LINERS AND CEMENT BASES

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GOAL:

After complete caries removal, select and place suitable liner and base materials according to the biomechanics of the preparation, the clinical symptomatology of the pulp tissue, and the anticipated functional requirements for the restoration.

Clinical judgment regarding the use of various liners, bases and cements is made on the bases of:

- Remaining dentin thickness
- History of the case
- Restorative material to be used

PROCEDURES FOR MIXING AND PLACEMENT

A. COPALITE* (cavity varnish)

This material is **NOT** used any more on the clinic floor because of the new OSHA regulations. This product will be probably replaced on our clinic floor with a dental adhesive agent after further consideration.

B. CALCIUM HYDROXIDE:

MIXING:

1) Calcium hydroxide will be placed in the area next to the sinks.

2) Dispense **separate** 1-2 mm lengths of "**base**" and "**catalyst**" on small a **paper pad** (find it in section **C** of the 2nd drawer).

3) Mix with a clean applicator instrument to a **uniform color** (use **Calcium hydroxide applicator, item # 30**).

4) Apply a thin layer, **less** than **0.5 mm,** using a ball-tipped applicator **(Calcium hydroxide applicator, item # 30).**

C. ZINC OXIDE EUGENOL(ZOE) (Reinforced)

a- IRM* (Powder and Liquid): IRM is used as a temporary restoration in a cavity prepared for an amalgam or a composite restoration.

b- ZINROC* (Powder and Liquid): Zinroc has much lower compressive

and tensile strength than IRM. Zinroc is used as a temporary restoration in cavities prepared for inlays, or when it is possible to otherwise use an acrylic temporary.

* Brand names

NOTICE: Cavity varnish and ZOE should not be used with composite restorative materials (methyl-methacrylate) where they may affect the polymerization process.

MIXING:

1) You will find IRM in the area next to the sinks.

2) Use the **measuring scoop for dispensing the powdered cement**. Lightly fluff the powder in the bottle and fill the cup, leveling it with the blade of the mixing spatula (item # 31). Dispense **three cups of powder** onto the center of a parchment mixing pad (find it in your **Group Section Package)**. Place **four (4) drops** of liquid alongside the powder. Keep the orifice of the dropper perpendicular to the surface of the slab.

3) Use a **stiff-bladed spatula** (item # 31, heavy blade side, fat & short) to mix half of the dispensed powder with the liquid, and then continue to quickly incorporate the remaining powder as it is needed to reach a **heavy putty-like consistency. Mixing should be done under heavy spatulation pressure** utilizing a **folding motion**. After almost all powder has been incorporated and the mix is smooth, roll it into a rope with the spatula.

4) Apply with a suitable instrument and contour. Amalgam condensers are useful for placement and packing. A discoid/cleoid or spoon excavator (item #26, 27 and/or 20) can be used for contouring.

5) To remove IRM from cavity:

a- Use Rotary instruments (high speed **with water** is preferred). Remove the IRM, starting from the center of the cavity preparation laterally towards the walls.

b- Thin the IRM adjacent to the walls and CSM, and then fracture the IRM away using a spoon excavator.

c- In a class 2 cavity prep, separate the occlusal section from the proximal section using ahigh speed, then loosen it away using spoon excavator.

ZINC OXIDE-EUGENOL (A provisional restoration):

Questions and Answers:

What are the effects of heat, moisture and mixing proportions on the setting time of a zinc oxide-eugenol?

Room Temperature:

Q - Why does the surface of a setting mix of ZOE stay tacky when allowed to set on the pad?
A - Exposure to air severely retards or inhibits the setting reaction.

Mouth Temperature:

Q - How does an increase in environmental temperature affect the setting reaction of ZOE cement?
A - Speeds it up.

Q - Is the mixing technique for ZOE cement as critical as for zinc phosphate cement?
A - No; the reaction is not exothermic, so precautions to dissipate heat need not be taken.

Addition of Water:

Q - How does moisture influence the setting reaction of ZOE cement? Why?
A - Speeds up the reaction - water acts as an accelerator in the setting reaction.

