Fixed Prosthodontics

Lecture 6 **Fifth stage**

Components of Bridge: Pontic:



It is the suspended portion of the FPD that replaces lost natural tooth/teeth to restore function and aesthetic. It is connected to the retainer by a rigid connection (solder joint) or non-rigid flexible connection (key & key way) in the stress-breaker type of bridges. It consists of metal backing, solder joint and facing.

Materials used in Pontic fabrication

They are made either entirely from cast metal, porcelain or zirconium, or a combination of metal backing with porcelain or acrylic facing. The full metal pontic is used for the posterior region while metal with facing or full ceramic and zirconium are used in anterior region.

Functions of the Pontic:

1) Mastication
2) Speech (phonetics): It helps to restrict air passage through edentulous area to aid in the reestablishment of normal sounds
3) Esthetics (appearance): It fills empty spaces that observed during talking and smiling, providing the support for lips and cheeks to allow normal facial form (Well-aligned teeth and a pleasing smile afford a positive social status)
4) Maintenance of teeth relationship: They maintain the integrity of dental arches by preventing movement of adjacent and opposing teeth from their normal position.

Ideal Pontic Requirements

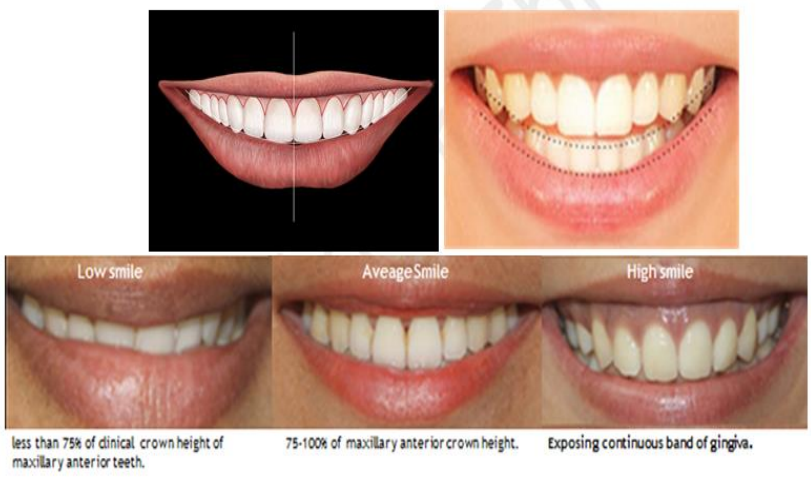
A- Aesthetic requirements: The pontic must meet the demand of aesthetic & comfort, the deciding factor for the esthetic value is “the smile line”, which is an imaginary line running from the incisal edges of maxillary incisors and coincides with the curvature of the lower lip together with upper lip line.

It determines the appearance zone of the facial aspect of teeth, which is 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.

As a general guideline, the lip line is optimal (average smile) when the upper lip reaches the gingival margin, displaying the total cervicoincisal length of the maxillary central incisors, along with the interproximal gingivae (75-100% of maxillary anterior crown height). A high lip line (high smile) exposes all of the clinical crowns plus a contiguous band of gingival tissue, whereas a low lip line (small smile) displays less than 75% of the maxillary anterior teeth.

The matter of concern here, is the form of the facial aspect of pontic that is related to appearance, so to fulfill the aesthetic requirement, the pontic must:

1) look like the replaced tooth 2) The tissue contact appears as normal tooth 3) The lower lip line helps to evaluate buccolingual position of the incisal edge and the curvature of the incisal plane.



In excessive bone loss, it is possible to construct a 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 dentin, while pink porcelain was used to simulate the gingival tissues.





B- Biologic Requirements:

1. The pontic must be hygienic; permit the maintenance of high standard of oral hygiene through providing a good access for cleaning the underlying soft tissue. Furthermore, the pontic must prevent soft and hard tissue irritation. Pontic design must allow the use of cleaning devices such as brushes, super floss and dental floss without difficulties.

2. The design of the tissue surface of pontic must not cause any problem to the underlying soft tissue (ulceration and inflammation) by pressure, a pressure free contact is indicated (passive contact, thickness of a film of saliva is sufficient for esthetical demand if the facial surface lies within the appearance zone). The design and materials may also case tissue irritation due to improper food staff shading that leads to plaque formation, so the tissue surface of pontic must be convex made from ceramic.

