Clinical Try-In & Cementation

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. Try-in procedure involves three stages: firstly, pre-operative evaluation of crown or fixed bridge on its die, secondly seating on the tooth and finally evaluation of the seated restoration.

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 un co-operative.

Pre-operative evaluation of crown or bridge on its die

It is always worth checking the fit of the crown on the cast before trying it in the patient. In this way problems involving marginal fit, aesthetics and articulation can be anticipated prior to try in.

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

Prior to Try in procedure, the inner surface of the restoration (crown or retainer) 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 (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 prevents 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 can't pass through the contact, this indicate that the contact is heavy and it must reduce.
b) **No resistance;** however, if the floss passes easily, it indicates 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)*

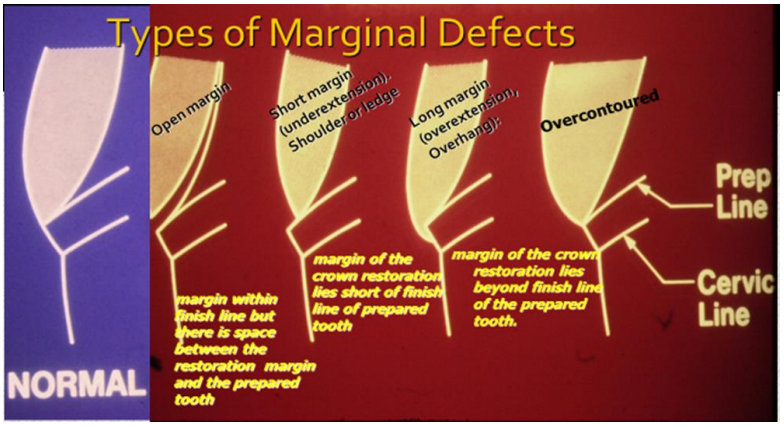
If the contact area is perfect and the crown is not seat completely this might mean that, ***there is interference*** *from inside (metal bubbles or undercut) we use* ***pressure indicating paste*** ***(****special elastomeric detection pastes such as silicon wash) or spray to identify the interferences. 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. Repeat this procedure till you achieve complete seating, if it fails refabricate the restoration.*

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. **Over contoured;**
   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

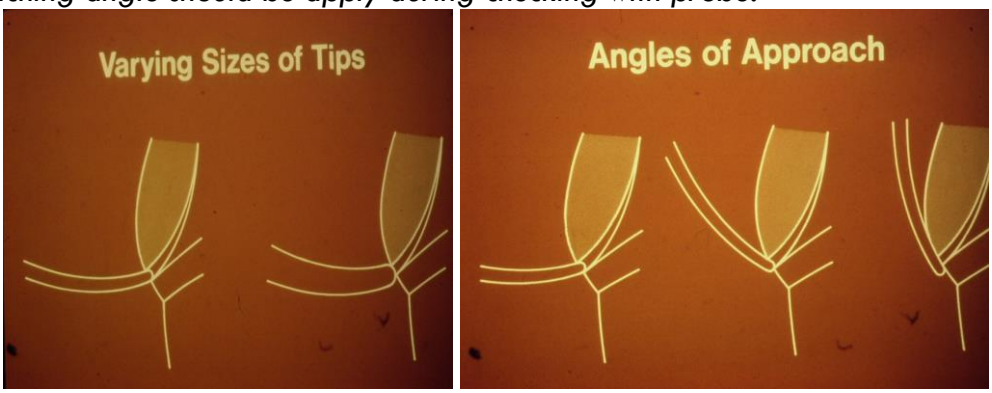
To check the marginal integrity of the crown restoration

- **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*

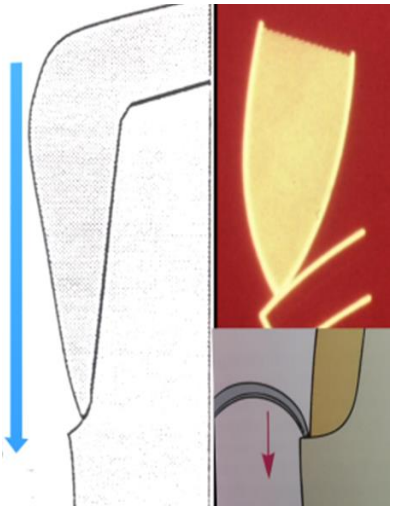
Probe can be used to check the marginal integrity of the crown restoration all around tooth, especially subgingial margin, varying tip size probes should be used. Varying approaching angle should be apply during checking with probe.



