بسم الله الرحمن الرحيم
Good Morning
Dental cement

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Introduction
Requirements of dental cement:

1- biological properties.

A. Non toxic and non irritant.

B. Bacteriostatic.

C. Protect the pulp.

D. Thermal insulation.

E. Chemical protection.

F. Electrical insulation.
2- solubility:

They should be insoluble in saliva.
3- Mechanical properties:

These must meet the requirements for the application of dental cements.
4- optical properties:
These also must meet the requirements for the application of dental cement.
e.g. translucent restoration.
5- bonding:

Bond strength of dental cement depends on:

- Strength of the dental cement.
- Surface texture of tooth and restoration.
- Design of the restoration.
6- Rheological properties:

The dental cement should give the suitable film thickness for application.
Classification of dental cements:

1- cements based on zinc oxide.

2- cements based on aluminosilicate glasses.

3- resin cements.
Cements based on zinc oxide

zinc oxide powder with

Eugenol------zinc oxide eugenol cement.

Phosphoric acid------zinc phosphate cement.

Polyacrylic acid------zinc polycarboxylate cement.
Cement based on alumino silicate glasses.

alumino silicate glasses + phosphoric acid--------

----- silicate cement.

alumino silicate glasses + polyacrylic acid ---------

----- glass-ionoimer cements.
Resin cements.

Others:

Varnishes and liners.

Calcium hydroxide.
Recent classification:

1- Oil based cements:
Zinc oxide eugenol.

2- Water based cements:
Zinc phosphate cement.
Zinc polycarboxylate cement.
Glass ionomer cent.

3- Resin based cements:
Resin cement.
Silicate Cements

- Silicate cements were introduced in 1903 as anterior esthetic filling materials. They are translucent.
- Silicates are attacked by oral fluids and in time degrade. The average life of a silicate restoration is four years.
- 1-25 years.
- Silicates are rarely used nowadays. This is due to development of better materials like composite resin and glass ionomer cements.
Applications

• Esthetic restoration of anterior teeth
• Intermediate restoration in caries active mouths.
Anticariogenic Properties:

The anticariogenic property is due to presence of 15% flouride. Flouride release is slow and occurs throughout the life of the restoration.
Zinc Phosphate Cement

Zinc phosphate is the oldest of the cementation agents.

It consists of powder and liquid in two separate bottles.
Classification:

• Type - I: Fine grained for luting, Film thickness should be 25 um or less.
• Type-II : Medium grain for luting and filling, Film thickness should not be more than 40 um.

Available As

• Powder and liquid system .
• Capsules of preproportioned powder and liquid.
Composition

Powder

• Zinc oxide 90.2%

Principal constituent

• Magnesium oxide 8.2%

• Other oxides (like bismuth trioxide, calcium oxide, barium oxide, etc.) 0.2%

Improves smoothness of mix

• Silica 1.4%

• Filler
• **Liquid**

• Phosphoric acid    38.2%
  Reacts with zinc oxide

• Water    36.0%
  Controls rate of reaction

• Aluminium phosphate or sometimes zinc phosphate    16.2%
  Buffers, to reduce rate of reaction

• Aluminium    2.5%

• Zinc    7.1%.
Setting reaction:

$$\text{ZnO} + 2\text{H}_3\text{PO}_4 + \text{H}_2\text{O} \rightarrow \text{ZN(H}_2\text{Po}_4)$$
Setting Time:
3-6 minutes.

Control of Setting Time by:
A/ Manufacturing process:

1. Sintering temperature: The higher the temperature, the more slowly the cement sets.

2. Particle size: Finer particles react more quickly as a greater surface area is exposed to the liquid.

3. Water content of liquid: Presence of excess water accelerates, whereas insufficient water retards the reaction.

4. Buffering agents: When added slow down the reaction.
B/ Factors under control of operator:

- Temperature: Higher temperatures accelerate the reaction
- P/L ratio: More the liquid, slower the reaction
- Rate of addition of powder to liquid: the reaction is slower if the powder is incorporated slowly.
- Mixing time: The longer the mixing time (within practical limits), the slower is the rate of reaction
Properties

Compressive Strength:

• Zinc phosphate cement is stronger (103.5 MPa) than zinc oxide-eugenol cement. The set cement gains 75% of its maximum strength in the first hour. Maximum strength is attained in the first day.

