Crown & Bridge Prosthodontics

Lecture 9 & 10 **Prof. Dr. Adel F. Ibraheem**

Clinical Try-In & Adjustment;

After the lab. procedure has been complete , the crown restoration is now ready to be tried in (checked on the prepared tooth inside patient mouth)prior to final finishing & cementation.

- **With or Without Anesthesia**

  The procedure can be accomplished in most patient without anesthesia, It give us the benefit of unimpaired tactile sensation that is of great value during occlusal adjustment. So Without Anesthesia Try-in procedure is better but sometime we use anesthesia if the patient unco-operative.

Pre-operative evaluation of crown or bridge on its die

- *Checking of the crown on the cast before trying it in the patient*
- *Preferable with a good light and under magnification*
- *The restoration should seated on the die without any pressure*

Prior to Try in procedure ,the inner surface of the restoration is inspected for :

- *nodules, bubbles might interfere with seating of the restoration on the die should be removed using a small round bur*
- *No contact should exist between the die and the internal surface of the restoration . A uniform space is necessary for the luting agent to spread evenly. Any contact(s) must be identified and relieved by selective grinding of the internal surface.*

Seating The restoration on the prepared tooth o(teeth) :

1. *Remove temporary restoration and clean the prepared tooth from any remnant of cement because it will interfere with seating of restoration. Instruments use to remove temporary restoration;*
   a. *Backhaus towel clamp or*
   b. *GC Pliers*
2. *Seat the restoration on the prepared tooth with pressure.*

Evaluation Sequence of the seated crown

1. *Proximal contacts*
2. *Marginal integrity*
3. *Retention & Stability*
4. *Occlusion*
5. *Polishing or Characterization and glazing*

1. Proximal contacts

- The location, size, and tightness of a restoration's proximal contacts should resemble those of the natural teeth.
- Excessive contact prevent the complete seating of the restoration and cause marginal discrepancy
- Open contact lead to food impaction
- The use of unwaxed floss is a method to compare the contacts with others in the dentition
- The use of 0.05 mm shim stock (thin Mylar film) is probably a more reliable indicator of proximal contact.
- **Satin finish** helps to identify Excessive tightness in metal restoration, Shiny spot will appear where binding occurs Shiny spot will appear, where adjustment is necessary.

How to Examine the inter proximal contact area

It should be tight as the other in the mouth. Dental floss is used to check the interproximal contact by passing it between the restoration and the adjacent natural teeth, it should have slight resistance otherwise we have either;

a) Heavy resistance; the dental floss cant pass through the contact, this indicate that the contact is heavy and it must reduced.

b) No resistance; however if the floss passes easily, it indicate that the contact area is under contoured (deficient contact).

How to correct

- *A metal crown or retainer with a deficient proximal contact can usually either you have to repeat the restoration or to correct this defect by adding solder to that area.*
- *Porcelain restoration*
  - *The area of contact can be identified with red pencil or thin marking tape.*
  - *A tight proximal contact in unglazed porcelain is easily adjusted with a cylindrical stone.*
  - *If adjustment of a glazed restoration is needed, it can be done with diamond-impregnated silicone points or diamond polishing paste*
  - *A deficient proximal contact correct by adding porcelain (lab)*

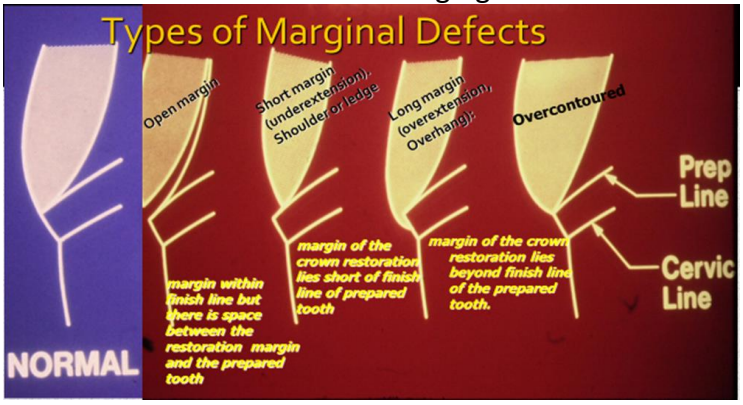
If the contact area is perfect and the crown is not seat completely this might mean that, ***there is interference*** *from inside (metal bubbles or undercut) we use* ***pressure indicating paste (****special elastomeric detection pastes such as silicon wash) or spray to identify the interferences. We place it into the inner surface of the crown restoration, the crown were then seated on the prepared tooth with pressure , the restoration were then removed and inspected for any pressure (shiny) area which indicates an interference area that should relieved*

2. Evaluating Complete Seating ;

The margin of the restoration is the most critical area of the restoration, we should have complete fitness between the restoration margin and finishing line of the preparation.

