# Crown and bridge Prosthodontics

Lecture: 12 **Dr.Adel F. Ibraheem**

## Components Of Fixed Partial Denture (Bridge)

### Pontics

It is the suspended portion of the fixed partial denture (bridge) replacing the lost natural tooth or teeth , restoring its function, and usually occupying the space of missing natural tooth.

- *The pontic is connect to the bridge retainer , which is attached to the reaming natural teeth , this union of pontic and retainer may be accomplished by mean of* ***rigid connection*** *such as solder joint or by mean of* ***non rigid, flexible connection*** *such as key and key way in the stress breaker type of bridge construction.*
- **Components of the pontic (PFM)**:

  ***1****-Metal backing.* ***2****-Solder joint* ***3****-Facing.*


- ***Materials used in pontic fabrication***

The pontic may be made entirely of **cast metal** or **porcelain** or **Zirconium. A combination** of metal backing and porcelain or acrylic facing can be used also. Usually full **metal pontic** is used for the **posterior region** while the **combination** of metal and facing is used in **anterior region**.

- **Functions of the pontic**

1) **Mastication**

*The pontic provides hard surfaces against which food can be chewed by teeth in the opposing arch*

2) **Speech (phonetics)**

*A space created by the loss of tooth alters the pattern of airflow making normal speech difficult. pontic helps to restrict air passage through edentulous area to aid in the reestablishment of normal sounds*

3) **Esthetics (appearance)**

*Pontics , fill in the empty spaces that would be observed during talking and smiling, provide support for lips and cheeks to allow normal facial form.( well-aligned teeth and a pleasing smile afford apositive social status!)*

4) **Maintenance of tooth relationship**

*Pontics maintain the integrity of dental arches by preventing teeth that are adjacent to and opposing an edentulous area from moving out of their relationship. when missing teeth are not replaced, the teeth posterior to edentulous areas can move forward from their normal position , its also possible for teeth anterior and to opposing edentulous spaces to drift distally and occlusally into open area.*

- **Ideal Pontic Requirements**

***Esthetic requirements***

1. *The pontic should meet the demand of esthetic and comfort the deciding factor for esthetic value is smile line (The smile line is an imaginary line running from the incisal edges of the maxillary incisors and coinciding with the curvature of the lower lip). it locate the appearance zone of the facial aspect of the teeth, this quite true for the*

*upper teeth ,however for the lower teeth , most of the time only the higher portion of the facial aspect as well as the occlusal surface lie in the appearance zone. The matter of concern her is the form of the facial aspect of pontic as related to appearance so to fulfill esthetic requirement pontic must;*

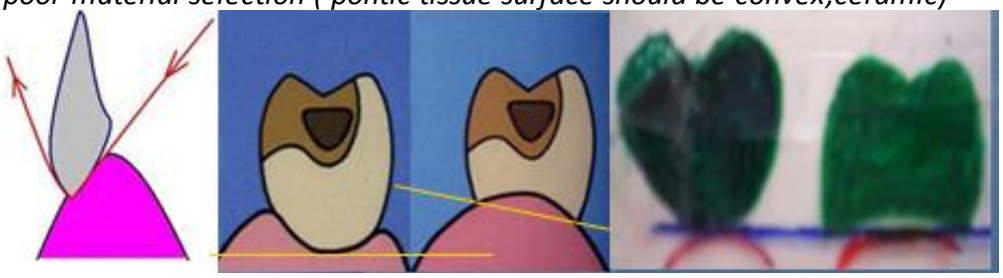
- Looks like the tooth it replaces
- Tissue contacts appear as normal tooth.
- Lower lip line helps to evaluate buccolingual position of the incisal edge and the curvature of the incisal plan

In excessive bone loss it is possible to construct pontic with a length coincide with clinical requirement for that patient but for esthetic reason you can add pink porcelain to the apical portion of pontic to simulate gingival tissue

- Root can be stained to simulate exposed dentine.
- Pink porcelain to simulate the gingival tissues