3. Glazed porcelain and highly polished metal (gold) are the preferred materials for tissue contact. Because of the porous nature and difficulty to obtain a highly polished surface, resins must not be used near the soft tissue. However, even highly polished surfaces will accumulate plaque if oral hygiene measures are ignored

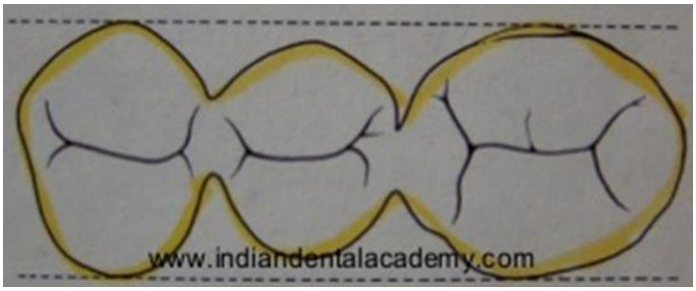
4. The contact area or solder joint must guard the interproximal area, the embrasure (mesial, distal and lingual) should be opened wide to allow massage of the gingival tissue.



5. 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

C- Mechanical Requirements

The pontic must be strong enough to withstand forces without deformation (Rigid & resistant to deformation). Part of pontic that subject to force usually made supported by metal. 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. It must restore the function of replaced tooth properly. 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, the width of pontic governed by esthetic, span length, abutment teeth strength, ridge form and occlusion.



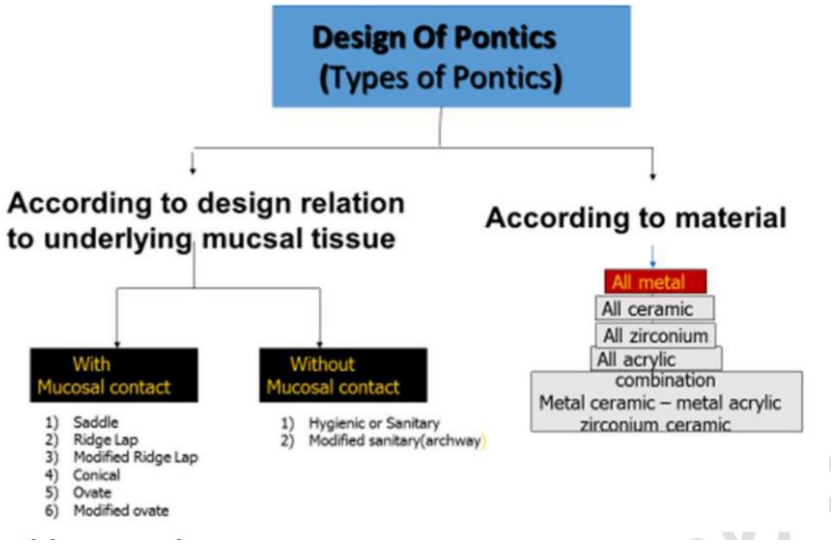
Summary of pontic Requirements

Aesthetic: Looks like the replaced tooth & tissue contacts as normal tooth.

Biologic: Can maintain healthy tissues, cleansable.

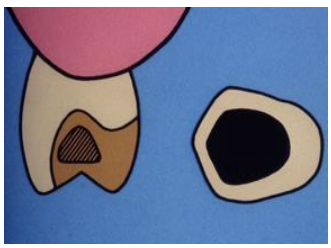
Mechanical: Strong enough to withstand functional forces, rigid & resistant to deformation, provides normal function.

Designs (Types) Of Pontic



(A) Pontics with mucosal contact:

1. Ridge lap (Saddle Pontic):

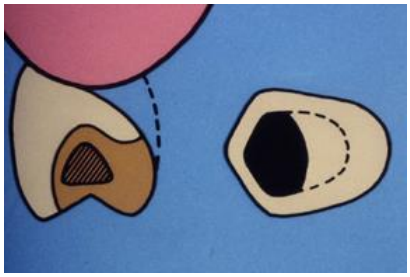


The tissue surface is concave buccolingually overlying the residual ridge buccolingually simulating the contours of emergence profile of missing tooth on both sides of the residual ridge. It is used for limited occlusal-gingival space, and for patients who reject the presence of a lingual space.

