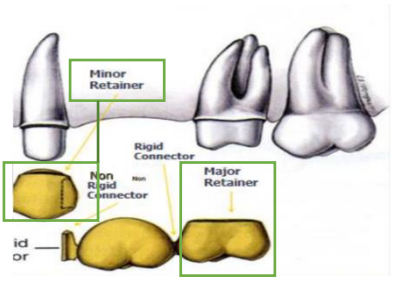
Crown & Bridge Prosthodontics

Lecture 5 **Fifth stage**

Components of Bridge: Bridge Retainers:

The bridge retainer unites the abutment to the restoration. It takes the support from the abutment tooth and provides stabilization & retention to the prosthesis. It could be either seated over or in the abutment tooth, connecting the pontic to the abutment. Retainers could be (divided into):

1. **Major retainer:** They are used in fixed-fixed, spring & cantilever bridges. In the fixed-mobile bridge, the major retainer is located at one end of the pontic only. In conventional bridges, the major retainer must be retentive & cover the whole occluding surface of the tooth (rigid connection to pontic).



2. **Minor retainer:** Represent the lesser retainer of fixed-mobile bridge into which a movable connector from a pontic seated on or attach to it. It doesn't need full occlusal coverage (Flexible connection to pontic).

Types of retainers: Major or Minor Retainer Designs

1. Based on preparation design:

1) Extra coronal retainer: complete crown or partial crown.

2) Intra coronal: Inlay, onlay

3) Intra radicular: Post & core.

Specific Retainer design: Standard: Full Metal Crown, 3/4 Crown, 7/8 Crown, Post Crown, PFM, full Zirconium, Combination.

Non-Standard: Implant, Inlay, Onlay, Resin Bonded “Maryland Bridge”

2. Based on material used

1) All-metal retainers 2) Metal-ceramic retainers 3) All-ceramic retainer 4) Zirconium retainers 5) Acrylic retainers.

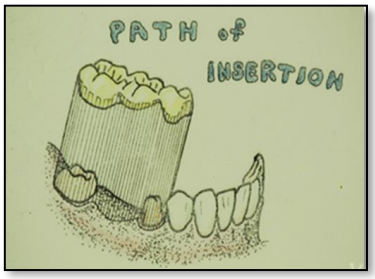
All metal retainers are the most conservative one, the simplest to prepare & least expensive. They are used in posterior region when aesthetic is not critical. Metal-ceramic, All Ceramic & Zirconium are used for anterior replacements where aesthetic is essential. Acrylic retainer used with temporary bridge.

Criteria for choosing suitable retainer (assessment factors):

The alignment of abutment teeth, the retention required, aesthetic, the condition of abutment teeth, periodontal, conservation of tooth structure, cost & Caries susceptibility.

1) Alignment of abutment teeth:

When abutment teeth are more or less parallel to each other, either complete or partial crown retainer can be used. If the abutments are not parallel, complete crown retainer will be less conservative.



2. Appearance (Aesthetic): The aesthetic of retainer must be acceptable to patients. If aesthetic is critical, PFM, All Ceramic, Zirconium or ¾ crown can be used. Some patient may worry about metal display on occlusal surface of posterior teeth, this needs to have porcelain extend to cover occlusal surface of metal. This led to a destructive preparation which is not always possible or desirable.

3. The condition of abutments: Extensive caries or large restoration involving the buccal surface, or loss due to fracture, necessitate complete coverage retainers. Pulp condition play a vital role in the selection of retainer design,

incisal relationship has great effect especially when the clinical length of the crown is short in anterior & posterior teeth (worn teeth).

4. Conservation of tooth structure:

Inlays, Onlays > partial coverage > complete coverage. Full metal> PFM > All ceramic crown. It the buccal enamel and dentin are sound, partial coverage provides a conservative preparation, reduce the harmful effect on the pulp & periodontium, and will not destroy the natural appearance. However, if there is sound indication for complete crown, this must be done.

5. Cost: Partial crown & complete crown (Retainer) may be less expensive than PFM, which is less expensive than All Ceramic or Zirconium retainers. Metal Retainer are least expensive. When there is no other factor affecting choice, this is obviously of considerable importance.

