DENTAL CEMENTS

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KNOWLEDGE TO EMPOWER

• CEMENTS- substance that hardens to act as a base, liner, filling material, or adhesive to bind devices and prosthesis to tooth structure or to each other.

•Cements are usually formed by an acid/base reaction in which an acidic liquid and a basic powder are combined to produce a matrix of reaction products in which are embedded un reacted powder particles.

• In most cases, the powders are either Zinc oxide or alumino-silicate glasses while the liquids are phosphoric acid, poly acrylic acid or eugenol.

CLASSIFICATION OF CEMENTS AS PER CRAIG

According to Function

1. Final cementation of completed restorations --- Zinc phosphate, zinc silico phosphate reinforced ZNO Eugenol, zinc poly carboxylate, Glass Ionomer

2.Temporary cementation of completed rest or cementation of temp rest --- ZNO eugenol, Non-eugenol ZNO

3.High strength bases. --- Zinc phosphate, rein forced ZNO eugenic, zinc polycarloxylate, Glass ionomer

4. Temporary fillings --- ZNO-eugenol, reinforced ZNO eugenol, Zinc poly carboxylate

5. Low-Strength bases --- ZNO-eugenol, CaoH

6. Liners varnishes --- CaOH in suspension resin in a solvent.

As per E.C. combe

a) Acid – base reaction cements eg.Zn Po4, Zinc Polycar boxylates, ZNO Eugenol

b) Polymerising materials eg. Resins

c) Other materials eg. CaOH varnishes.

As per skinner

according to uses

1. Zn phosphate -- Lutting agent

   Thermal insulating bases.

2. Zn phosphate with Ag or copper salts -- Intermediate rest

3. ZNO eugenol --- Temporary and intermediate rest

   Temporary luting agent for rest.

   Pulp capping agent

   Root canal sealer

4. Polycar boxlate --- Pulp capping agent, Lutting agent for rest, Thermal insulating bases, Intermediate rest
5. Glass ionomer --- Coating for eroded areas, luting agent, Pit and fissure sealent, Anterior restoration
6. Resin --- Luting agent for relf, Temp rest
7. CaoH --- Pulp capping agent,Thermal insulating bases.

ACID BASE REACTION CEMENTS

- Cements are formulated as powder/liquid, in which liquid acts as the acid and the powder as the base.
- On mixing the both together, viscous paste is formed which hardens to a solid mass.
- These cements can be further classified by the nature of the cement powder.

a) Zinc oxide : this can react with a range of liquids.

b) Ion-leachable Glasses : Particularly fluorine containing alumino silicate.

The five principal types of acid – base reaction cement are

1. Zn phosphate
2. Zn oxide eugenol
3. Zn polycar boxylate
4. Glass ionomers
5. Silicates.

- A.D.A specification has further classified cements as :

Type – I : Fine grain for luting.

Type – II : Medium grain for bases.

GENERAL STRUCTURE

On mixing the powder and liquid, only a part of powder reacts with the liquid and the final set material is composed of

Core: of unreacted powder, surrounded by

Matrix: formed by reaction of powder & liquid

Ideal properties of a Dental Cement:

Cement should ideally be adhesive to enamel and dentin and to gold alloys, porcelain and acrylics, but not to dental instruments.

• A cement should be bacteriostatic if inserted in a cavity with residual caries.

• Cement should have an obtundent effect on the pulp.

• Rheological properties are important. A luting cement should have sufficiently low viscosity to give a low film thickness and should have adequate working time at mouth temp to permit placement of the rest.

- Thermal insulation – A cement usd under a large metallic rest' should protect the pulp from temp charges.

- Chemical protection – A cement should be able to prevent penetration into the pulp of harmpel chemicals from the rest material.

- Electrical insulation under a metallic rest' to minise galvanic effects.

- Optical properties : for cementation of a translucent rest' the optical properties of the cement should parallel those of tooth set.

KEY TERMS

BASE: Layer of insulating, sometimes medicated, cement, placed in the deep portion of the preparation to protect pulpal tissue from thermal and chemical injury.

CAVITY LINER: thin layer of cement, such as a CaOH2 suspension in an aqueous or resin carrier (after evaporation), used for protection of the pulp; certain glass ionomer cements that are used as an intermediate layer between tooth structure and composite restorative material are also considered liner.

VARNISH: a solution of natural gum, synthetic resin, or resins dissolved in a volatile solvent, such as acetone, ether, or chloroform.

ZINC PHOSPHATE CEMENT

CLASSIFICATION

- Type I - Fine grained for luting
  Film thickness should be 25 um / less
- Type II - Medium grained for lutting and filling
  Film thickness should be more than 40 um

ZINC PHOSPHATE MANIPULATION

- Materials and instruments:

  glass slab and stainless steel spatula.

- W/P ratio 1.4 gm / 0.5 ml.

- Divide the powder in one corner of the glass slab into increments.

