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DENTAL CEMENTS

[1]Dr. Meer Juned Ali and [2,*]Dr. Supratim Tripathi

[1]Post- Senior Lecturer, College- College of Dental Sciences and Hospital, Indore
[2]Post- Associate Professor, College- Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow

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ABSTRACT

Dental cements are the most widely accepted and used dental materials with varied cemistry and worknig. This article deals with the basic concepts of using the cements and that there are certain concepts to be taken care of to provide the best results in the favour of the patient.

INTRODUCTION

Dental cement is defined as a substance that hardens to act as a base, liner, filling material, or adhesive to bind devices & prostheses to tooth structure or to each other. They are of low strength but used extensively. Regardless of some inferior properties, they possess so many desirable characteristics that they are used in 40 to 60% of all restorations.[1]

Specifications

1) Water based cements – ANSI/ADA No. 96
ISO 9917
2) Resin based cements - ANSI/ADA No. 27
ISO 4049

CLASSIFICATION

Acc to skinner [1]

1° uses **2° uses**

ZnPO4 Luting agent for restoration Intermediate restoration & orthodontic appliance& Thermal insulating base

ZOE: Temp & intermediate restoration R C restoration Temp & permanent luting agent Periodontal dressing Thermal insulating base Cavity liner & pulp capping

PCC: Luting agent uting agent for orthodontic appliance Thermal insulating base Intermediate restoration

Silicates: Anterior restoration

SilicoPO4: Luting for restoration Intermediate restoration Luting agent for orthodontic appliance

GIC: Coating of erodedareas, Pit& Fissure sealents Luting agent for orthodontic Thermal insulating base appliance & restoration, cavityliners

RESIN: Luting for restoration & Temporary restoration Orthodontic appliances
Ca (OH) 2: Pulp capping agent Thermal insulating base

Acc. to Craig[2]

1) Glass & hybrid ionomers

- For class 5 restoration
- Retention of alloy restoration & orthodontic bands

Corresponding author: Supratim Tripathi,
Post- Associate Professor, College- Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow.

- High strength base & provisional restoration

2) Zn Polycarboxylate

- Retention of alloy restoration & orthodontic bands
- High strength base

3) ZnPO4

- Retention of alloy restoration & orthodontic bands
- High strength base & provisional restoration

4) ZOE

- Low & High strength base & provisional restoration
- Temp & permanent retention of restoration

5) Non eugenol ZO

- Temp retention of restoration, RC sealers
- Periodontal packs, surgical dressings

6) CaOH

- Low strength base

7) Compomers

- Bonded conventional crowns & bridges
- Retention of orthodontic brackets
- High strength base

8) Composites & adhesive resins

- Bonded conventional crowns & bridges
- Bonded ceramic veneers, inlay, onlay
- Bonded lab composites
- Bonded post & core
- Bonded Maryland bridges
- Retention of provisional restoration
- Retention of orthodontic brackets
- High strength base

Acc to ADA[3]

Type I – fine grain for cementation – luting
Type II – medium grain for bases, orthodontic purpose

SILICATES

COMPOSITION

PowderLiquid

Silica – SiO2 – 40%	H3PO4 - 52%
Alumina – Al2O3 – 30%	Buffer salts - 4%
NaF, CaF2, Na3AlF6 (Flux) - 19%	AlPO4,ZnPO4
Ca (H2PO4)2.H20	Water - 40%
CaO	

These are fused at 1400˚ C

SETTING REACTION

It is ofAcid – Base type. Powder particles are attacked by acid. Ca, Al, F ions are released. Metal ions precipitates as phosphates.

PROPERTIES

- Hardness – similar to dentine 70 KHN
- Compressive strength – 180 MPa
- Tensile strength – weak – 3.5 MPa
- Solubility – 0.7 (High)
- Aesthetics
- Adhesion

BIOLOGIC PROPERTIES

Has severe pulp irritation as it has pH less than 3 at insertion, pH as noted is below 7 after 1 month.Is anticariogenic.[4]

MANIPULATION

It requires a Dry field, mixing by agate or plastic spatula. P/L ratio is- 1.6 gm/ 4 ml. aftter placement Varnish is applied for protection.

ADVANTAGES

Markedly has less secondary caries. Incidence of proximal caries adjacent to silicate cement is also less because of fluoride release.

