# DENTAL MATERIAL

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# ZINC POLYCARBOXLATE CEMENT

**The first cement that developed chemical bonding to tooth structures.**

## These cements are available in two forms:

**A. Conventional type: powder and liquid in two separate bottles.**

# COMPOSITION of the conventional types:

- **Powder**

**powder is mainly zinc oxide.**

**small quantities of magnesium oxide.**

- **Liquid**

**A-liquid is a viscous solution of polyacrylic acid in water (30% to 40%).**

**B. Other organic acids such as:**

**1) Itaconic acid to prevent gelation during storage.**

**2) Tartaric acid to control setting reaction.**

**C. $NaH_2PO_4$ to reduce polyacid viscosity and retard setting.**

## B. Water settable type

**1) Its powder is the same powder as that of the conventional type but the freeze- dried powder of the polyacid in one bottle.**

**2) Its liquid is either distilled water or weak solution of $NaH_2PO_4$.**

## Setting reaction:

**The setting reaction is the same, whether the polyacid is freeze-dried and subsequently mixed with water, or if the conventional aqueous solution of the polyacid is used:**

**1) When the powder and liquid are mixed together, the acid attacks the surface of ZnO powder particles and Zn ions are released.**

**2) These ions cross-link polyacid chains by combining with the COOH groups of the acid**

**Microstructure of set cement:** Cored structure consisting of an amorphous gel matrix in which unreacted ZnO particles are dispersed.

**Manipulation**

1) Waxed paper pad or glass slab and st.st. spatula is used for mixing.

2) Powder liquid ratio: Follow manufacturer's directions.

3) Dispense liquid just before mixing to avoid evaporation of water.

4) Rapidly incorporation most of the dispensed powder into the liquid and mix over a small area of slap to avoid destruction of formed gel.

5) The correct consistency is found in a mix that is viscous but will flow back under its own weight when drawn up with a spatula.

6) The mixed cement should be placed onto tooth surface before loosing its glossy appearance. Glossy appearance indicates a sufficient number of free COOH groups on material surface ready for bonding with tooth structures.

7) The excess cement that has extruded beyond the margins of the casting, should not be removed while the cement is in the rubbery stage, because there is danger cement pulling out from beneath the margins (open margin).

# Properties:

## I. Working and setting times:

1) It has shorter working time than zinc phosphate.

2) Lowering the temperature of glass slab increase the working time.

Unfortunately, temperature lowering will increase the viscosity and makes mixing procedure more difficult. Powder cooling retards the reaction without thickening the liquid.

## II. Mechanical properties:

1) Lower compressive strength than zinc phosphate.

2) Stronger tensile strength than phosphate cement.

3) Lower elastic modulus than phosphate cement.

**III. Solubility:** It has low solubility in water.

## IV. Bonding to tooth structures:

1) It bonds chemically to enamel and dentine. Some of the carboxyl groups form chemical bonds with tooth minerals.

The acrylic acid forms hydrogen bonding with the organic constituents of the  enamel and denting (collagen).

2) Bonding is higher to enamel than dentine, due to the greater inorganic content and greater homogeneity of enamel.

3) Smear layer removal by etching tooth surface with 10% polyacrylic acid for 10 seconds, will increase the bond strength.

## V. Bonding to restorations:

1) It sticks to clean stainless steel, amalgam, Cr-Co and other base metal alloys.

2) Bonding to gold in the as cast condition is inferior but if fresh gold surface is exposed by sandblasting, the cement will bond well to the gold.

3) Gold Tin plating help in better bonding to porcelain.

4) Polcarboxylate cement do not bond to porcelain.

## VI. Biocompatibility:

**A) The effect of polycarboxylate cements on the pulp Is comparable to or less than that of zinc oxide- eugenol.**

**B) Although the pH of a polycarboxylate cement is higher than that of a zinc phosphate cement, the former produces minimal irritation to the pulp than the latter due to:**

1) Lower intrinsic toxicity.

2) The rapid rise of the cement pH toward neutrality (few minutes for polycarboxylate but 24 hours for the phosphate cements).

3) Localization of the polycarylic acid and limitation of diffusion by its bigger molecular size and ion binding to dentinal fluid and proteins, that is blocking dentinal tubules.

4)The minimal movement of fluid in the dentinal tubules in response to the cement.

# Uses

1) Permanent cementation of cast restoration.

2) Cavity liners, base materials and temporary filling.

The end