**Biologic Requirements**

2. *The pontic must be hygienic; permit maintenance of high standard of oral hygiene by the patient through providing good access for cleaning pontic underlying soft tissue, furthermore, pontic should prevent soft and hard tissue irritation. Pontic design should allow the patient to use devices such as brushes ,super floss and dental floss without difficulties.*
3. *The tissue surface of the pontic should design so that it should not cause any problem to the underlying soft tissue(ulceration and inflammation) by pressure, a pressure free contact is indicate (passive contact, thickness of a film of saliva is sufficient when esthetic demand pontic facial surface to be lies within appearance zone)*
4. *The tissue surface of the pontic should design so that it should not cause any problem (irritation follow by inflammation) to the pontic underlying soft tissue by improper food staff shading ,that is important for plaque formation, through poor pontic design or poor material selection ( pontic tissue surface should be convex,ceramic)*



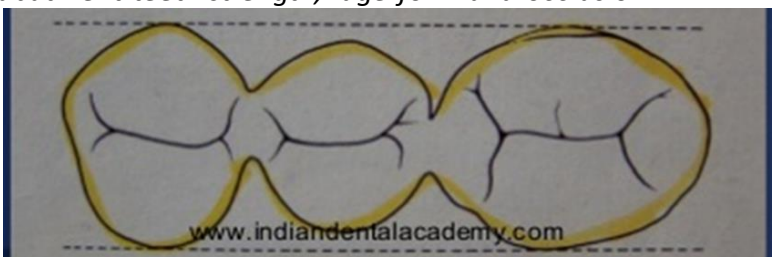
- *Glazed porcelain and highly polished metal (gold) are the preferred materials for tissue contact* The glazed porcelain is the preferable material that should be used on those portion of pontic which approximate the edentulous ridge.Because their porous nature and difficulty in obtaining a highly polished surface , resins should not be used as near the soft tissue

5. *The contact area or solder joint should guard the interproximal area and the embrasure (mesial ,distal and lingual) should be opened wide to allow massage of the gingival tissue.*


6. *The contour of the labial and lingual surfaces of the pontic must be proper and lie with the same line of contour of the adjacent teeth so it will allow stimulation as well as protection of the underlying tissue*

**Mechanical Requirements;**

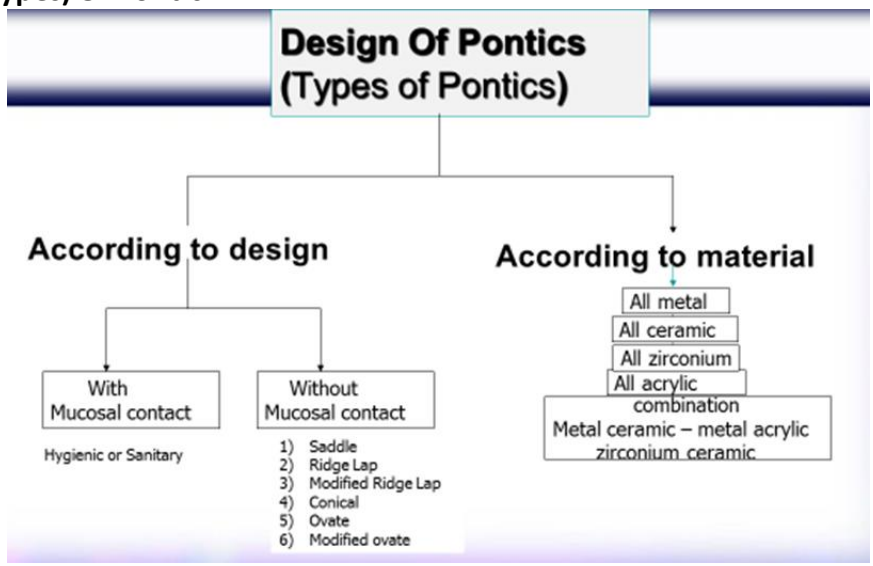
7. *The pontic must be strong enough to withstand the force to which it is subjected without deformation (Rigid & resistant to deformation). Part of pontic that subject to force usually made of metal or supported by it. All metal pontic may be needed in situation of high stress rather than metal ceramic pontic which is more susceptible to fracture. Mechanical problems may be due to*
   - *Improper choice of material.*
   - *Poor framework design.*
   - *Week connectors*
   - *Poor occlusion*
   - *Poor tooth preparation*
8. *It should restore the function of teeth it replaced i.e. masticatory functionn efficiency must restored to the proper limit*
9. *Sometime it is desirable to reduce the occlusal surface width by 20% to reduce torque on retainers and abutments and simplify the cleaning with minimal soft tissue contact ,however,width of the pontic required will be governed by esthetic,span length,abutment teeth strength,ridge form and occlusion*