6. Size and position of the abutment: Partial crown needs sufficient large and long tooth. Position may affect aesthetic.

7. Caries susceptibility: Patient with poor oral hygiene is indicated for complete crown.

8. Retention required: The retention of a bridge retainer should be at least as great as for similar restoration made as single unit. Retention of crown vary according to preparation feature, crown material properties and type of luting cement.

Factors affecting the amount of required retention:

1) Length of span & rigidity: The longer the span the greater the stresses on the retainer & the more will become un cemented. Furthermore, the casting will be more liable to flex, so you must a certain they are sufficiently rigid (The longer the span, the stronger must be all the component bridge).

2) Type of bridge: Certain types of bridges induce greater stresses on the cementing media of retainers than other. Thus, strong retainers are required for fixed-fixed than fixed-mobile bridge. Indeed, little retention is needed for the minor retainer of fixed-mobile design, to preserve the tooth tissue. For ex, the replacement of max 1st premolar by fixed-mobile bridge using full coverage on 2nd premolar as major retainer & a class III inlay on the distal of canine as the minor retainer. This design will be conservative, aesthetic with intact labial surface.

3) Strength of the bite: The strength of the bite determines the degree of retention required, this will vary with age, sex & muscular development of the patient. The heavier the bite the stronger & thicker the retainer material is needed to prevent failure of the retainer or pontic.

4) Tooth or teeth to be replaced: The size & position of the pontic have a direct effect on the type of retainer required (stress amount). Thus, the replacement of a molar causes greater stress to the abutment than lower incisor, and the forces acting on canine are more likely than on an incisor.

5) Occlusal coverage: Full occlusal coverage is always indicated for fixed-fixed bridges. It gives the abutment complete protection during mastication and protect cusps from fracture especially in large restorations or endodontically-treated teeth. The occlusal reduction must be sufficient to provide enough thickness for the material to be rigid.

6) Habits of patient: Habits might induce stress on the bridge retainer such as pipe smoking, clenching & bruxism. If many teeth severely worn, then any metal retainer will similarly wear unless the habit can be corrected. Therefore, retainer must be thicker & stronger than normal.

Requirements of ideal retainer:

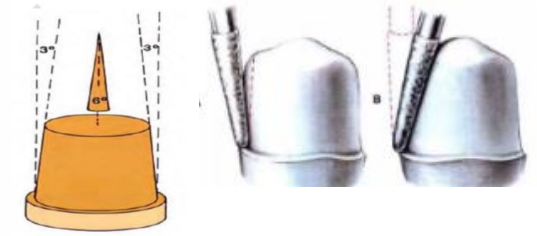
1) Provide maximum retention 2) Maximum aesthetic 3) Preserve the vitality of the prepared teeth 4) Conservative preparation (less amount of traumatic reduction) 5) Biologically accepted to the surrounding tissues 6) Withstand masticatory forces 7) Easily constructed.

General factors in tooth preparation:

In order to obtain these ideal retainer requirements as far as related to tooth preparation, if the case permit, the design of the preparation of abutment tooth for a metal or porcelain crown restorations are limited by five principles: 1) Preservation of tooth structure 2) Retention & resistance from 3) Structural durability of restoration 4) Preservation of periodontium 5) Marginal integrity.

Factors affecting retention & resistance of crown restorations:

1) Taper of the preparation: The more nearly parallel the opposing walls of preparation the greater will be the retention. To avoid undercut & seating problems, 5-6° convergence angle is used to provide the needed retention. Tooth preparation must be kept minimum because of the adverse effect on retention.



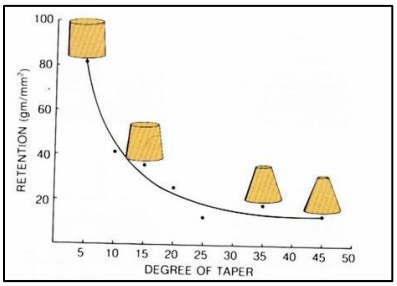
2) Surface area of the preparation,

3) Length and height of the preparation.

4) Diameter of the tooth (tooth width).