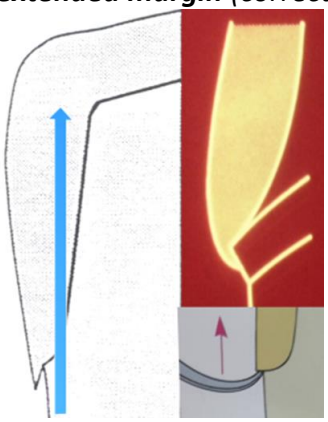
How to check the marginal integrity

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.

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****.*

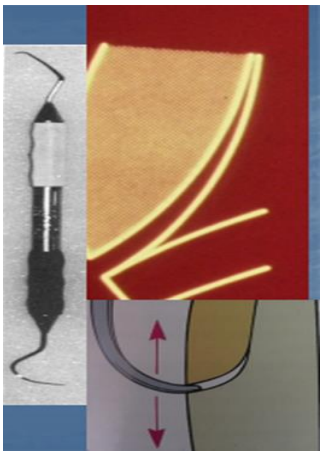


2) ***Move from tooth surface toward restoration margin****, if the probe catch by the margin, this indicate* ***over extended margin*** *(correction might lead to open margin)*



3) ***If the probe passes smoothly in the two direction*** *without catching or interpretation, 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 one 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 (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

- **Checking of 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;

glazing of porcelain dental restorations is a routine procedure designed to provide a transparent a glossy surface (shiny layer) & duplicate natural tooth surface luster and characterization (esthetic). *There are two methods for glazing* ***Self Glaze(AUTOGLAZING)*** *or* ***Over glaze(Add on glazing)****.* ***Self Glaze*** *is control heating of ceramic restoration so the top layer selectively melts and fuse, while,* ***Over Glaze*** *is a low-fusing glass liquid/paste applied all over restorations (all ceramic crown or bridge) surfaces and refiring .*

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

Having successfully negotiated the planning, preparation, impression and prescription of your crown, the cementation stage represents the culmination of all your efforts. This stage is not difficult, but a successful outcome needs as much care as the preceding stages. Once a restoration is cemented there is no scope for modification or repeat.

Permanent Cementation

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

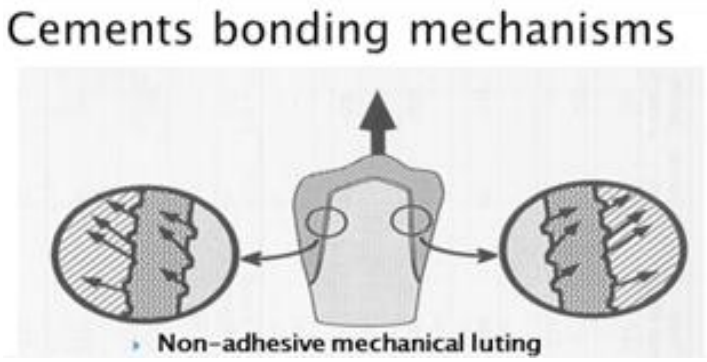
Luting Agent:

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

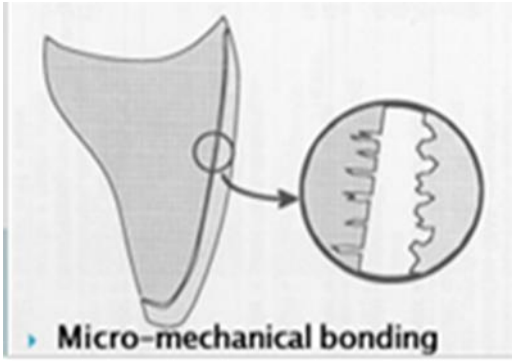
- ***Nonadhesive (mechanical) luting***

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.



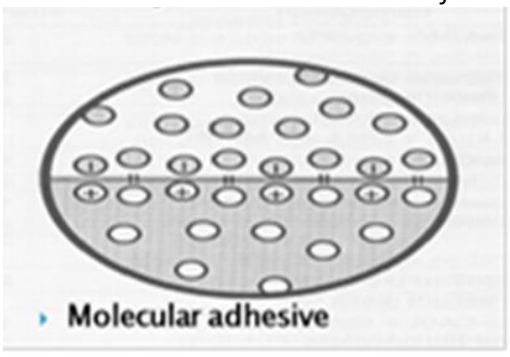
- ***Micromechanical bonding***

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** rely 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 pulp***

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.*

Polycarboxylate 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 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 procedure*

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 glass ionomers.