**Summary of pontic Requirements**

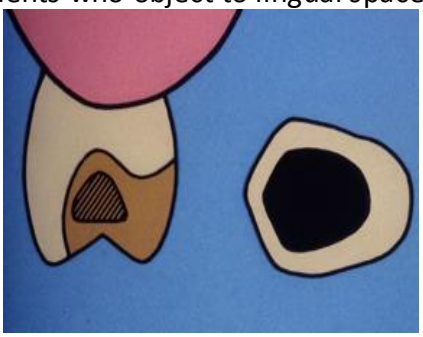
- **Esthetic**
  - Looks like the tooth it replaces
  - Tissue contacts appear as normal tooth
- **Biologic**
  - Can maintain healthy tissues
  - Cleansable
- **Mechanical**
  - Strong enough to withstand functional forces
  - Rigid & resistant to deformation
  - Provides normal function

**Designs (Types) Of Pontic:**

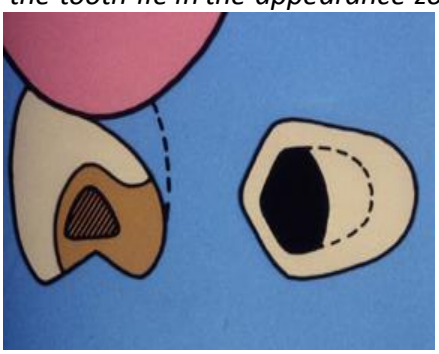



**(A) Pontics with mucosal contact:**

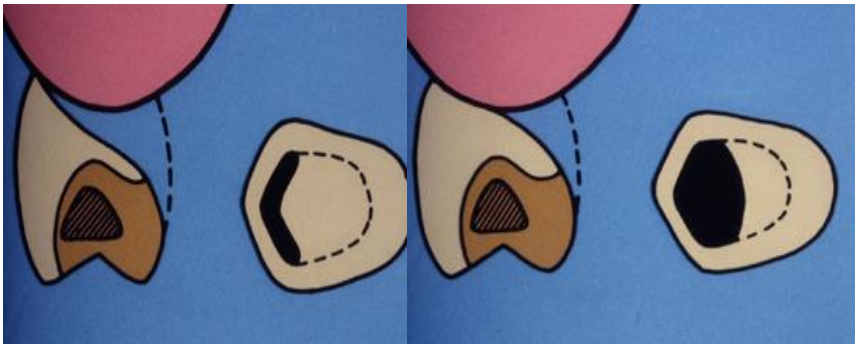
1. **Saddle Pontic (full ridge lap)**
   - *Overlaps the ridge (largest area of contact)*
   - *Most natural feeling*
   - *Most difficult to clean (concave tissue surface overlying residual ridge BL)*
   - *Should never be used*
   - *Used for*
     - Limited occlusal-gingival space
     - Patients who object to lingual space



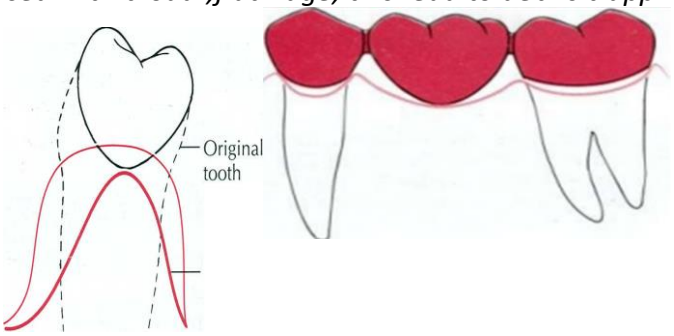
2. **Ridge Lap Pontic**
   - *Like saddle on buccal*
   - *Convex on the lingual*
   - *More cleansable than saddle design*
   - *Potential for tissue irritation minimized*
   - *Give the illusion of being tooth*
   - *Combines best features of saddle & hygienic pontics*
   - *Used when the tooth lie in the appearance zone (max & man.)*