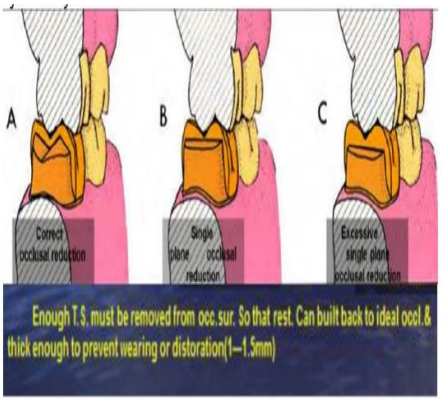
5) Texture of the preparation.

6) Accessary mean.



3. Structural Durability of the restoration

The crown must be rigid enough to avoid flexing, perforation or fracture. Rigid restorations need bulk which require sufficient tooth reduction, so the restoration can withstand the forces of occlusion, prevent wearing holes in metal & allow proper contouring & carving of anatomy in the restoration.



4. Preservation of periodontium: Whenever possible the margin of the preparation must be placed supragingivally. The casting should have proper contact, embrasure form, occlusion with healthy occluso-gingival contour.

5. Marginal Integrity: The restoration margins must fit as closely as possible against the finishing line of preparation, and be placed in an area where the dentist can prepare and finish easily, and the patient can clean properly. The margin affects both marginal adaptation & degree of seating of the restoration.

Margin (Finishing line) placement:

1. Supragingival: Placing the margin above the gingival tissue is considered to be more conservative, when placed on hard enamel. Easy preparation, finishing, visibility & impression making and more hygienic as the patient can keep the area clean easily.

2. Subgingival: Placing the margin below the gingival tissue.

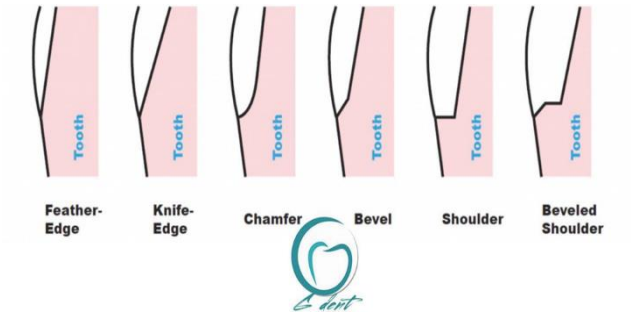
3. Equigingival: Placing the margin with in the level of the gingiva.

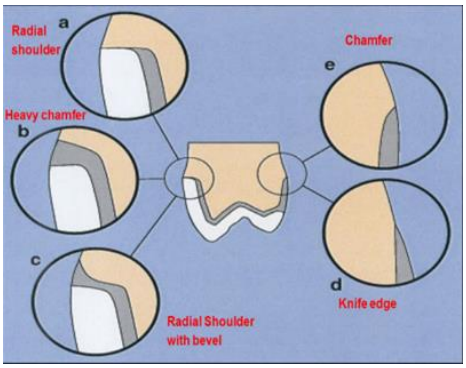
The factors that affect the position of finishing line are: a- Aesthetic b- Extra retention is needed c- When there is caries or filling near the margin at the area of finish line.

Requirement of finishing line: It must be clear, smooth, well defined, continuous from one surface to the other, and at sound tooth structure.

Factors affecting design of the FL: Type of the restoration, materials used in construction & the amount of occlusal force (stress).

Types (design or configuration) of finish line: The designs depend on the type of the crown restoration: knife edge, shoulder, shoulder with bevel, radial shoulder, chamfer & heavy chamfer. The configuration of F.L. determines the shape and the bulk of the restoration.





Complete Cast Crown (Full metal):



It is the most conservative crown, indicated in posterior region when aesthetic is not needed. It provides better retention & resistance, because all the axial surfaces of teeth are included in the preparation. It is indicated when the abutment teeth show extensive tooth destruction as a result of caries or trauma, can receive clasp, endodontically treated teeth and patient with high caries index.

Advantages: Greater retention & resistance, high resistance to deformation (Strong) even in thin sections, preserve tooth structure (conservative) & easy to be prepared. **Disadvantages**: Poor aesthetic, difficulty to test the vitality of the abutment tooth especially by electrical pulp tester, interfere with taste, tarnish & corrosion so it needs prophylactic measures.