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 crown restorations is not clear cut decision.

Factors Affecting On Selection Of Cement:

With the availability of different types of cements, the decision of choosing the suitable luting agent and method can be confusing for the practitioner. Especially with the wide use of contemporary restorative materials such as new generations of highly translucent zirconia as well as reinforced-composites, it is important to take into consideration that the properties of such materials differ highly from metal or earlier generations of zirconia. Subsequently the choice of the luting agent must be appropriate to achieve satisfying results and long-term success. The factors that determine cement type include:

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

■ Restoration Material Types

Flexural strength and translucency of the restorative material are critical factors that influence the decision which luting agent to use. With the continuous introduction of new restorative materials to the dental market it is important to take into consideration the different mechanical properties of the various materials. The composition and the surface properties of the material have a decisive role in the ability to accomplish mechanical and/or chemical attachment to the restoration and therefore achieving required retention. Depending on the Flexural strength of the restoration, you can choose the type of cement material so;

- ***Weak restorations (Ceramic with low Flexural strength under 350 MPa)*** *e.g. all porcelain (glass-ceramic, hybrid-ceramics) and all-composite crowns, inlays, onlays, and veneers must be adhesively bonded with strong cements. This increase in strength has been credited either to the ability of the cement to fill defects and prevent crack propagation in the ceramic or to the better mechanical properties of the resin cement (increased strength and lower water sorption).*
- ***High-strength ceramics with flexure strength of more than 350 MPa*** *(lithium disilicate and zirconia restoration) adhesive luting is highly recommended. resin cements may be a better choice when dealing with translucent zirconia or zirconia restorations with minimal occlusal thickness. This is because resinbased cements allow better stress distribution when loaded, can inhibit crack formation, and optimize overall assembly strength.*
- ***For metal restorations****, adhesive luting as well as conventional cementation can be used.*

■ Translucency (optical properties) of the restorative material:

The choice of an opaque conventional cement for cementation of high-translucent restoration should not be recommended as it can negatively influence the final esthetic results. To meet the increasing esthetic demands

- ***For all translucent ceramic restorations, adhesive luting is highly recommended.***
- ***For metal and opaque high-strength zirconia restorations, adhesive luting as well as conventional cementation can be used.***

■ Ability to maintain a dry field

Adhesive bonding procedures are technique sensitive and intolerant to contaminations, therefore the luting process needs a dry oral environment avoiding any contamination, such as saliva or blood, preferably using rubber dam, as any contamination can compromise the bond strength. Therefore, inability to maintain dry field as in case of subgingival preparation margins and posterior aspect of the mouth, particularly in the mandibular arch, is considered a contraindication for traditional full-adhesive bonding.

■ Chewing forces

For some ceramic crown materials, it is necessary to bond the crown to tooth structure to strengthen the restoration. Adhesive bonding with composite resins and proper treatment of the abutment tooth and the ceramic bonding surface increase fracture resistance of ceramic restorations, improve retention, and reduce microleakage.

■ Preparation design

- ***Non-adhesive mechanical luting;*** *Zinc phosphate cement can be used*
  1) ***When tooth preparation provides high degree of mechanical retention***
  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 possess in-adequate retentive features*
2. *When the depth of the preparation raises some concern about the vitality of pulp.*

- ***Resin cements*** *are suitable for bonding porcelain, cast ceramic, and composite restorations and recommended for teeth that have inadequate retention/resistance after preparation and non-retentive minimal-invasive restorations. The clinician's choice to bond a crown may depend on several clinical factors, such as the need for additional retention, the need to improve the strength of the crown, and whether adequate isolation can be achieved.*

- ***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 possesses 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 used as 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 desiccate*
2. *Isolate the prepared tooth or teeth with cotton roll (dry field of operation).*
3. *Partial protection of pulp can have 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*