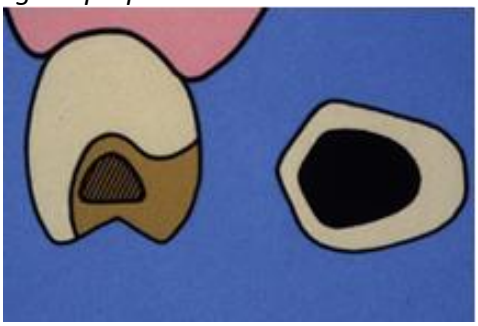
3. **Modified Ridge Lap Pontic**
   - *Contacts tissue only on most facial surface of the pontic*
   - *Most cleansable*
   - *Least tissue irritation*
   - *Space between pontic and tissue on lingual can be unacceptable to the patient*
   - *Used when the tooth lie in the appearance zone (max & man.)*



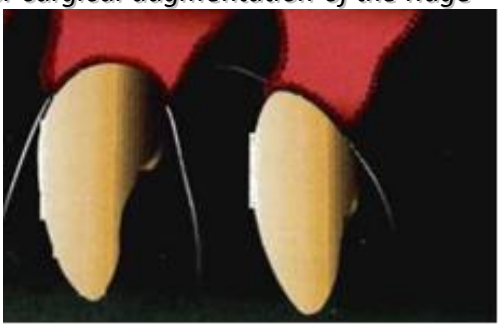
4. **Conical Pontic (bullet, spheroid)**
   - *egg shaped or spheroid shape.*
   - *used as pontic in non esthetic areas.*
   - *convex shape with only one point touches the residual ridge.*
   - *The most easiest design to clean.*
   - *Used when occlusal 2/3 of the facial surface lie in the appearance zone but not gingival 1/3 (lower incisors, premolars and molars).*
   - *if used with broad ,flat ridge, this lead to debris trapping embrasure space.*



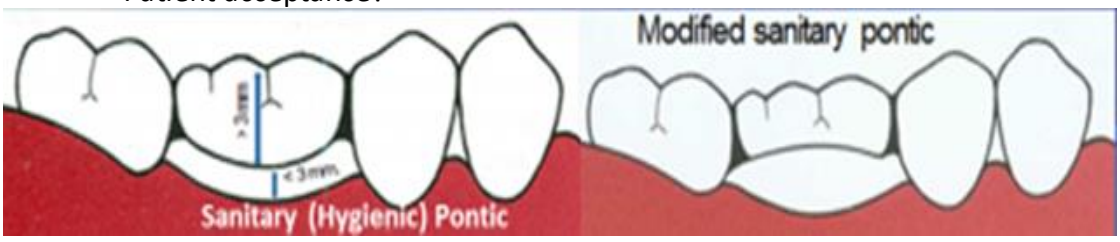

5. **Ovate Pontic**
   - *Placed in convexity on edentulous ridge*
   - *Appears to be growing out of tissue*
   - *Natural feeling for patient*
   - *Difficulty in cleaning*
   - *Potential for tissue irritation*
   - *Used for Maxillary incisor and premolars*
   - *Requires surgical preparation*



6. **Modified Ovate Pontic**
    - *The modification of the ovate pontic involves moving the height of contour at the tissue surface from the center of the base to a more labial position.1_1.5mm apical and palatal to gingival maegin*
    - *The modified ovate pontic does not require as much faciolingual thickness to create an emergence profile.*
    - *Excellent esthetics*
    - *Fulfilled functional requirements*
    - *Greater ease of cleaning compared with the ovate pontic owing to the less convex design*
    - *Its major advantage over the ovate type is that often there is little or no need for surgical augmentation of the ridge*



7. **Hygienic Pontic (sanitary, wash through);**
    - *Made entirely from metal*
    - *Doesn't have any contact with underlying tissue*
    - *Primary design for the non appearance zone in mandibular posterior regions*
    - *Most cleansable*
    - *Convex shaped*
    - *No tissue contact*
        - 3 mm space
        - 3 mm thickness
    - *Patient acceptance?questionable*
8. Modified **Hygienic Pontic ( Archway pontic)**
    - A modified version of the sanitary pontic.
    - It gingival portion is shaped like archway between the retainers
    - This geometry added bulk for strength in the connectors whil decreasing the stress concentrated in the pontic and connectors
    - Made entirely from metal
    - Doesn't have any contact with underlying tissue
    - Primary design for the non appearance zone in mandibular posterior regions
    - Access for cleaning is good ,also, tissue Susceptible to proliferation that can occur when the pontic is too close to the residual ridge
    - No tissue contact
    - Patient acceptance?