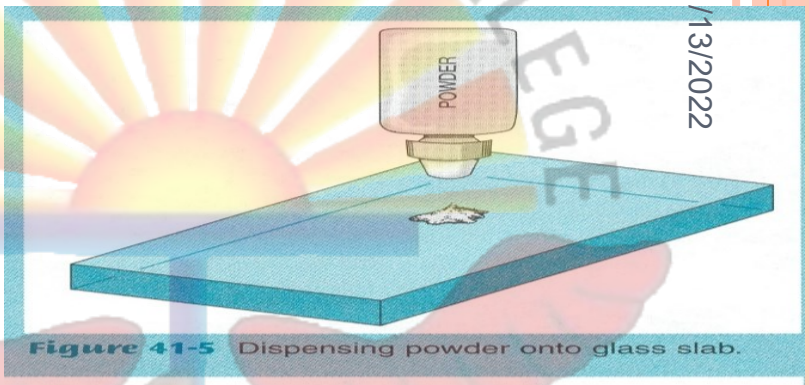

Figure 41-5 Dispensing powder onto glass slab.

Figure 41-4 Assembling of materials.

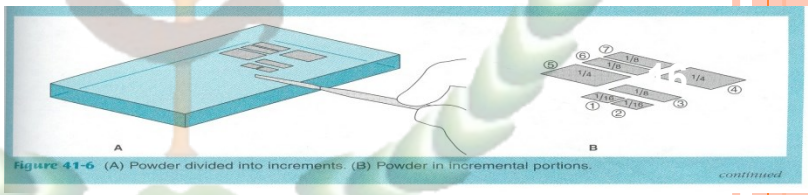

Figure 41-6 (A) Powder divided into increments. (B) Powder in incremental portions.

continued

- Dispense the correct amount of liquid
- temperature of glass slab 21.c
- avoid moisture on glass slab

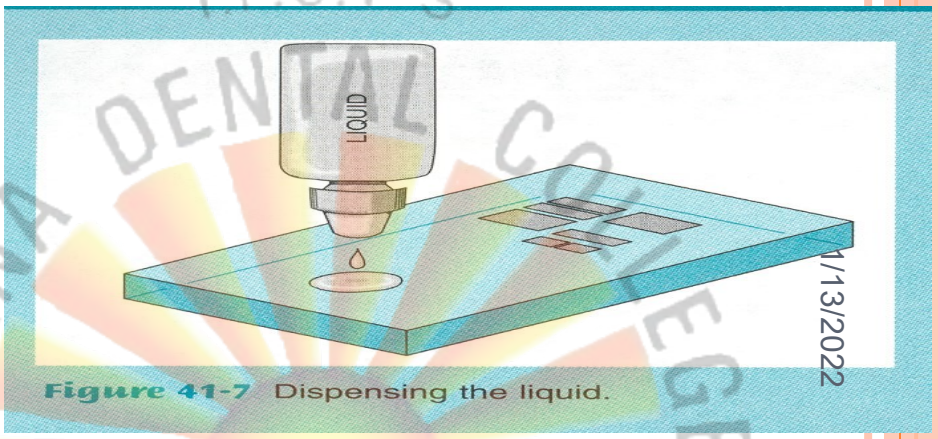

Figure 41-7 Dispensing the liquid.

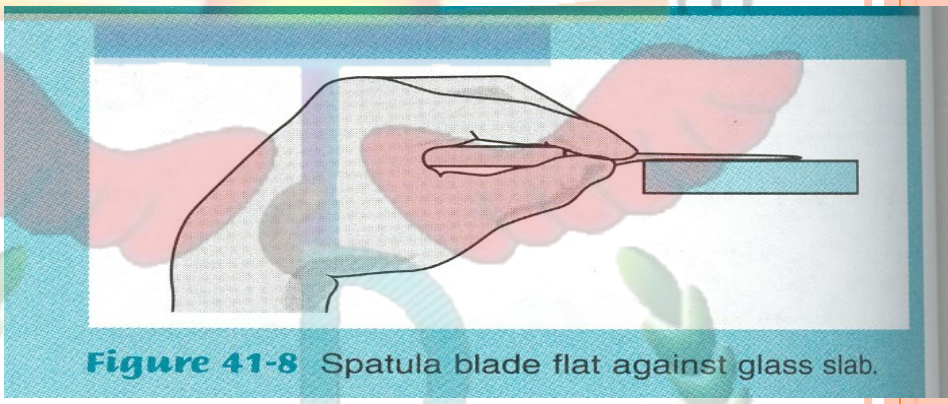
Figure 41-8 Spatula blade flat against glass slab.