Technique Tips

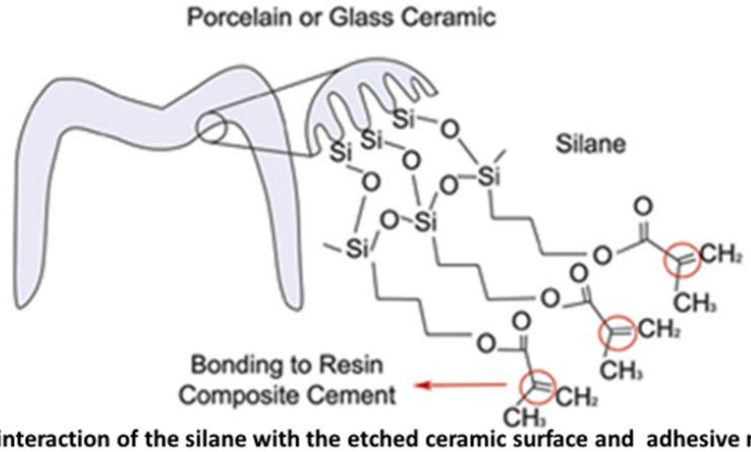
- *Fluff powder before dispensing. Hold liquid bottle vertically, and release each drop slowly to ensure equal size drops.*
- *For any powder/liquid cement, incorporate the powder thoroughly. Insure mix is homogeneous.*
- *Load the crown evenly with cement.*
- *Place crown cement-side done on your palm 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.*

Cementation of All-Ceramic Crown and bridge: **(*Cementing or Bonding?)***

Due to inherent brittleness, the behavior of ceramics in the oral cavity under functional stress is very different from metals. Excessive forces and surface damages may lead to fractures and cracks. Adhesive bonding with composite resins and proper treatment of the abutment tooth and the ceramic bonding surface increase fracture resistance of ceramic restorations, improve retention, and reduce microleakage. Clinical and laboratory bonding protocols must be follow depend on the type, composition, and properties of the ceramic. Ceramic restorations available today are either etchable or non-etchable based on the core material.

- ***Etch-able are the silica-based ceramics: feldspathic, Leucite-reinforced feldspathic porcelain (IPS Empress®), and lithium-disilicate glass-ceramic (IPS e-max®) should always be resin-bonded and treated with acid-etching and silane coupling-agent application.***

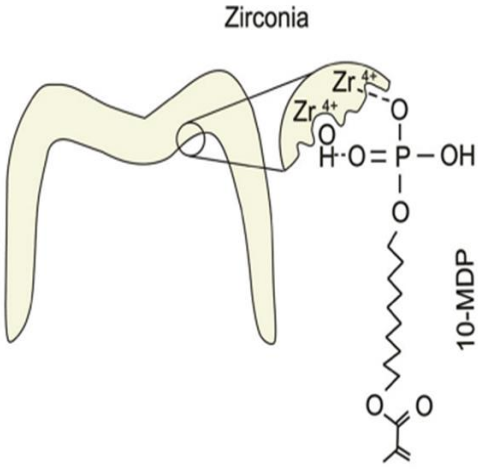
  *Etching is done **by using of 5% HFL gel** applied to the inner surface of the crown or bridge retainer for **20 seconds** and then copiously rinsed with water. **A primer** (silane coupling-agent) is applied for **60 seconds**. The primer allows bonding of resin cement to the restorative material. **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**.*

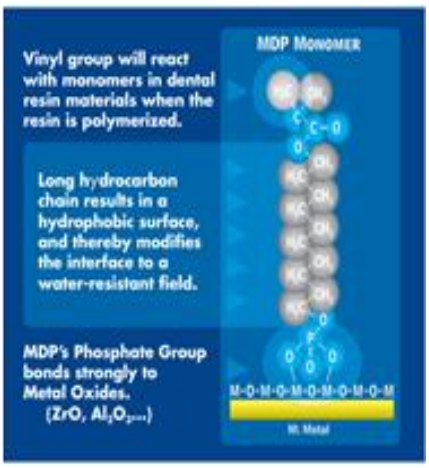


Chemical interaction of the silane with the etched ceramic surface and adhesive resin. Note the formation of Si - O - Si bonds on the surface of the restoration. At the opposite end of the silane molecules, the methacrylate groups react with unreacted monomers in the resin composite cement by breaking of double bonds (circled in red).