Q - Why is the surface of the set mix in the mouth not as tacky as the one on the pad?
A - Moisture from the oral environment is drawn into the reaction.

Q - Clinically, how does this principle affect the placement of ZOE cement?
A - Longer working time is available in a dry field.

Improper Proportioning:

- Increased liquid to powder ratio causes slow setting
- Increased liquid to powder ratio causes a softer surface
- Increased liquid to powder ratio causes a weaker base
- Increased liquid to powder ratio causes a decreased workable consistency for use as a Provisional Restoration
- Increased powder to liquid ratio causes a stronger **Provisional Restoration**

D. ZINC PHOSPHATE CEMENT:

MIXING:

1) You will find Z. Ph. C. in the area next to the sinks.

2) Use the powder bottle **cap** as a measuring scoop. Pack **2/3** of the dome shaped cap with powder (Fig. 1) and dispense it on the lower right corner of the glass slab (find it in section C of the 2nd drawer), and another full cap on the upper right corner of the slab.

3) The powder (initial **2/3 bottle cap)** is divided into **six equal parts,** using the flexible blade, thin & tall, side of the spatula (item # 31).

4) Swirl the liquid bottle before dispensing **6 drops** of liquid onto the center of the slab beside the divided powder. Keep the orifice of the dropper perpendicular to the surface of the slab.

5) Mixing starts by carrying the first one-sixth portion of the powder into the liquid. The mixing area should cover **at least** half of the slab (use the flexible spatula to mix, item # 31).

6) At the end of **15 seconds,** the second portion of powder is incorporated. Each of the portions is spatulated for **15 seconds**

7) A **primary consistency*** is usually attained at the end of **90 seconds** (it may be that not all of the last sixth portion will be required or a slight additional amount of powder from the upper corner of the slab is required to achieve this primary consistency). When the mass is gathered together and the spatula is laid into it and withdrawn, the cement will **string up for 1 to 1 1/2** inches before breaking. **The primary consistency mix is used for inlay, onlay and crown cementation**.

8) **Secondary consistency** (**Cement base consistency**)
The unused powder from the **upper right corner** is now incorporated, perhaps in increments of **1/4,** and thoroughly mixed **until** a slightly **tacky but heavy putty like mass** is developed. The secondary consistency mix should be completed within **2 to 2 1/2 minutes** from the beginning of the mix. This secondary consistency demonstrates **a carving advantage, an ease of placement and decrease of setting time.**

9) **INSERTION-** The secondary consistency can be inserted and contoured with a condenser.

NOTE: Cement tends to stick to the instruments, but this can be prevented by dipping the instrument into the remaining dry cement powder.

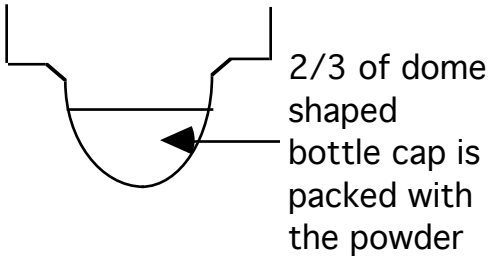

Fig. 1

Zinc Phosphate Cement (**Z.Ph.C.**):

Question and Answers:

What are the effects of temperature, liquid-powder ratio, consistency of the mix, and contamination with water on the setting time of Zinc Phosphate Cement?

Q - For what two reasons is the setting time of Z.Ph.C. an important property to measure?
A - (1) - indication of working time available
(2) - indication of physical properties of set cement

Q - What procedures must be taken in an effort to ensure standardization of the mix with optimum properties?
A - Cool slab; uniform P/L ratio; mixing over large area of glass slab; addition of small increments of powder at a time during the mixing.

Q - What could have taken place during the mixing procedure to introduce a large number of air bubbles into a cement mixture?
A - Mixing over a small area of slab; mixing too large an increment; failure to mix smoothly with a thin flexible spatula.

Q - If air bubbles are presented in the mixture, what does this suggest about the strength of such a mix?
A - Weaker than one with less voids.

Q - What is effect of increased temperature on the mix?
A - A mix of Z.Ph.C. will set faster under higher temperatures, with less working time available.