DISADVANTAGES

Has high solubility rate which causes loss of anatomic contour. Degradation of margin quality causing gross leakage at margins. Has the tendency for severe pulp irritant. [4]

ZINC SILICOPHOSPHATE [3]

- Combination of ZnPO4 + silicate powder
- **Other names:** Zn silicate, silicate Zn, silicoPO4
- **Application:** Luting agent for restoration& orthodontic appliance
- Intermediate restoration
- Die material

CLASSIFICATION

Type I: Cementing medium
Type II: Temp posterior filling material
Type III: For dual purpose (Type I & II)[5]

COMPOSITION

PowderLiquid

Silicate glass	H3PO4
ZO powder	Water
MgO	Zn & Al salts

SETTING REACTION

Same as silicates (but more formation of ZnPO4)

- Setting Time : 3 to 15 min

PROPERTIES: Compressive Strength – 165 Mpa

Film thickness – 25µm
Solubility – 0.9 %
Anticariogenic due to F^-
Semi translucency

POLYCARBOXYLATE CEMENT (PCC)[3]

Developed in 1960's by Dennis Smith.He chose an acid-functional polymer (Polyacrylic acid) as a substitute for H3PO4. It is the First cement to adhere via chelation to dental substrates 6

COMPOSITION

Powder

- ZnO – basic ingredient
- MgO /SnO– principal modifier
- BiO - small amount
- Al2O3
- SnF – modify setting time, enhance manipulative prop, increase strength, reduces sintering temperature, anticariogenic (15 – 20% of GIC)

Water settable cements
E.g. Poly-F

Liquid

- Aquous solution of Polyacrylic acid
- Copolymer of acrylic acid with Itaconic acid,
- Tricarboxylic acid, Maleic acid
- Increases reactivity of liquid

Increasesviscosity

Decreasestendency for gelation

- Molwt of polyacids (30,000 to 50,000)
- Acid content : 32- 42%

SETTING REACTION

Acid dissolves the powder particle surface and releases Zn, Mg, Sn ions – bind to polymer chain via carboxyl groups. Cross-linked salt is formed. Set cement consists of an amorphous gel matrix in which unreacted particles are dispersed. Microstructure resembles ZnPO4 [7]

Bonding to tooth structure

Polyacrylic acid reacts via the carboxyl groups with Ca of hydroxyapatite (CHEMICAL). Bond strength to enamel is greater than that to dentin (3.4 to 13 MpaE ; 2.1 Mpa D). Inorganic component and homogeneity of enamel is greater. [7]

PROPERTIES

1) Film thickness – 25 µm or less, visc ous, pseudo plastic – undergoes thinning at ↑ shear rate

2) Working and setting times – 2.5 min (short)

- Increases with ↓temp (cooling of slab not recommended as it leads to thickening of liq, difficult to mix. Therefore powder is refrigerated)
- Setting Time - 6 to 9 min

3) Mechanical prop – Not as brittle as ZnPO4

- Compressive Strength- 55 to 67 Mpa; Tensile Strength – slightly higher (40% of ZnPO4)
- Modulus OfElasticity -2.4 to 4.4 Gpa
- Due to its plastic deformability- diff. to remove after set

4) Solubility:in water is less but increased in organic acids & with a reduction in P:L ratio

5) Biologic properties

- pH of liquid- 1.7 but neutralized by powder
- Minimal irritation to the pulp
- pH of the cement mix rises more rapidly (5.5 after 30 min)
- Larger size of the acid molecule limit its diffusion through dentinal tubules [8]
- Postoperative sensitivity is negligible [4]

MANIPULATION

Areas of major concern

- Mixing of cement
- Surface preparation & retention
- Nature of tooth surfaces
- Removal of excess cement

Mixing of Cement

Liquid is Viscous. Powder:Liquid ratio 1.5:1. Material is Mixed on a glass slab/ paper pad. Refrigerated powder – not below dew point

- Liquid dispensed just before mixing – else loss of water &increased viscosity
- Powder rapidly incorporated into liquid in large quantities
- MT – 30 sec
- Glossy appearance – good bonding &means sufficient no. of free –COOH group
- Dull appearance- insufficient no. of unreacted –COOH group[2]

USES

Principal uses

- Luting agent for restorations
- Thermal insulating bases

Secondary uses

- Luting agent for orthodontic appliances[4]

ZINC OXIDE EUGENOL

- Used in Dentistry since 1890's
- pH approx 7

- One of the least irritating of all dental materials
- Provides excellent seal against leakage
- Has obtundent (sedative) effect on the pulp
- Not adequate strength
- Supplied : P/L

COMPOSITION

Powder

ZnO	69% - principal ingredient
White rosin	29.3% - ↓ brittleness of set cement
Zn stearate	1.0% - accelerator
Zn acetate	0.7% - accelerator, improves strength

Liquid

Eugenol 85% - main reactant
(Oil of Cloves)
Olive oil 15% - plasticizer

MODIFICATION 2

Strength increased by two methods

1) EBA – alumina reinforced ZOE (super EBA)