## Pretreatment assessment

### 1) Available pontic space

- One function of the fpd is to prevent tilting or drifting of the adjacent teeth into the edentulous space.
- If such movement has already occurred, the space available for the pontic may be reduced and its fabrication complicated.
- Space discrepancy (reduce pontic space) – less problem in posteriors, Overly small pontics are undesirable because they trap food and are difficult to clean, furthermore , in anterior its unacceptable estheticall
- Orthodontic repositioning, modification of abutments with complete coverage retainers can be made rather than doing bridge

### 2) Residual ridge contour

- *An ideally shaped ridge has smooth, regular surface of attached gingiva, which facilitates maintainance of a plaque-free environment.*
- *Should have sufficient height to allow placement of pontic such that it apperas to emerge out from the ridge (mimics appearance of neighbouring teeth).*
- ***Loss of residual ridge contour may lead to unesthetic open gingival embrasures (black traingles). This leads to food accumulation and saliva percolation( food entrap-ment)***

### Classification of residual ridge deformities

*Siebert has classified residual ridge deformities into:*

*1-Class I defects faciolingual loss of tissue width with normal height.*
*2-Class II defects loss of ridge height with normal ridge width.*
*3- Class III defects a combination of loss in both dimensions.*


## Residual ridge Preservation

Residual ridge Preservation can be achieved using the following techniques;

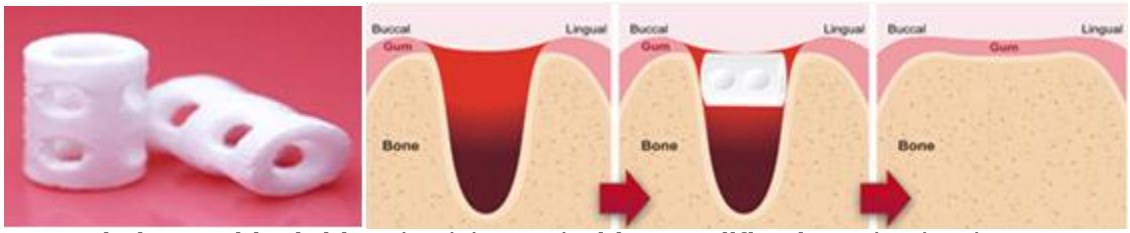
### 1) Alveolar architecture preservation technique

Preservation of the alveolar process can be achieved through immediate restorative and periodontal intervention at the time of tooth removal. The procedure involve preparing the abutment teeth prior to extraction and provisional FPD can be fabricated indirectly, to be ready for immediate insertion. The tissue-side of the pontic should be an ovate form. *After preparation of the extraction site, a carefully shaped provisional FPD is placed* and seat it on the abutments. According to Spear's the pontic of the bridge should extend approximately 2.5 mm apical to the facial free gingival margin of the extraction socket. Because the soft tissues of the socket will begin to collapse immediately after the tooth extraction, the pontic will result in tissue blanching as it supports the papillae and facial/ palatal gingiva. The contour of the ovate tissue- side of the pontic is critical and must conform to within 1 mm of the interproximal and facial bone contour to act as a template for healing.


b) **Conditioning the extraction site (Alvelac pack)**

Also Preservation of the alveolar process can be achieved by conditioning the extraction site and providing a matrix for healing, the pre-extraction gingival architecture (or "socket") can be preserved. **Alvelac can be used at** the time of tooth removal, it is a porous, osteoconductive, biocompatible and biodegradable synthetic scaffold that is synthesized from *polylactic co glycolic acid (PLGA) and polyvinyl alcohol*.