Types of Marginal Defects

1. Short margin (under extension, Shoulder or ledge);
   Margin of the crown restoration lies short of finish line of prepared tooth
2. Long margin (overextension, Overhang);
   Margin of the crown restoration lies beyond finish line of the prepared tooth.
3. Open margin;
   Margin within finish line but there is space between the restoration margin and the prepared tooth
4. Overcontoured;
   Margin within finish line but the contour of gingival third show excessive bulk.



Poor fitting margins will lead to:

- *Cement dissolution*
- *Plaque retention and affect the health of gingiva*
- *Recurrent caries*

How to check

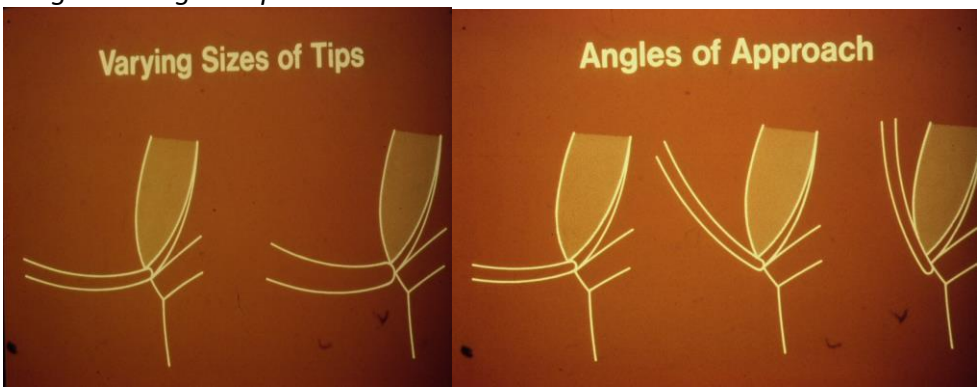
To check the marginal integrity of the crown restoration

- **Visual**

  This indicate especially for the supra gingival margin or margin that have easy access to evaluate by the operator eyes that might be:

  - Direct or indirect visual (mirror)
  - Use of Magnification apparatus such as eye loops or microscop.
- **Radiographic**
  - *Use to detect Interproximal margins that cannot seen by eye*
  - *Angle of beam (parallel technique to detect interproximal margin)*
- **Explorer**
  - *Size of tip*
  - *Angle of approach*

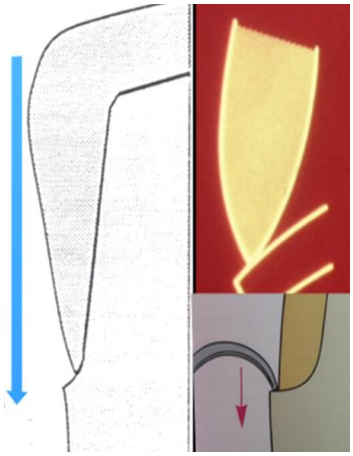
Probe can be used to check the marginal integrity of the crown restoration, especially subgingial margin, varying tip size probes should be used. Varying approaching angle should be apply during checking with probe.



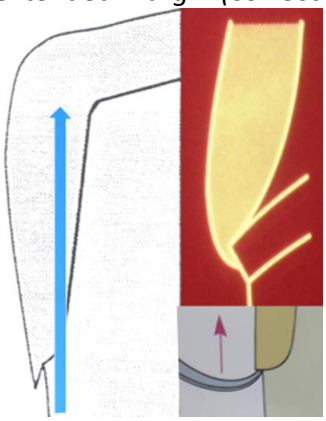
To check the **marginal integrity** of the crown restoration , **sharp pointed probe** (varying tip size) should be move in a two direction (varying approaching angle) , the direction of the movement and the angle of approach during checking with probe is very important .