Powder Liquid

ZnO 70%	Ortho EBA 62.5%
Alumina 30%	Eugenol 37.5%

CS- 55 Mpa ; long WT; ST- 9.5 min

2) Polymer- reinforced ZOE

Powder Liquid

ZnO 80%	Eugenol
PMMA 20%	Acetic acid &thymol

- CS- 48 Mpa ; long WT; ST- 6 to 10 min
- Improved abrasion resistance & toughness

3) Resin reinforced ZOE

Powder Liquid

ZnO 88%	Eugenol 90%
Rosin 10%	Polystyrene 10%

- CS- 40 Mpa ; long Working Time

4) Cements containing vanillate esters

PowderLiquid

ZnO	Hexyl Vanillate&ortho EBA

- Claims to have high strength & low solubilty

5) Fast setting ZOE

Accelerator like Zn acetate added to increase ST

6) Non setting ZOE

Additives added to reduce ST & hardness

- ZOE in 1% propyl paraben
- Eugenol

Silicone grease
Sealing agent

7)Non Eugenol ZOE

ZnO, aromatic oil, olive oil, petroleumJelly, beeswax, oleic acid (fatty acid)

SETTING REACTION 4

- 2 molecules of eugenol react with one molecule of ZnO to form Zn eugenolate
- Chelation reaction

$$ZnO + H2O \rightarrow ZnOH2$$

$$2Eugenol + ZnOH2 \rightarrow \text{ Zn Eugenolate} + 2Water$$

- Presence of water is essential for setting
- Water is also the by-product of the reaction
- Set cement consists of amorphous matrix of Zn eugenolate with unreacted ZnO particles

PROPERTIES[4]

1) **Film thickness**: higher than other cements 25µm

2) **Setting time**: 4 to 10 min, 2 to 10 min (for RM & Bases)

ST depends on

Particle size, P/L ratio, accelerator, retarders,
Low temperature: cool glass slab increases ST

Accelerator: water, Zn acetate, alcohol, acetic acid
Retarders: glycol, glycerin

3) **Compressive Strength**: 3 to 55 Mpa: TS: 0.32 to 5.8 Mpa

4) **Biocompatibility**:

At time of placement – pH 7, therefore least irritatingbacteriostatic &obtundant effect

5) **Solubility** – highest of all cements

MANIPULATION[9]

- Powder & Liquid or 2 paste systems
- 2 paste – equal lengths of each paste mixed to a uniform color (streak free)
- Powder and liquid mixed on a glass slab or paper mixing pad with stiff steel spatula
- Bulk of powder is incorporated and thoroughly spatulated
- Sets quickly in mouth due to moisture & heat

CLASSIFICATION[8]

Type I – Temporary cementation (40 μm)
Temporary ZOE luting cement
Type II – Permanent cementation (25 μm)
Long term ZOE luting cement
Type III – Temporary ZOE restorations
Type IV – Intermediate ZOE restoration

USES OF ZOE[4]

- Temporary cementation
- Permanent cementation
- Temporary restorations
- Intermediate restorations
- Bases
- Liners
- Root canal sealers
- Periodontal dressing
- Impression material
- Bite-registration material

ZINC PHOSPHATE

- It is the oldest of the luting cement
- It also known as "crown and bridge" cement and zinc oxy phosphate cement.
- Serves as a standard with newer systems can be compared (gold standard)

CLASSIFICATION: ADA specification No.8 designates them as

1. Type I – Fine grained for luting
   Film thickness should be 25 μ or less
2. Type II - Medium grain for bases & restoration
   Film thickness should not be more than 40μ10

PRINCIPAL USES

- Luting agents for restorations and orthodontic appliances.
- Secondary uses intermediate restorations, thermal insulating bases.

MODE OF SUPPLY: Available as

- Powder and liquid system.
- Capsules of pre-proportioned powder and liquid
- Variety of shades also available like yellow, gray, golden-brown, pink and white.

COMMERCIAL NAMES

- Confit, Harvard, Zinc cement improved
- Modern tenacin

COMPOSITION

Powder

Zinc oxide - 90.2% - Principle constituent
Magnesium oxide - 8.2% - Aids in Sintering
Other Oxides
Bismuth trioxide, Calcium oxide, Barium oxide – 0.2% - Improves smoothness of mix, R/O
Silica – 1.4% - Filler

Liquid

Phosphoric Acid - 38.2% - Reacts with zinc oxide
Water - 36% - Controls rate of reaction
Alumina/ Zn PO4 – 16.2% - reduces reaction rate, buffering action
Aluminium - 2.5% - buffer
Zinc - 7.1% - buffer

SETTING REACTION[6]