- *It is a rigid structure specifically designed to prevent collapse of the buccal and lingual walls in achieving width maintenance.*
- *It is designed to maintain socket height and width, which will allow for natural bone healing (Figure ). In addition, it will be resorbed in approximately two to six months*
- *It is strategically placed in extraction socket with the top of scaffold in line with the crest of the socket in order to raise the forming blood clot to that level thus achieving height maintenance.*
- *The size of Alvelac™ does not occupy the whole socket thus allowing maximum space for blood to fill the socket. This allows for the patient's own bone to form naturally within that space*
- *Within a short period of time, patient's own bone will form fully in the socket, achieving the speed of alveolar ridge preservation required*




**For pre existing residual ridge,** it might need **Ridge Modifications** that involve

1) **Ridge Reduction Indications**
   - Excessive or irregular soft tissue
     - Recent extraction
     - Ill fitting prosthesis
     - Other irritations
   - In adequate space for pontic
   - Poor cleansable area
2) **Ridge Augmentation**
   - Indicated to treat a Defect in pontic space
     - Bone resorbtion after extraction
     - Require long, unaesthetic pontic
   - Periodontal surgery using fibrous, osseous or synthetic materials to augment space

# Components of Bridge

## Connector

It is that part bridge or F.P.D which joins the individual components (retainers or pontics) together, retainer with pontic, retainer with retainer or pontic to pontic. This can be accomplished by non rigid movable (flexible) connector or , most commonly, rigid (fixed) connector.

■***Materials used in pontic fabrication***

- *Maximum esthetics vs. maximum strength*
- *all metal Connector can be use to provide maximum strength when esthetic is not critical*
- *Metal ceramic or All ceramic, can be use to provide maximum esthetic when strength is not critical*

■**Types of Connectors**

- **Rigid**
  - **All metal**
  - **Metal-ceramic**
  - **All ceramic**
- **Non Rigid**
  - **Prefabricated in plastic or metal and incorporated into the wax pattern**
  - **Milled into the wax pattern or casting**

**RIGID CONNECTORS**

rigid connectors in metal can be divided into (according to fabrication technique):

**a) cast connectors:**

*It made by casting multiunit bridge in one single piece. Cast connectors are stronger than soldered and possible to carve them so that to provide maximum appearance bridge is often cast.*

**b) Soldering connectors:**

*Here the pontic and connector have to be made separately. Then after casting we solder then together by using of intermediate metal alloy whose melting temperature is lower than that of the parents metal.*

**c) Welded connectors:**

*Melting adjacent surfaces with heat or pressure*

**d) Loop connectors**

*Sometimes required when an existing diastema is to be maintained in a planned fixed prosthesis.*

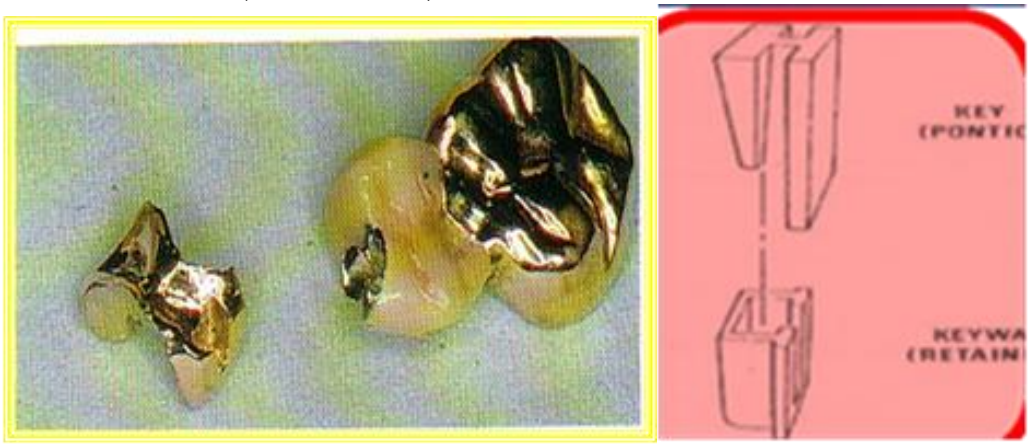
**NON RIGID CONNECTORS**

*Is indicated when it is not possible to prepare two abutment for an (FPD) with a common path of placement. So segmentally the design of large , complex (FBD) into shorter compartments (multiple pieces ) to make bridge seating more easier ,furthermore, it can be used in cases that need reduction of occlusal force that acting on abutment (weak).*