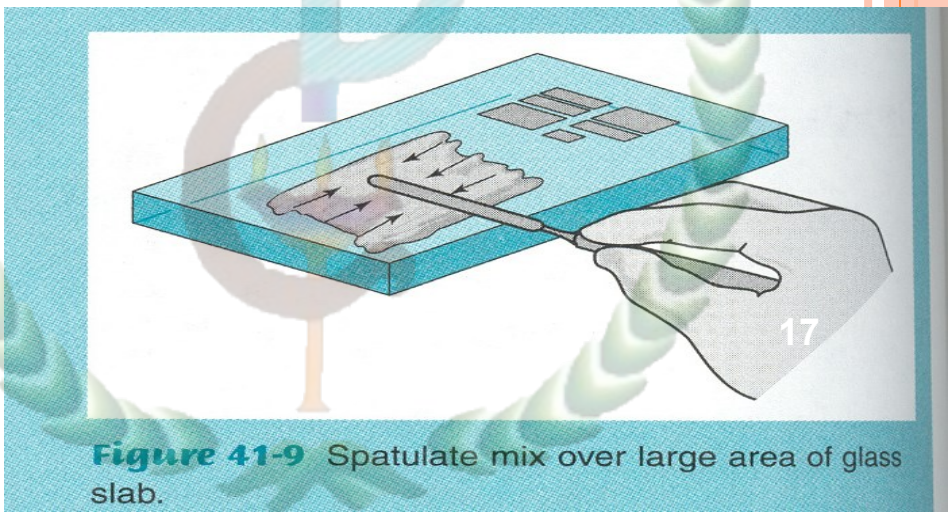

Figure 41-9 Spatulate mix over large area of glass slab.

ZINC PHOSPHATE

SETTING REACTION

- When the powder is mixed with the liquid the phosphoric acid attracts the surface of the powder and releases zinc ions into the liquid.

- Aluminium ions which already forms a complex with the phosphoric acid reacts with zinc and yields a zinc aluminophosphate gel

- set cement is a cored structure consisting primarily of un-reacted ZnO particles embedded in a cohesive amorphous matrix of zinc aluminophosphate .
- water is critical to reaction.
- Loss of water from the acid can lengthen the setting reaction
- Additional water during mixing accelerates the reaction .

ZINC POLYCARBOXYLATE CEMENT

- POWDER
- Stannous oxide or
- Silica or Alumina or
- Bismuth
- Stannous fluoride – improves the manipulation, characteristics, strength – 4.5%
- Sodium fluoride - Anticariogenic property about 1%

- **LIQUID**
- Liqueous solution of Polyacrylic acid
- Co-polymer of acrylic acid C other unsaturated carboxylic acid water.

- ZINC POLYCARBOXYLATE

MANIPULATION

- a powder liquid ratio of 1.5 parts of powder to 1 part of liquid.
- The consistency of the mixes is creamy .
- The mixed cement is thixotropic.
- Dispensing the liquid should be done immediately before mixing to prevent evaporation of water and lead to subsequent thickening .

- It should be mixed within 30-60 secs, with half to all of the powder incorporated at once to provide the max. length of
- working time – 2.5 – 6 min.
- The working time can be extended to 10-15 min by mixing on a glass slab chilled to 4C .
- The strength of the mixed cement is not compromised by this technique

SETTING REACTION

- The cement involving particle surface dissolution by the acid that releases zinc, Mg. and Sn Ions, which bind to the polymer chain via the carboxyl groups.

- These ions react with carboxyl of adjacent polyacid chains so that a cross linked salt is formed as the cement sets.

- The hardened cement consists of an amorphous gel matrix in which unreacted particles an dispused.

ZINC OXIDE EUGENOL

POWDER

Zno	Principal Ingredient
White rosin	Brittleness of set cement
Zn acetate	Accelerator strength – up to 1%
MgO	Modifier
Zn stearate	Plasticizer

LIQUID

Eugenol	Reacts with ZnO
Olive Oil	Plasticizer (85% Eugenol)
Water	Initiator
Acetic acid/alcohol	To accelerate setting – about 1%

ZINC OXIDE EUGENOL CEMENT

Type I	Temporary ZOE lutting cement
Type II	Long Term ZOE lutting cement
Type III	Temporary ZOE Restoration and Thermal insulators
Type IV	Intermediate ZOE Restorations and cavity linear

ZINC OXIDE EUGENOL

- **SETTING REACTION**

- consists of ZnO hydrolysis and the reaction between zinc hydroxide and eugenol to form a chelate.

- Water is needed to initiate the reaction and it is also a by-product of the reaction.

- so the reaction proceeds more rapidly in a humid environment.

- The setting reaction is also accelerated by the presence of zinc chelate dehydrate.

- Acetic acid is a more active catalyst for the setting reaction than is water because it increases the formation rate of zinc hydroxide.

ZINC OXIDE EUGENOL

MODIFICATIONS

- Modifications of ZOE are
- 1) Reinforced ZOE Cements
- 2) EBA and other Chelate Cements

REINFORCED ZINC OXIDE EUGENOL CEMENTS

CONCLUSION

- Zinc phosphate cement has long served as the universal luting cement.
- Its advantages includes good handling characteristics and a proven longevity in the oral cavity when it is used for cementation of well designed and well fitting restorations.
- The main advantage of improved ZOE cement is their biocompatibility.
- The physical and mechanical properties and the handling characteristics generally inferior to those of other long term luting cements.