How to check ;

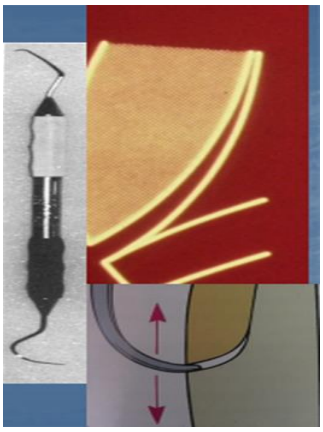
1) *Move probe from the restoration toward tooth surface, if it passed smoothly without any interpretation the margin is OKY however if there is any interpretation during this movement--- this indicate under extended margin.*



2) *Move from tooth surface toward restoration margin , if the probe catch by the margin, this indicate over extended margin (correction might lead to open margin)*



3) *If the probe passes smoothly in the two direction this mean the margin extension is correct.*



4) *if there is space between the restoration and tooth surface at area of f.l. & probe can go in ,this mean open margin*

3. Retention and stability

- The restoration should then be assessed for Stability on the prepared tooth. And it should not rock or rotate when force is applied. If instability is due to a small positive nodule it can usually be corrected, however. If instability due to distortion, remade will be necessary

4. Occlusion

- After complete seating, adjust the occlusal relationship in all mandible movements (centric and eccentric) using articulating paper.
- Any occlusal Prematurity should be relieved
- Occlusal adjustment can be done using high speed diamond burs
- For those that are out of occlusion, the treatment is remaking (metal) or refiring (Porcelain)

- *Now for metal crown(gold) restoration is ready for* **Margin finishing;**

Objectives; is to obtain at least ome mm wide margin that is closely adapted to the tooth surface at the area of finish line--- micro leakage.

a) ***Sub gingival margin*** *can be finish on the die using burnisher, no intra oral finishing is desirable because of the risk of damaging the tooth and the periodontal tissue.*

b) ***Supra gingival margin*** *can be finished directly on the tooth , margin adaptation can be improved by using burnisher or dull bur.*

5. Polishing or Characterization and glazing

- **Metal restoration.**

Purpose of Polishing;

Objective *is to provide smooth shiny restoration surface that will be less susceptible to plaque accumulation or deposition. polishing provide a restoration that have (purposes);*

1) Glossy surface
2) Plaque resistant
3) Tarnish/corrosion resistant
4) Good appearance

Surface defects and roughness are removed by grinding with abrasive particles bound on grinding stone or rubber wheel or paper discs or it applied as abrasive paste. The most commonly used abrasive is Tripoli on soft Robinson bristle brush

- **Porcelain in PFC and all ceramic crown restorations**

➢ **Contour & Shade of the restoration**

- *the evaluation should be done before glazing*
- *Moistened with water or saliva (to reflect the light same to glazed restoration)*
- *Verify shade & contour of the gingival third*
  Excessive bulk might cause periodontal disease

➢ **Incisal edge**

- *On anterior teeth, establish the proper position and shape of the incisal edge.*
- *This is important step in achieving good esthetics and function.*
- *Ideally, the incisal edges of the maxillary anterior teeth will follow the curvature of the lower lip when it is relaxed.*

➢ **Incisal embrasures**

Proper incisal embrasures enhance good separation between restorations, whereas their absence draws attention to reveals its artificial nature

➢ **Surface Texture Characterization**

- *should duplicate the surface detail & reproducing natural defects of the patient's natural teeth.*
- *Avoid over characterizing restorations (lead to artificial appearance)*

Glazing;

It is the application colorless glass powder to the fired crown or bridge surface produce a glossy surface & duplicate natural tooth surface luster and characterization.

Insufficient glazing will lead to:

- Rough surface may lead to abrasive wear of the opposing dentition
- Increase the rate of plaque accumulation.
- Inflammation of the soft tissues it contacts.
- Reduction in the strength of a ceramic restoration.