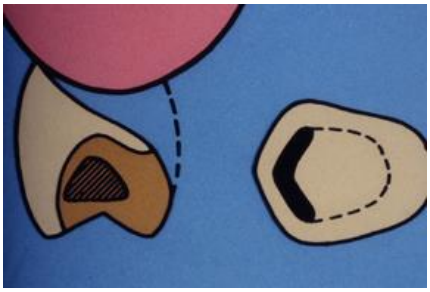


It has the largest area of contact (overlaps the ridge) with most natural feeling. But it is the most difficult to clean. SHOULD NEVER BE USED

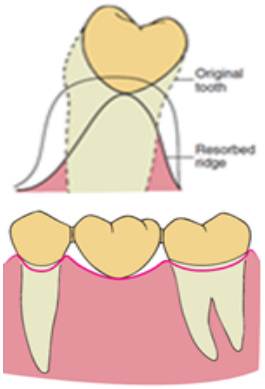
2. A: Modified Ridge Lap Pontic: It resembles a saddle on buccal, and convex on the lingual. More cleansable than saddle design. Less tissue irritation, giving an illusion of a tooth. It combines best features of saddle & hygienic pontics. It can be used when the tooth lies in the appearance zone (max & man.)



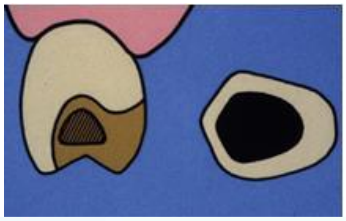
2. B: Modified Ridge Lap Pontic: It contacts the underlying tissue on the most facial surface of the pontic only. It is the most cleansable design with least tissue irritation. The space between pontic and tissue lingually can be unacceptable to the patient. It can be used when the tooth lies in the appearance zone (max & man.)

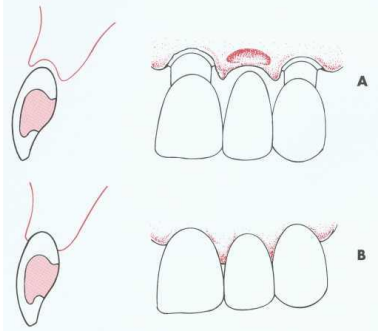


3. Conical Pontic (bullet, spheroid): It is an egg or spheroid-shaped, used in non-esthetic areas. It is convex with one-point contact with the residual ridge. The easiest design to be cleaned. It can be used when occlusal 2/3 of the facial surface lies in the appearance zone but not gingival 1/3 (lower incisors, premolars and molars). It is not indicated for broad flat ridge, as it leads to debris trapping embrasure space. Clinical applications: Knife edge ridge, posterior teeth (where aesthetic is not needed)

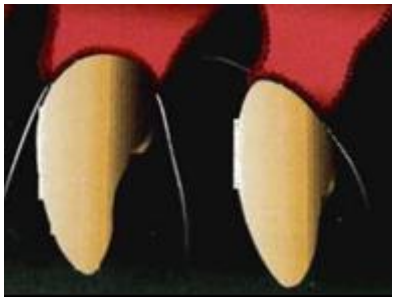


4. Ovate Pontic: Excellent aesthetic. It is convex tissue surface resides in a soft tissue depression or hollow in the residual ridge, which makes it appear that a tooth emerging from the gingiva. Careful treatment planning is necessary for successful results, it gives natural feeling for patient. But it has a difficulty in cleaning with potential tissue irritation. Used for maxillary incisor & premolars, requires surgical preparation.



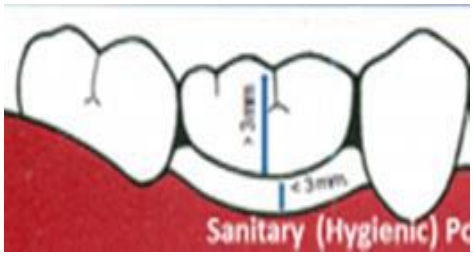


5. Modified Ovate Pontic: It is a modification of the ovate pontic that involves moving the height of contour at the tissue surface from the center of the base to a more labial position 1-1.5 mm apical and palatal to gingival margin. This pontic does not require as much faciolingual thickness to create an emergence profile.