Q - What is the main difference between a primary mix and a secondary mix of Z.Ph.C.?
A - Secondary mix has a higher P/L (powder to liquid) ratio.

Q - Why does a secondary mix set faster than a primary mix?
A - More powder is available to react with a given amount of liquid.

Q - Is lowering the P/L ratio of a mix an acceptable way to gain working time? Why?

A - No; physical properties will be poor (lower powder to liquid ratio). Acidity will be greater.

Q - What effect would the placement of the above mix over exposed dentin have on vital pulp tissue?

A - Greater irritation and inflammatory response.

Q - What is the effect on setting time of contaminating zinc phosphate liquid with small amounts of water?

A - Faster setting time.

Q - From what possible sources could the open bottle or dispensed cement liquid become exposed to additional moisture?

A - Absorption of moisture from air with high humidity; use of a slab cooled below dew point; use of a slab not fully dried.

Q - What happens if a warm slab (100 F) is used for mixing Z.Ph.C.?

A - Reaction rate is accelerated to the point that a primary consistency is reached before all powder could be incorporated.

Q - How should the physical properties of this mix compare with those of a correct mix?

A - Poorer lower powder to liquid ratio obtained

E- GLASS IONOMER (GC Fuji Lining L.C.):

GI is proven to be:

a- Adhesive (Molecular bond to the tooth structure):
b- Fluoride releasing and
c- Cariostatic

There are two forms of GI are available:

a- Conventional Glass Ionomer:

Calcium fluoro-alumino-silicate glass + polyacrylic acid

b- Hybrid Glass Ionomer:

composite resin + glass ionomer. This glass ionomer has auto-cured glass ionomer components and light cured resin components.

WHAT TO REMEMBER ABOUT GLASS IONOMER:

- Very technique sensitive
- **Least** soluble of all dental cements when it is **set**

- **High** early SOLUBILITY (before it is **completely set**)
- Damaged by desiccation
- Requires moisture for **PROPER SETTING**
- Is hydrophilic in the putty stage (the stage that it is applied), **but it is also very soluble in this stage.**
- Lack of adequate moisture can*:

1- reduce adhesion to the tooth structure
2- retard or even stop setting
3- possibly cause tooth sensitivity

***There is a fine balance between enough moisture and too much moisture**

What is Adequate Moisture:

Hydrate the dentin before placement of GI with a WET COTTON PELLET and then BLOT DRY* (do not use compressed air). Blotting is not necessary if there is no **VISIBLE MOISTURE.**

FACTS ABOUT GI:

- Approximately **24%** of the set cement is water. Further water can be taken up by the water soluble calcium polyacrylate chain. However, if the cement is allowed to remain exposed to air, water will be lost. The water loss or water uptake is known as water balance.

-The initial set will be reached within 4 minutes, however, complete maturity and resistance to water loss will not occur for at least for 2 weeks or more

DIRECTIONS:

1) One level spoonful of powder + one drop of liquid.
Hold the liquid bottle vertically upside down. Allow air bubbles to escape before dripping. If the liquid clogs at the top of the nozzle, remove it with damp gauze

2) Mixing: Divide the powder into two equal parts. Incorporate the first portion into the liquid, and mix for about **5-10 seconds** (use the flexible spatula to mix, item # 31)**.** Then, add the second portion and mix the whole mass for **10-15 seconds**.

Total mixing time should not exceed 15 seconds.

3) Application*: Apply the mixture into the preparation with a calcium hydroxide applicator (item # 30). Apply 0.5mm thick. If the application exceeds 0.5mm in depth, use a **layering technique.**

4) Cure for 30 seconds with the curing light (cure thickness of .5mm at a time).

5) Check the set by using your explorer with light pressure it should not leave an indentation mark. If soft, cure for an extra 30 seconds.

*****If the remaining dentin over the pulp chamber **is less than .5mm,** a protective pulpal material should first be applied and then GI be placed (WHY?).

Reminder:

- Mix cement as quickly as possible. It needs the powder **just** be wetted.

- **Loss of gloss (surface shine)**: placement of the cement after loss of gloss will risk failure.

- No mechanical retention is needed for GI, it bonds to tooth structure.