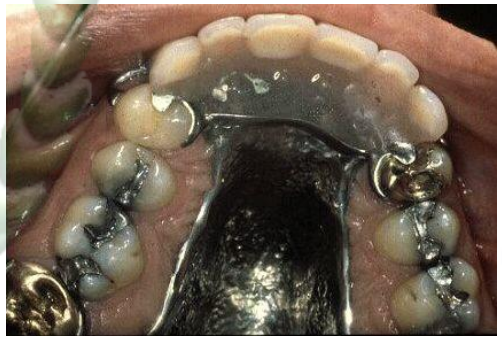


Class IV maxilla



indirect retainers





Summary

- The indirect retainer is a major connector stabilizer.
- A secondary fulcrum line is usually established.
- Prevents the retentive clasp tip from becoming a fulcrum.

Conclusion

Indirect Retainers are an integral part of removable dental prosthesis. They help form a balanced prosthesis.

Take Home Message

Study of Indirect Retainers is an integral part in the process of removable dental prosthesis.

Saqs

1. Functions of Indirect Retainer
2.Enumerate factors influencing effectiveness of Indirect Retainer

Laqs

1. Indirect Retainers