Polishing *An alternative to glazing is to polish the porcelain surfaces of the restoration.*

- *provides precise degree of luster and distribution than glazing.*
- *Polishing dental ceramics as way of restoring luster after adjusting by grinding.*
- *polishing can be done using : silicone wheels or diamond polishing paste.*

Cementation of crowns and bridges

Permanent Cementation

The mechanisms of holding a crown restoration on a prepared tooth using specific luting material (agent). it could be ***nonadhesive (mechanical) luting, micromechanical bonding , and molecular adhesion.*** *Dental cement doesn't contribute to the retention of the restoration.*

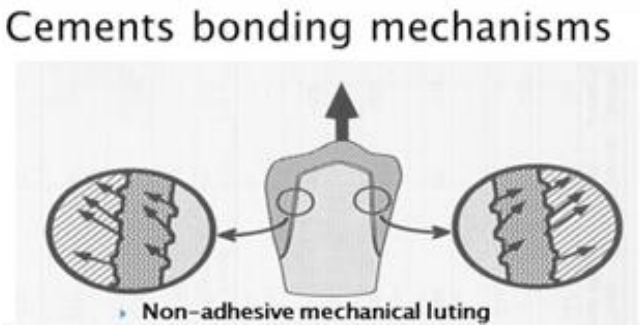
Luting Agent:

A material that acts as an adhesive to hold together the crown restoration to the tooth structure. Luting agents are designed to be either permanent or temporary.

Bonding Mechanisms

- ***Nonadhesive (mechanical) luting***

Involves filling of the macro-spaces between the tooth structure and the restoration with luting agent, when it sets (into the small irregularities between the opposing surfaces), it provides a mechanical bond (interlocking) that prevent the restoration from removal.

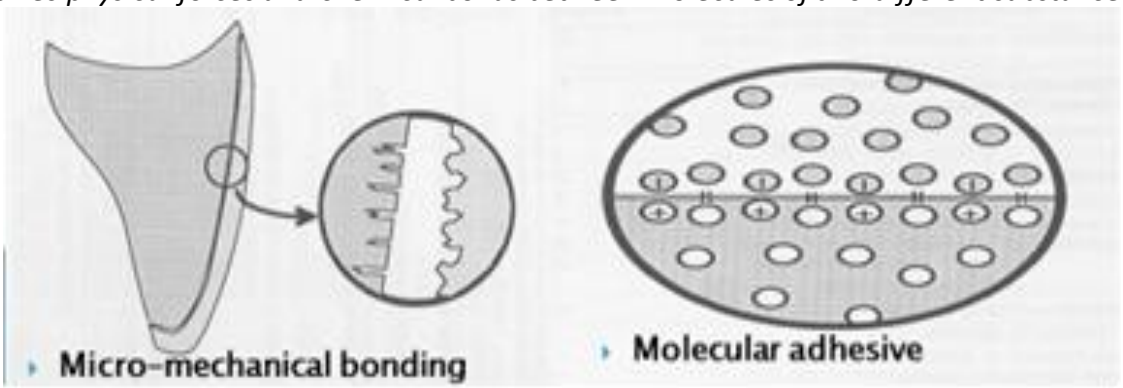


- ***Micromechanical bonding***

Involves deep irregularities that can be produced on enamel surfaces by etching with phosphoric acid solution or gel; on ceramics, by etching with hydrofluoric acid; and on metal, by electrolytic / chemical etching, and sandblasting

- ***Molecular adhesion***

Involves physical forces and chemical bonds between molecules of two different substances



Properties of ideal luting agent:

1) *Low film thickness(≤25µm)*
2) *Adequate strength(minimum 70 MPA)*
3) *Low viscosity & solubility*
4) *Adequate working time*
5) *Reasonable setting time*
6) *Should provide good sealing. And must be non-toxic to the pulp (Biocompatible)*
7) *Radiopaque*
8) *Adhesion to tooth structure and restorative materials*

Function of cement:

1) *To secure a lasting retention of the restoration to the prepared tooth.*
2) *To seal the gap against penetration of fluid and bacteria from oral cavity.*
3) *To act as an insulating barrier against the thermal and galvanic activity.*

Factors affecting the retention of the cemented cast restoration

1. *Geometrical relations of the preparation; retentive properties of the preparation (taper, height, surface area…..etc).*
2. *Biophysical factors relating to the restoration ; such as accuracy of fit, metallurgical characters, inside surface texture of the casting restoration*
3. *Mechanical properties of the luting agent; such as compressive strength, tensile strength, shear strength , adhesive property and film thickness*
4. *Difference in the co efficient of thermal expansion between tooth, restoration and cement.*

Dental Cementing (luting) Agents

Cements may be classified as soft or hard.