Porcelain Fused to Metal:



The most widely used retainer when aesthetic is a factor. It combined the strength of full metal crown & the aesthetic of all ceramic crown. It is indicated when aesthetic, excessive retention & resistance are needed. But it is contraindicated in case of large pulp chamber, intact buccal wall & when more conservative retainer is required.



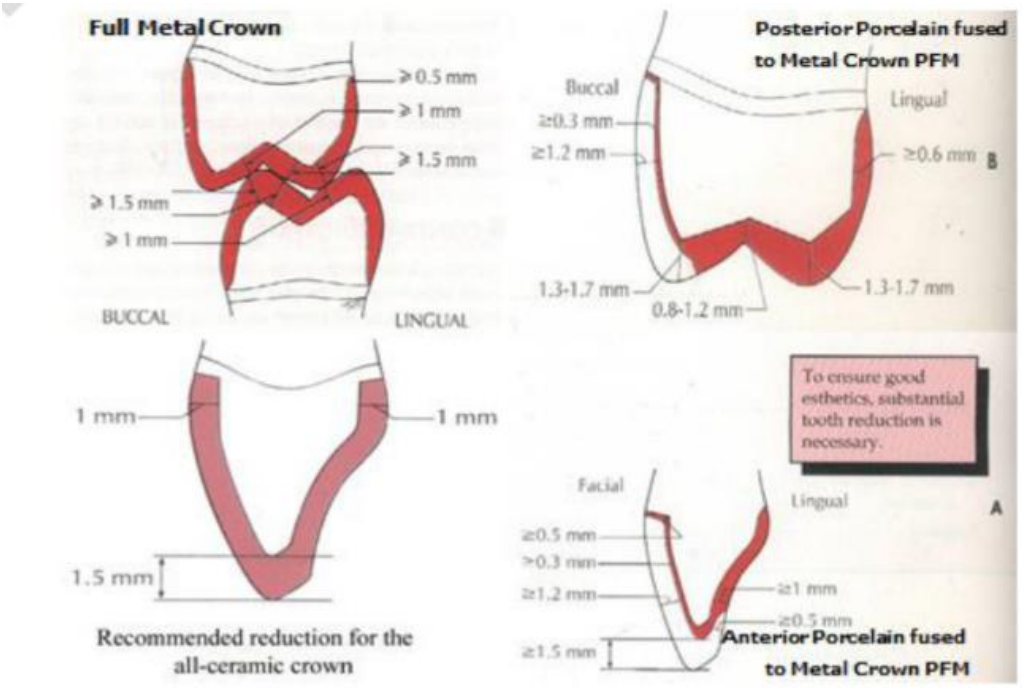
Advantages: Combined strength of FM & aesthetic of all ceramic crown. **Disadvantages:** 1) Substantial removal of tooth structure 2) More subjected to fracture because of brittle nature of porcelain 3) Shade selection might be difficult 4) Inferior aesthetic compared to All Ceramic Crown 5) More expensive

All Ceramic Crown:

It is the most aesthetically pleasing retainer as it made entirely from ceramic substance with no metal substructure to block light transmission. It resembles the colour & translucency of natural teeth more than other restoration. It is indicated when high aesthetic is needed, considerable proximal caries, endodontically treated teeth with post & core & favourable distribution of occlusal load.



But it is contraindicated when high strength is needed, thin teeth faciolingually & insufficient coronal tooth structure, unfavourable distribution of occlusal load, and in bruxism.



Partial veneer crown (3/4 crown):



Cast restorations that cover 3/4 of the clinical crown leaving intact buccal or labial surface. It has less retention & resistance to displacement compared to full metal, full veneer with facing. It is indicated in short span bridge, teeth with good clinical crown length & thickness labio-lingually, good oral hygiene & low caries index.

Good axial relationship of abutments to facilitate the path of insertion. It is contra-indicated in short teeth, poor oral hygiene, grossly caries teeth, long span bridges, poorly aligned abutment & endodontically treated teeth.