• The strength of zinc phosphate cement is sufficient when used as a base or luting agent. However, when it is exposed to the oral environment, e.g. temporary restorations, its brittleness and low strength causes it to fracture and disintegrate.
Modulus of Elasticity:

It is comparatively high. This makes it stiff and resistant to elastic deformation. This is necessary when it is employed as a luting agent for restorations that are subjected to high masticatory stresses.
• **Solubility and Disintegration**:

This property is important for cements used for permanent cementation., it shows low solubility 0.1-2.5% after 24 hours. However, in the mouth they show greater disintegration over a period of time. This shows that other factors are involved.

• **Film Thickness**:

For Type I - Film thickness not more than 25 um, for Type II - Film thickness not more than 40 um.
• **Thermal Properties:**
Zinc phosphate cements are good thermal insulators and may be effective in reducing galvanic effects.

• **Adhesion Property:**
The retention of a cemented restoration is by mechanical interlocking of the set cement with surface roughness of the cavity and restoration.
• **Biological Properties** :

  Pulp response-moderate. The acidity is high at the time of insertion. Three minutes after mixing, the pH is 3.5. It approaches neutrality in 24 to 48 hours.

  A thickness of dentine as great as 1.5 mm can be penetrated by the acid of the cement. If dentine is not protected against infiltration of this acid, pulpal injury may occur, especially during the first few hours. Pulp protection in deep cavities is needed.

• **Optical Properties** :

  The set cement is opaque.
Manipulation:

- Spatula used Stainless steel. Mixing time 1 min. 15 seconds.

- **Powder-Liquid Ratio: 1.4 gm/O.5 ml**: A cool glass slab is used in order to delay the setting and allow more powder to be incorporated before the matrix formation occurs. The liquid should be dispensed just before mixing.
Procedure
• Maximum amount of powder should be incorporated in the liquid to ensure minimum solubility and maximum strength. Note: An appropriate consistency is attained by addition of more powder to the liquid and not by allowing a thin mix to thicken.
Insertion

• The crown should be seated immediately and held under pressure till set. Field of operation should be dry. Varnish is applied at the margins, where the cement is exposed.
Applications:

- Luting of restorations (cementation)
- High strength bases
- Temporary restorations
- Luting of orthodontic bands and brackets.
Zinc polycarboxylate cement
presentation

a- traditional form: powder and liquid.

b- preproportioned capsules: for mechanical mixing.

c- water settable cement:

The polycarboxylic acid is freeze dried and added to the powder.
a) Basic components: primary zinc oxide, small quantities of magnesium oxide.

b) Acidic component: polyacrylic acid, which may be supplied:
   1) As a viscous aqueous solution of concentration 30-40%
   2) As a dry powder, blended with the basic components.

c) Additionally, some products contain stannous fluoride, alumnia and silica.
Setting reaction

This involves the formation of a salt, zinc polyacrylate. The set material is a cored structure containing a considerable quantity of unreacted zinc oxide.

Setting time:

a) This depends on the composition and method of manufacture of the powder and liquid.

b) A faster setting time is achieved at higher temperatures.
Manipulation

Powder /liquid 1.5:1 or 2:1.
Mixed on special paper using stainless steel spatula or using plastic spatula.
Creamy mix.
Using cool glass slap.
Properties
Biological properties

It is acidic but not irritant as phosphate cements.

a- weaker acid.

b- polyacid chains are too large.

c- Rapid rise of PH of mixed cement on setting to approach 5.5 -6 pH.
Film thickness

The film thickness of the polycarboxylate cement is slightly higher than that of zinc phosphate cement; it is about 25-45 microns.
solubility

0.01 – 0.02%

Less than zinc phosphate cement.
strength

Compressive strength 55 - 95 Mpa. Less than ZPC.

Tensile strength 3.5 – 7.5 Mpa more than ZPC.
Bonding

Most important advantage of polycarboxylate cements is their ability to bond chemically to enamel and dentine.

But mechanical bond to gold alloy.
Optical

Because of the present of zinc oxide, the material is opaque.
Application:

1- cementation of crown and inlay.

2- base under restorations.
THANK YOU