1) *Soft cements can be used for provisional cementation of definitive crowns when a trial assessment period is needed, for example if the occlusion or aesthetics is being significantly altered.*
2) *Hard cements There are used for definitive (permanent) cementation. There are essentially three types of hard cement: conventional, resin or a hybrid of the two.*
   a) ***Conventional cements** , rely on an acid-base reaction resulting in the formation of an insoluble salt (the cement) and water (e.g. zinc phosphate, zinc polycarboxylate and glass ionomer).*
   b) ***Resin cements**, set by polymerization**.***
   c) *Hybrid **cements** relay on acid base reaction and polymerization*

In fact we have different types of cement that are used as luting agents:

Zinc phosphate cement

It is the traditional luting agent that have proven itself after years of work, it has compressive strength of pulp (cavity varnish used to decrease that's effect) 14000-16000 PSI, with low PH at the time of cementing (about 3.5) which might irritate the pulp, come in two separate containers; powder and the liquid.

- ***Oldest Luting agent***
- ***Little effect on the retention of the restoration***
- ***Irritant to the***

Recommendations:-

1. *Good default cement for conventional crowns and posts with retentive preparations.*
2. *Working time can be extended for cementation of multiple restorations by incremental mixing and cooled slab.*

Zinc silicophosphate cement

Has compressive strength of 22000 PSI but it has highly acidic PH and affect the health of the pulp (irritant).

1. *Mixture of zinc phosphate & silicate cement.*
2. *Film thickness, compressive strength & tensile strength in the range of ZPHC with slight lower solubility.*
3. *Anti cariogenic property due to fluoride content.*
4. *Low PH & pulpal irritation, doesn't use now a day.*

Poly-carboxylate cement

adhere to enamel, dentine and stainless steel but not to gold alloy, high bond strength to enamel (1300 PSI) but its binding to dentine is considerably less 480 PSI. the setting PH is (4.8) , Attains a relatively neutral pH level after setting ,because of the large size of poly-acrylic acid molecule, it has less effect on the pulp, Low film thickness optimizes fit and marginal integrity of the crowns.

Recommendations:-

- ☒ *Traditionally used for vital or sensitive teeth, but no evidence to support efficacy (dentine bonding agents used to seal preparation prior to cementation may be a better option).*
- ☒ *Occasionally useful to retain an unretentive provisional crown.*

Glass ionomer cement

As for polycarboxylate cement but cement has similar acidity to zinc phosphate on mixing,has compressive strength of 18600 PSI(Low tensile strength), it bonds to enamel and dentine (to enamel more), it releases fluoride after setting which is indication of an ability to inhibit secondary caries. Sensitive to early moisture contamination. Has been accused of causing post-operative sensitivity but a controlled trial reports it is no worse than zinc phosphate

Recommendations:-

- ☒ *general prosthodontic use. Fluoride release may be beneficial for some patients. Avoid using glass ionomer with hypersensitive teeth.*
- ☒ *Used empirically for conventional crowns where patient has had a previously high caries rate.*
- ☒ *May be used as an alternative to zinc phosphate.*

RESIN LUTING CEMENT

They have wide range of formulation , can be classified basis of polymerization method (chemical, light cure, dual cure) & the presence of dentin bonding mechanisms.Chemical cure for metal restoration , light cure for ceramic restorations.