Advantages: Conservative, good aesthetic, reduced pulpal and periodontal insult during tooth preparation, less periodontal irritation because all margins of the crown are placed supergingivally, the vitality test can be done on the unprepared surfaces, easy finishing by dentist & oral hygiene by patient.

Disadvantages: Recurrent caries along to cavosurface line angle, possibility of showing gold especially in the lower anterior & posterior teeth, and difficulty in preparation compared to other types of crowns, limited adjustment can be done in the path of placement.

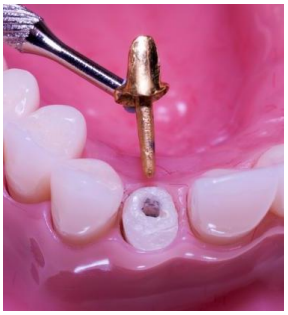
Telescopic retainers

Design involves fabrication of two copings one over the other. The internal or primary coping function to modify the morphology of tooth, changing the path of insertion, while the secondary or external coping to fit over the primary one. It is recommended when the path of insertion of FPD does not coincide with long axis of abutment.



Post crown

It is a fixed artificial restoration which replaced the coronal portion of the natural tooth completely. It retained by a mean of post (dowel) that extended and cemented to the root canal space of endodontically treated tooth. The post crown will reinforce the remaining tooth structure against forces by distributing the forces to the supporting tissue. It is indicated for endodontically treated abutments, abutment tooth with short clinical crown & realignment of malposed abutment. For multi-rooted posterior teeth, the post should be placed in the largest canal. Ex, the palatal canal in maxillary molar, the distal canal in mandibular molars, and the buccal in maxillary premolar.





The retention of post crown depends on:

1) Taper of the root canal: parallel-sided preparation is more retentive than tapered one (diverge occlusally)

2) Post length: The longer length the more retention (2/3 length of root, equal to length of clinical crown, 4-5 mm from apex, 8 mm deep from CEJ)

3) Post diameter: One third the root diameter at CEJ and should be at least 2 mm less than root diameter at mid-root area

4) Post surface texture.

Factors affect the selection of a tooth for post crown retainer:

The root of the abutment must have sufficient length, width and without sharp angulations in the middle third. The root should be without internal or external resorption. Good quality of root-filling which must be well-condensed especially in the apical 3rd of the canal.

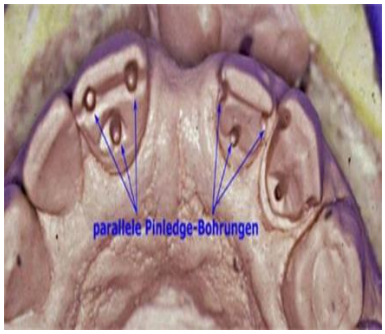
Resin bonded retainers:



It's the most conservative retainer that requires minimal tooth preparation, acid etched, aesthetically attractive, economical & do not irritate soft or hard tissues.

It is indicated as retainers when the abutment tooth has sufficient enamel surface for etching. It stabilizes teeth after orthodontic treatment. But contraindicated in patients with sensitivity to base metal alloys, when the facial aesthetic of abutment is not efficient, inadequate enamel surface to bond (caries, existing restoration, attrition), & in thin incisors.

Pinledge: A partial veneer retainer. The preparation incorporating pins holes to provide retention. It is indicated when the anterior teeth are not damaged, high aesthetic requirement, when proximal grooves are impossible to prepare, also to alter lingual contour of maxillary anterior teeth.



Inlay

A fixed intracoronal restoration made outside of a tooth to correspond to the form of the prepared cavity, which is then luted into the tooth. Inlay may be used as a single tooth restoration or as a minor retainer for FPD. They made up of gold alloy or ceramic material. It is contraindicated in patient with high caries index, poor oral hygiene, MODs & poor dentin support that require wide preparation.





Onlay

A restoration that restores one or more cusps and adjoining occlusal surfaces or the entire occlusal surface and is retained mechanically or by dental adhesive. It is used to restore extensively damaged posterior teeth that needs wide mesio-occluso-distal restorations. It can be used as a retainer for FPDs. It is contraindicated in patient with high caries risk, poor oral hygiene, short clinical crown, extruded tooth and in bruxism.