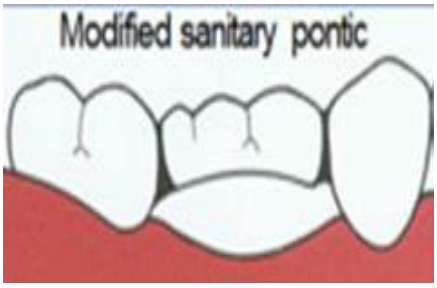
It gives excellent aesthetics with fulfilled functional requirements. Greater ease of cleaning compared to ovate pontic. Less convex design. The major advantage over the ovate is that there is little or no need for surgical augmentation of the ridge

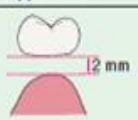
6. Hygienic Pontic (sanitary, wash through): It is made entirely from metal, doesn't have any contact with underlying tissue. It is advocated for the non-appearance zone in mandibular posterior regions. Most cleansable design, convex-shaped, with no tissue contact, 3 mm space with 3 mm thickness. However, the patient acceptance is questionable.



7. Modified Hygienic Pontic (Archway pontic): It is a modified version of the sanitary pontic. The gingival portion is shaped like archway between the retainers. This geometry added bulk for strength in the connectors which decreases the stress concentrated in the pontic and connectors.

It made entirely from metal, doesn't have any contact with underlying tissue. Primary design for the non-appearance zone in mandibular posterior regions and limited OG height. The access for cleaning is good. No tissue contacts with questionable patient acceptance.



Pontic Design	Appearance	Recommended Location	Advantages	Disadvantages	Indications	Contraindications	Materials
Sanitary/hygienic		Posterior mandible	Good access for oral hygiene	Poor esthetics	Nonesthetic zones Impaired oral hygiene	Where esthetics is important Minimal vertical dimension	All metal
Saddle/ridge-lap		Not recommended	Esthetic	Not amenable to oral hygiene	Not recommended	Not recommended	Not applicable
Conical		Molars without esthetic requirements	Good access for oral hygiene	Poor esthetics	Posterior areas where esthetics is of minimal concern	Poor oral hygiene	Metal-ceramic All resin All ceramic
Modified ridge-lap		High esthetic requirement (i.e., anterior teeth and premolars, some maxillary molars)	Good esthetics	Moderately easy to clean	Most areas with esthetic concern	Where minimal esthetic concern exists	Metal-ceramic All resin All ceramic
Ovate		Very high esthetic requirement Maxillary incisors, canines, and premolars	Superior esthetics Negligible food entrapment Ease of cleaning	Necessitates surgical preparation Not for residual ridge defects	Desire for optimal esthetics High smile line	Patient's unwillingness to undergo surgery Residual ridge defects	Metal-ceramic All resin All ceramic
Modified ovate		Very high esthetic requirement Maxillary incisors, canines, and premolars	Superior esthetics Negligible food entrapment Ease of cleaning	Necessitates surgical preparation	Where horizontal ridge width is not sufficient for a conventional ovate pontic	Patient's unwillingness to undergo surgery	Metal-ceramic All resin All ceramic

Pretreatment assessment of Pontic area

1) Available pontic space

One function of the FPD to prevent tilting or drifting of the adjacent teeth in to 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 aesthetically. Orthodontics repositioning, modification of abutments with complete coverage retainers.



2) Residual ridge contour

An ideally-shaped ridge should have smooth, regular surface of attached gingiva, which facilitates that maintenance of a plaque-free environment. Sufficient height to allow placement of pontic such that it appears to emerge out from the ridge (mimics appearance of neighboring teeth). Losses of residual ridge contour may lead to an aesthetic open gingivally embrasures (black triangles). This leads to food accumulation and saliva percolation (food entrapment)

Classification of residual ridge deformities: Siebert has classified residual ridge deformities into:

Class I defects: faciolingual loss of tissue width with normal height

Class II defects loss of ridge height with normal ridge width

Class III defects a combination of loss in both dimensions.



Residual ridge Preservation: Preservation of the residual ridge can be achieved using the following techniques

a) Alveolar architecture preservation technique

The preservation of the alveolar process can be achieved through immediate restorative and periodontal intervention at the time of tooth removal. The procedure involves 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 must be an ovate form. After preparation

of the extraction site, a carefully shaped provisional FPD is placed and seat it on the abutments.