Advantages

1. *chemical Bond to the tooth structure*
2. *High strength*
3. *Reduce fracture of ceramic restoration*
4. *Low solubility*

Disadvantage

1. *Difficult to remove excess after setting*
2. *High cost*
3. *Irritant to the pulp*

Recommendations:-

1. *Must be used with or incorporate an effective dentine bonding agent.*
2. *Material of choice for porcelain veneers, ceramic crown & composite restoration and resin bonded ceramic crowns.*
3. *May be used to improve retention where preparation geometry sub-optimal.*

Types

1) *Adhesive Resin Cement*

- ▶ *Two component system - one bottle (self-etch), one syringe.*
- ▶ *Time-consuming, etching, bonding.*
- ▶ *Sensitive proccedure*

2) *Self-adhesive resin cement*

- *One component type*
- *Time-saving, no etching, or bonding.*
- *Easy to use*

Resin modified glass ionomer cements and compomers

Resin modified glass ionomer (RMGI) cements are a hybrid of traditional glassionomer cement with small additions of light curing resin and generally have the advantages of both , combine the strength and insolubility of resin with the fluoride release of GIC. They were introduced with the aim of overcoming the moisture sensitivity and the low strength of conventional glassionomers.

Compomers are also composed of resin and glass ionomer but are more closely related to composites with the glassionomer setting reaction occurring slowly as moisture is absorbed into the set resin matrix.

The use of RMGIs for luting purposes is becoming more popular because of their relatively high bond strength to dentine, and their ability to form a very thin film layer. RMGIs leach fluoride, but it is unclear how useful this is in preventing secondary caries formation.

- *Sustained fluoride release.*
- *Moisture tolerant.*
- *Low solubility*
- *Low microleakage*
- *Less post cementation sensitivity*

Recommendations:-

1. *Worth trying for metal or metal ceramic crowns especially where preparation retention is border line.*
2. *Currently unclear which RMGI cements can be used safely with ceramic crowns &post, delayed cement expansion might result in ceramic fracture or root fracture.*

Delivery system

1)*Hand mixing* ***2)****Applicap / maxicap capsule* ***3)****Auto mix (syringe or clicker dispenser)*

The selection of cement for placement of cast restoration is not clear cut decision.

The factors that determine cement type include:

1) *Restoration material of the crown and its strength*
2) *esthetic demands*
3) *ability to maintain a dry field*
4) *chewing forces (anterior/posterior, bruxism)*
5) *tooth structure remaining*
6) *preparation design (retentive/no retentive)*
7) *location of margin*

<u>Restoration Material Types</u>

Choosing of cement material Depend on the strength of the restoration so;

- *Weak restorations, e.g. all porcelain or all-composite crowns, inlays, onlays, and veneers, must be adhesively bonded with strong cements.*
- *strong (metal) have sufficient strength to allow the use of any cement type.*
- *Most porcelain-fused-to metal crowns are cemented with traditional luting cements*

Non-adhesive mechanical luting Zinc phosphate cement is used

1) *When maximum mechanical retention is required*
2) *The pulp of the tooth is of no concern*
3) *Also we use it on endodontically treated teeth or teeth with heavy amalgam or composite filling.*

However** more biologically compatible cement is used **(polycarboxlate, GIC, Compomer);

1. *On teeth whose preparation posses in-adequate retentive features*
2. *When the depth of the preparation raise some concern about the vitality of pulp.*

***Resin cements** are suitable for luting porcelain, cast ceramic, and composite restorations and recommended for teeth that have inadequate retention/resistance after preparation*

Temporary Cements

***Plain ZnOE Cements** based on zinc oxide and eugenol are classical soft cements .The eugenol acts in a bacteriostatic or bactericidal function and arrest the production of toxin by the microorganism. **Eugenol limited application because it will inhibit the polymerization**. ZnOE is **not used for permanent cementation** because:*

1. *It has poor oral durability due to continuous eugenol loss.*
2. *Also it possess low compressive strength, so we use it for temporary cementation.*