- ***Non-etch able are the non-silica-based ceramics, High-strength, metal-oxide-based ceramics such as aluminum oxide (Procera® AllCeram) and zirconium oxide.*** *Strong agreement state that* ***a combined micromechanical and chemical pretreatment is necessary for long-term durable resin bonds to zirconia. Conventional or translucent*** *zirconia restorations can be* ***bonded without pretreatment****, but a physical surface* ***pretreatment*** *prior to cementation is* ***strongly recommended****. The* ***two most*** *commonly used* ***methods*** *are* ***based on grit-blasting, either*** *using* ***alumina powder*** *or* ***silica-coated alumina particles*** *(tribochemical silica-coating). If* ***no pretreatment*** *or* ***grit-blasting using alumina*** *powder is used, an* ***adhesive resin*** *composite cement system that* ***contains 10-methacryloyloxydecyl dihydrogen phosphate (10-MDP)*** *should be* ***used*** *because conventional silane coupling agents cannot bond to metal-oxide ceramics.* ***Air-particle abrasion*** *with* ***Al2O3 (grit-blasting using alumina powder)*** *is both* ***effective*** *and practical to* ***provide*** *long-term* ***durable bond*** *strengths* ***to high-strength ceramics****. Adhesive resin composite cements or ceramic primers containing* ***10-MDP*** *are* ***indicated because*** *10-MDP, the most promising* ***functional monomer****, forms a relatively* ***stable chemical bonding*** *with the demineralized* ***tooth (through reaction between the hydrophobic 10-MDP parts with collagen)*** *and with* ***zirconia (through reaction between the phosphate ester groups of 10-MDP with the hydroxyl groups on the passive zirconia surface)****. Alternatively,* ***if tribochemical silica-coating (silica-coated alumina particles) is employed****, creates an irregular silica layer on the ceramic surface when the* ***special silica-coated alumina powder is blasted****. It should be* ***followed*** *by rinsing, air drying and the* ***application of silane*** *(silane coupling-agent), which enables chemical adhesion to any resin composite adhesive cement (silica particles bonded to the surface of zirconia-based ceramics, and a silane coupling agent with a resin cement system bonded to the silica-coated surface).*

Chemical interaction of the 10-MDP monomer with the roughed zirconia surface obtained by grit-blasting. Ionic and hydrogen bonding may occur between 10-MDP and zirconia - here both possibilities are illustrated, but they may also occur separately.





Cementation procedure :(Adhesive Bonding)

1) *Remove the temporary crown, cleaning of the prepared tooth pumice and water from any residues of cement. Finally rinse and dry*

2) *Isolate the prepared tooth or teeth. (inability to maintain dry area is considered a contraindication for traditional full-adhesive bonding)*

3) *Treat the internal surface of the restoration as appropriate for its composition.*

4) *Apply bonding agent to the internal surface without curing, if this is specified by the manufacturer.*

5) *Etch the prepared teeth with 35% or 37% phosphoric acid (H3PO4) (15 s for dentin, 30 s for enamel). Tooth tissues do not possess any natural affinity to dental ceramics. This is why proper pretreatment and adhesive resin composite cements are vital when bonding ceramic materials to the tooth, so, by Application of phosphoric acid increases the surface energy of the dentin by removing the smear layer and promoting demineralization of the most superficial layer of hydroxyapatite crystals. The resin monomers infiltrate the water-filled spaces between collagen fibers, which results in a hybrid layer composed of collagen, resin, residual hydroxyapatite and traces of water*

6) *Gently wash and dry. Do not dehydrate the dentin.*

7) *Apply a thin layer of bonding agent on the cavity without curing.*

8) *Apply a coating of the resin cement to the insides (fitting surface) of crown restoration.*

9) *Insert the restoration into the prepared tooth (abutment teeth) and remove excess cement.*

10) *Apply light-curing for 10 s, and then remove excess resin cement from the proximal area (with dental floss).*

11) *Apply light-curing for 40–60 s per surface.*

12) *check occlusion. Adjust if necessary.*

13) *Finish and polish with fine diamonds and rubber points.*



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.*

Technique Tips
Preparation:

- *After try-in of zirconia crown restoration, the saliva should be cleaned off with a strongly alkaline zirconia cleaner. These cleaners, such as ZirClean™ (BISCO), neutralize the ionic bond between saliva phosphates and zirconia.*
- *Rinsing with water, or the use of acetone and alcohol, is not effective in cleaning zirconia surfaces that have been contaminated with saliva*

- ***Choice of cement:***
  - ***Never use light-cure only resin cement with zirconia-based ceramic restorations.***
  - ***Use light-activation whenever possible - dual-cured resin cements typically, have increased flexural strength and bond strength when activated with a light vs. self-curing only.***
  - ***Translucent shades of resin cements may be sensitive to ambient light.***
  - ***Resin cements should not be applied directly on exposed pulp or dentin that is close to the pulp.***
  - ***Self-adhesive resin cements are contraindicated where there is not enough retention.***

➢ ***Excess cement is easy to remove after light curing, but hard to clean up if you light cure too long.***

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.*