*Movable Joint (key-key way, slide channel):*

This is stress breaking design of joints that allows some movement between the components of the joint, of 2 pieces:

1) *The piece that is attached to the mesial terminal of the pontic (key slide)*
2) *Key is fitted in the second piece (key way channel) that is attached to the distal aspect of anterior abutment (minor retainer).*



**PRINCIPLES CONNECTORS DESIGN**

**1-size**

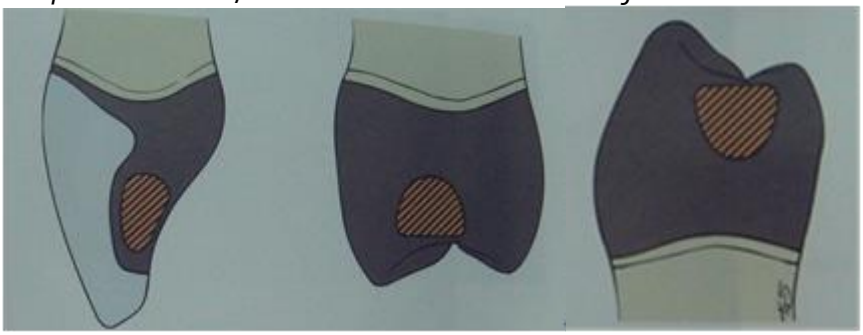
*Connectors must be sufficiently large to prevent distortion or fracture during function. but not too large to prevent interference with plaque, periodontal tissue disturbance over time.*

**2-shape**

*The shape of the tissue surface of the connector should be curved faciolingually and highly polished and smooth to facilitate cleaning and patient should be satisfied with the appearance.*

**3-postion**

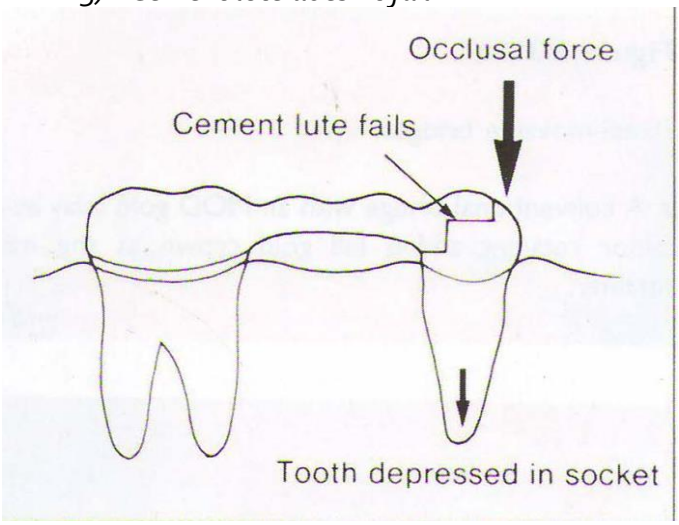
*The location of the contact area should be established correctly to influence the success and stability of the prosthesis. In the anterior teeth, the connector should place lingually. In the posterior teeth, located in the occlusal third of the crown and more lingually*



**Occlusal coverage:**

*Majer Retainer that is rigidly connect to the pontic (fixed-fixed bridge design) need full occlusal coverage while Minor Retainer that have movable connection with pontic doesn't need that. Full Occlusal Coverage is always (nearly) indicated because :*

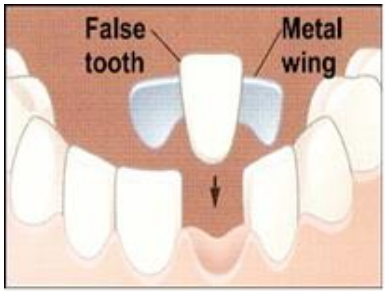
1) *It gives abutment complete protection during mastication.*
2) *There is no fear of cusp fracture (M O D inlay, or endo. Treated teeth).*
3) *Cement lute doesn't fail*



# Adhesive bridge (Resin bonded bridge, acid etched bridge)

*Fixed dental prosthesis that is luted to the unprepared or minimum preparation surface of abutment teeth permanently by acid etching of enamel with some type of resin bonding agent.*

- It is alternative for the conventional bridge.
- It is involve attaching the pontic via a metal plate to the unprepared lingual surface of the abutment teeth.
- The attachment to the abutment is made by composite resin material after acid etch of the enamel.
- It is the most conservative methods.
- It is used when the abutment teeth have sufficient intact enamel, & usually used in younger patient.