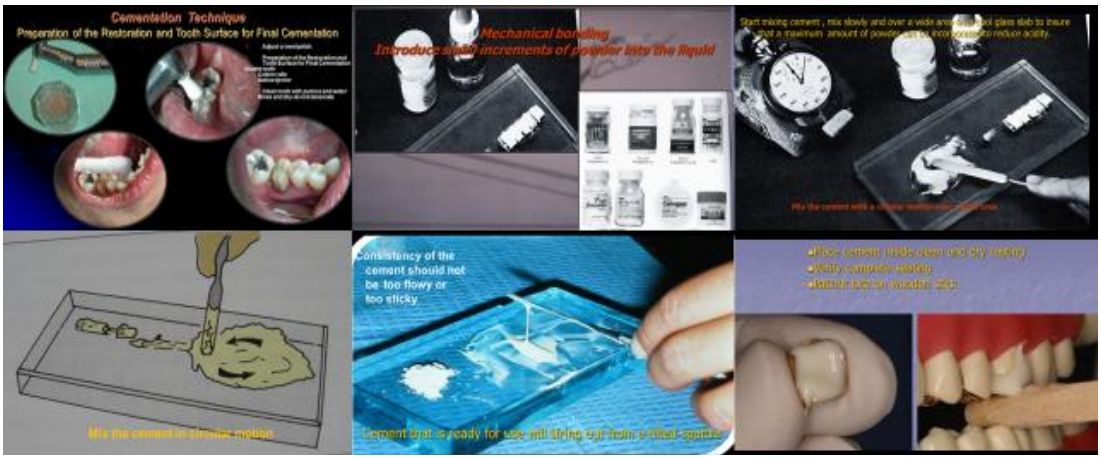
Temporary cement zinc oxide non-eugenol

- *Eugenol free for universal application because it will not inhibit the polymerization of resin*
- *Should have low film thickness help ensure an optimal fit*
- *Should have High adhesion to the tooth, to be removed easily for final cementation for time saving.*

Cementation Technique

When ZPC is usedas luting (for metal & PFM) :(mechanical bonding)

1. *Remove the temporary crown, cleaning of the prepared tooth pumice and water from any residues of cement. Finally rinse and dry-do not dessicate*
2. *Isolate the prepared tooth or teeth with cotton roll (dry field of operation).*
3. *Partial protection of pulp can provided by application of two layer of cavity varnish.*
4. *Start mixing cement, mix slowly and over a wide area on a cool glass slab to insure that a maximum amount of powder can be incorporated to reduce acidity.*
5. *Apply a coating of the cement to the inside of clean dry casting restoration, if there is any internal prep. Features such as grooves or boxes apply some cement on these areas of prep.*
6. *Seat the casting crown on the tooth with pressure and have the patient to apply force to the occlusal surface of the casting by biting on wooden stick or cotton roll for 3-4 minutes (to ensure complete seating).*
7. *After cement setting, remove any excess cement from the interproximal area, gingival cervical and underneath the bridge using dental probe and dental floss.*
8. *Check occlusion*



Cementation procedure for All-Ceramic Crown and bridge:

Luting of all ceramic crowns or bridges is dependent on the substrate being used Ceramic restorations available today are either etchable or non-etchable based on the core material.

- *Etchable are the silica-based ceramics: feldspathic, Leucite-reinforced feldspathic porcelain (IPS Empress®), and lithium-disilicate glass-ceramic (IPS e-max®).*

Using of 5% HFL gel is applied to the inner surface of the crown or bridge retainer for 20 seconds and then copiously rinsed with water. A primer is applied for 60 seconds. This primer allows bonding of the resin-based cement to the restorative material. Depending on the type of luting agent used (self-etch adhesive resin/adhesive resin) the tooth may or may not need to be pre-conditioned.

- *Non-etchable are the non-silica–based ceramics, such as aluminum oxide (Procera® AllCeram) and zirconium oxide.*

Just micro sand blasting ,application of silica bond and adhesive resin

- *follow the same steps 5 to 8 listed in Cementation technique when ZPC was used as luting agent:(mechanical bonding)*

Factors that influence the completeness of seating after cementation

1) *Viscosity of the cement.* **2)** *Morphology of the restoration.* ***3)*** *Vibration.*
4) *Seating force.* ***5)*** *Venting.*

Technique Tips

- *Fluff powder before dispensing. Hold liquid bottle vertically, and release each drop slowly to ensure equal size drops.*
- *For any powder/liquid cement, incorporate the powder thoroughly. Insure mix is homogeneous.*
- *Load the crown evenly with cement.*
- *Place crown cement-side done on your palm for the dentist to pick up and seat on the tooth.*
- *As the cement loses its gloss and start to set, it will have a stringy, non-sticky consistency. Start removing excess cement before it hardens.*
- *After removal of excess, use a piece of knotted floss and run it through the interproximal areas to remove remnant cement.*
- *Instruct patients to wait 1 hour after cementation.*