Cementation

Permanent Cementation

Dental cement doesn't contribute to the retention of the restoration. It is used only to fill the micro-spaces between the tooth structure and the restoration when it sets (into the small irregularities between the opposing surfaces), it provides a mechanical bond (interlocking) that prevent the restoration from removal.

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 casting;
   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, casting and cement.

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.

Properties of ideal luting agent:

1) Should have good working and setting property.
2) Adequate strength.
3) Compressible into a thin layer.
4) Should provide good sealing. And must be non-toxic to the pulp.
5) Should adhere well to the inner surface of the restoration.
6) Low viscosity and solubility.

Dental Cementing (luting) Agents may be classified as soft or hard.

1) ***Soft cements*;** 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*;** 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**.**

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

Zinc phosphate cement

It is composed of ZnO powder and phosphoric acid, it has compressive strength of 14000-16000 PSI, with low PH at the time of cementing (about 3.5) which might irritate the pulp.

Advantages:-

1. Good compressive strength (if correctly proportioned).
2. Good film thickness.
3. Reasonable working time.
4. Resistant to water dissolution.
5. Long track record.
6. No adverse effect on pulp although initially acidic.

Disadvantages:-

1. Low tensile strength
2. No chemical bonding
3. Not resistant to acid dissolution

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 ZPC with slight lower solubility.
3. Anti-cariogenic property due to fluoride content.
4. Low PH & pulpal irritation.

Poly-carboxylate cement

adhere to enamel, dentine and stainless steel but not to gold alloy, the setting PH is (4.8) but because of the large size of poly-acrylic acid molecule, it has less effect on the pulp, high bond strength to enamel (1300 PSI) but its binding to dentine is considerably less 480 PSI.

Advantages:-

1. Good compressive strength (if correctly proportioned).
2. Adequate working time.
3. Bonds to enamel and dentine.
4. Adequate resistance to water dissolution (but less good than zinc phosphate).
5. Reasonable track record.
6. No adverse effect on pulp and less acidic than zinc phosphate on mixing.

Disadvantages:-

1. Low tensile strength
2. Can deform under loading
3. It is difficult to obtain low film thickness
4. Not resistant to acid dissolution

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

has compressive strength of 18600 PSI and it bonds to enamel and dentine (to enamel more), it releases fluoride after setting which is indication of an ability to inhibit secondary caries.

Advantages:-

1. As for polycarboxylate cement but cement has similar acidity to zinc phosphate on mixing.
2. Fluoride release.

Disadvantages:-

1. Sensitive to early moisture contamination.
2. Low tensile strength.
3. Not resistant to acid dissolution.
4. Has been accused of causing post-operative sensitivity but a controlled trial reports it is no worse than zinc phosphate

Recommendations:-

- ☒ 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. Good compressive and tensile strengths.
2. High tensile strength (relative to conventional cements).
3. Resistant to water dissolution.
4. Relatively resistant to acid dissolution.
5. Can enhance strength of ceramic restoration if bond obtained.

Disadvantages:-

1. Film thickness varies substantially between materials.
2. Excess material extruded at margin may be difficult to remove especially proximally.

Recommendations:-

- ☒ Must be used with or incorporate an effective dentine bonding agent.
- ☒ Material of choice for porcelain veneers, ceramic onlays and resin bonded ceramic crowns.
- ☒ May be used to improve retention where preparation geometry sub-optimal, but clinical studies needed to determine long-term success.

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.

Advantages:-

1. Good compressive and tensile strengths (if correctly proportioned).
2. Reasonable working time.
3. Resistant to water dissolution.
4. Fluoride release.

Disadvantages:-

1. Short track record.
2. May expand and crack overlying porcelain because of water absorption.

Recommendations:-

- ☒ Worth trying for metal or metal ceramic crowns especially where preparation retention is border line.
- ☒ Currently unclear which RMGI cements can be used safely with ceramic crowns.

Conclusion: no one cement material is perfect. Selection of luting agent to be used for a given restoration should be based on a basic knowledge of the materials available, the type of restoration to be placed, the requirements of the patient and the expertise & experience of the clinician.

The selection of cement for placement of **cast restoration** is not clear cut decision. Zinc phosphate cement is mainly used Because of its long-time use and excellent clinical performance.

Resins are useful for **all-ceramic, veneers** and for metal or metal-ceramic restorations where retention and resistance form is compromised.

Plain ZnOE Cements based on zinc oxide and eugenol, is classical soft cements. 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.

To improve the properties of ZOE, modified ZOE cement was introduced by adding 2-ethoxybenzoic acid (EBA),aluminum oxide and PMM

Cementation Technique

Cementation procedure for ZPC:

1. Remove the temporary crown, cleaning of the prepared tooth from any residues of cement.
2. Isolate the prepared tooth or teeth with cotton roll (dry field of operation).
3. Partial protection of pulp can be 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 maximium 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 cervix and underneath the bridge using dental probe and dental floss.
8. Check occlusion