**Indications:**

1) *Adolescents with single missing teeth (traumatic or congenital).*
2) *Caries- free abutment teeth and good oral hygiene.*
3) *Maxillary incisor replacements (most favorable prognosis) and Mandibular incisor replacements.*
4) *Periodontal splints.*
5) *Post orthodontic fixed retention*
6) *Short span edentulous areas(Single posterior tooth replacements).*

**Contra Indications:**

1) Small sized abutments – Peg Laterals
2) Extensive caries.
3) Heavily restored abutments.
4) Deep vertical overbite.
5) Mal-alligned abutments
6) Parafuncitonal habits
7) Long span edentulous area
8) Allergy to base metal alloys

**Advantages:**

1) *Conservative.*
2) *Saving clinical chairs time.*
3) *Not expensive.*
4) *Lab procedure is easy & short.*
5) *It can be re-cemented if failure occurs.*
6) *Good appearance.*

**Disadvantages:**

1) *Not strong as conventional bridge.*
2) *Limited use because abutment teeth should have sufficient enamel for etching.*
3) *Tendency to de-bond.*
4) *Increase thickness of tooth surface by the metal plate.*

**Types:**

1. **Direct:**

*This type is made by using the crown of patient own tooth as a pontic, for example rapid replacement of a tooth that lost by traumatic injury. In order to increase the strength of the bridge (attachment) we add metal mesh or wire (temporary replacement).*

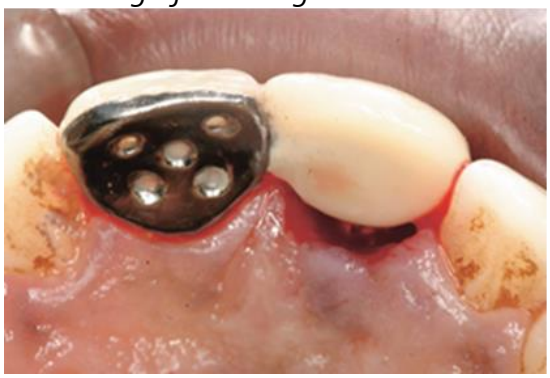
2. **Indirect adhesive bridge:**

*According to the mean or way of retention of the metal frame work to the abutment teeth we have different types:*

a) *Macro mechanical retention (Rochette).*
b) *Medium mechanical retention (Virginia).*
c) *Micro mechanical retentive (Maryland).*
d) *Chemically retention (Panavia).*

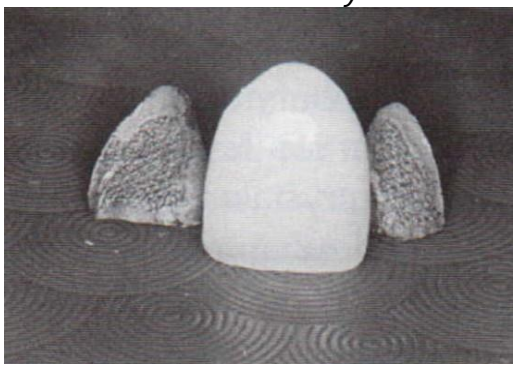
***a. Macro mechanical retention (Rochette) :***

*In this types there is multiple funnel shaped undercut perforations in the cast metal frame of the retainer is used for retention & through which composite flow during cementation and make mechanical interlocking after setting*



## b. Medium mechanical retention (Virginia):

*Retentive feature cast as a part of the metal frame work (non undercut lumps, mesh, on the fit surface of the retainer). The size of the retentive feature is intermediate between macro mechanical & micro mechanical retentive system*



### c. Micro mechanical retentive (Maryland):

*In state of perforations, the tooth side of the frame work is electrolytically etched, with hydrofluoric acid , which produce a microscopic undercuts, the bridge attached with a resin luting agent that lock into the microscopic undercut of both the etched retainer & etched enamel.*

### d. Chemically retention (Panavia):

*The resin adheres chemically to recently sand-blasted metal surface and is retained on the tooth by conventional acid etching of the enamel.*