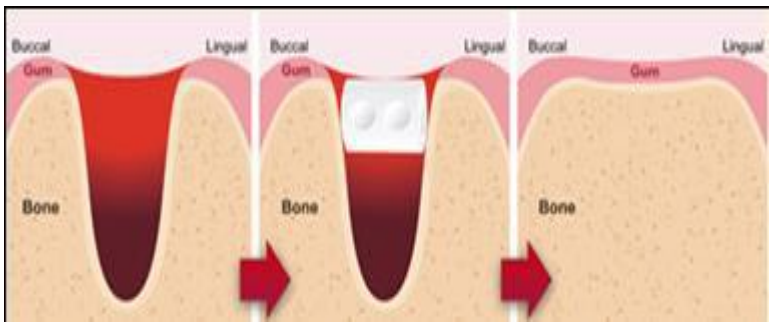
According to Spear's the pontic of the bridge should extend approximately 2.5 mm apical to the facial free gingival margin of the extraction socket. Because the soft tissues of the socket will begin to collapse immediately after the tooth extraction, the pontic will result in tissue blanching as it supports 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)

Another approach of preserving 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 porous, osteoconductive and biocompatible, and biodegradable synthetic scaffold made from polylactic co glycolic 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. 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, to speed up the preservation of the alveolar ridge.

For pre-existing residual ridge: It might need Ridge Modifications that involve

A. Ridge Reduction: It is indicated when there is an excessive or irregular soft tissue that might occur because of recent extraction, ill-fitting prosthesis or other irritations like; in adequate space for pontic, and poor cleansable area.

B. Ridge Augmentation: It is indicated to treat a Defect in pontic space when there is a bone resorption after extraction, or require long, unaesthetic pontic. The periodontal surgery is done using fibrous, osseous or synthetic materials to augment space and treat the defect.

3) Occlusion

Components Of Fixed Partial Denture (Bridge): Connector

It is that part bridge or FPD 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 aesthetics vs. maximum strength.
- All Metal Connector can be used to provide maximum strength when esthetic is not critical.
- Metal ceramic or All ceramic, can be used 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 a single piece. Cast connectors are stronger than soldered and possible to carve them to provide the maximum appearance bridge is often cast



b) Soldering connectors:

The pontic and connector are made separately. Then after casting, they soldered together by using an intermediate metal alloy whose melting temperature is lower than that of the parent's metal.



c) Welded connectors: Melting the adjacent surfaces with heat or pressure.



d) Loop connectors: Sometimes required when an existing diastema is to be maintained in a planned fixed prosthesis.



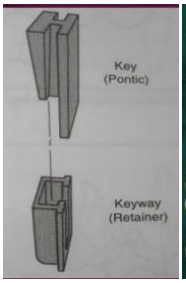
NON-RIGID CONNECTORS

It is indicated when it is not possible to prepare two abutments for a FPD with a common path of placement. So segmentally the design of large, complex FBD into shorter compartments (multiple pieces) to make bridge seating 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 allows some movement between the components of the joint, of 2 pieces:

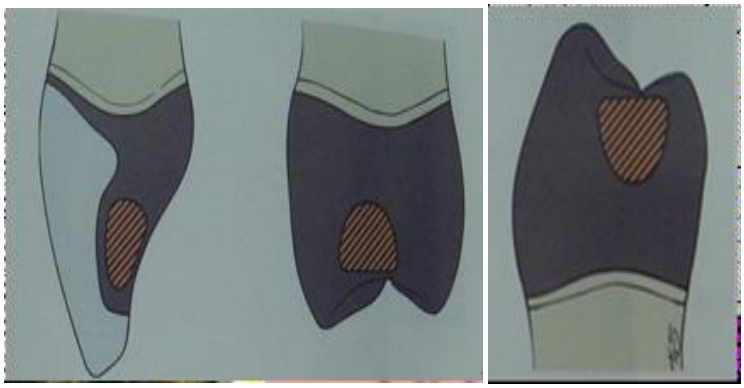
The piece that is attached to the mesial terminal of the pontic (key slide). The key is fitted in the second piece (key-way channel) that is attached to the distal aspect of anterior abutment (minor retainer).





Principles of Connectors Design

1- **Size:** Connectors must be sufficiently large to prevent distortion or fracture during function, but, not too large to that induce a periodontal problem over time.
2- **Shape:** The tissue surface of the connector should be curved faciolingually, highly polished and smooth to facilitate cleaning with a satisfied appearance.
3- **Position:** The location of the contact area should be established correctly which affects 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:

Major 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 indicated because: It gives abutment complete protection during mastication with no possibility of cusp fracture (MOD inlay, or endo. Treated teeth), cement lute doesn’t fail