When powder & liquid is mixed, H3PO4 acid attacks the surface of the particles & releases zinc ion into the liquid in an "exothermic reaction"Aluminum, which already forms a complex with H3PO4 acid, reacts with Zn to yield zinc alumino phosphate gel on the surface of the remaining particles Set cement:

Core → unreacted zno
Amorphous matrix → znalpo4

Water is critical to reaction, so the composition of the liq. Should be preserved for consistent reaction.The set cement is porous

PROPERTIES[6]

1) Strength

Compressive Strength – 104 Mpa: Tensile Strength – 5.5 Mpa :ModulousOf Elasticity – 13.7 Gpa

2) Solubility: relatively low
Greater in organic acids like lactic acid etc

3) Thermal properties: good insulator

4) Retention: mechanical interlocking
Any coating like varnish decreases retention

5) Biological properties
pH→ 2 (2 min) → 5.5 (24 hrs) → 7 (48 hrs)

Therefore pulp protection if thin layer of dentine remains

MANIPULATION

- Powder/Liquid ratio – 1.4 gm/ 0.5 ml
- Maximum amount of Powder – for strength & decreased solubility
- Use of cool glass slab: prolongs Working Time& Setting Time, incorporation of max powder
- Liq: not dispensed until mixing is to be initiated because water will be lost to air by evaporation
- Powder divided into several portions

- Initiate mixing by incorporating small amt of powder, it dissipates heat
- Brisk spatulation
- Mix over large areas (exothermic reaction)
- Spatulate each increment for 15 to 20 sec before adding next
- Complete Mixing Time: 1.5 to 2 min
- Desired consistency: for luting cement should be fluid yet it should string for 2 – 3 cm
- For base – putty like
- Consistency reached by adding powder & never by allowing a thin mix to stiffen 10

Frozen slab technique[4]

- Used for orthodontic bands
- Decreases ST & increases WT
- Glass slab cooled in refrigerator at 6˚C or freezer at -10 ˚C
- 50 to 75 % more powder incorporated

Advantage

- Increase Working Time : 4 to 11 min
- Short Setting Time : 20 to 40% (due to water of condensation)
- Strength & solubility similar to normal mixes

CALCIUM HYDROXIDE

Introduced in 1930 by Herman.Has antibacterial effect & promotes remineralization of affected dentine. Relatively weak cement.Used in pulp capping procedure.Due to alkaline nature it serves as protective barrier or base not only beneath resin restn but virtually under all restorative materials.

Mode of supply

- Two paste system in collapsible tubes
- Powder / distilled water
- Light cure system

Commercial names

dycal, life, care, prisma VLC dycal

COMPOSITION

Paste 1 /Catalyst

Calcium hydroxide (50%) Primary reactive ingredients
Zinc Oxide (10%) Primary reactant
Zinc stearate (0.5%) Accelerator
Ethyl toluene- sulphonamide(39.5%) Oily compound act as a carrier

Paste 2 / base

Glycolsalicylate (40%) - Primary reactive ingredient
Calcium phosphate (3%) – Controls pH
Titanium dioxide - Inertfillers, pigments and R/O
Calcium sulphate
Calcium tungstate

SETTING REACTION

- CaOH + salicylate → calcium disalicylate
- Set mass is unstable & contains large percent of unreacted CaOH
- Ca , OH & Salicylate ions are released continuously from the mass

PROPERTIES

1) **Setting Time**: 2.5 to 5.5 min

- Reaction accelerated by moisture & accelerator

2) **Mechanical properties**

Compressive Strength: 10 to 27 Mpa, Tensile Strength: 1Mpa, MOE: 0.37 Gpa

3) **Antibacterial properties**

High pH (9.2 to 11.7) & protein lysing effect
Helps in dentine formation
Kills bacteria by disrupting membrane
Activates alkaline phosphatase

4) **Solubility:** is high & is necessary to achieve its therapeutic properties

MANIPULATION

In 2 paste system

- Equal length dispensed on slab, mix →streak free mix & uniform colour.
- Mixed with plastic filling material as it has short ST

LIGHT CURED CaOH

One component, it contains
Dimethacrylates (BISGMA / UDMA)
Polymerization activators
CaOH, BaSO4 &

Low viscosity monomer

- Used to line the cavity
- Has long WT & is less brittle
- Cured by light source for 20 sec for each 1mm layer

GLASS IONOMER CEMENT

Glass ionomer is the generic name of a group of materials that use silicate glass particles and an aqueous solution of polyacrylic acid.Hybrid of silicate and polycarboxylate. It is also called as polyalkenoate cements. [10]

- According to Skinner

Type I - Luting
Type II - Restorations
Type III - Liners & Bases

COMPOSITION

Traditional glass ionomers

Powder Liquid

Silica-	35-50%	Polyacrylic acid	45%
Alumina-	20-30%	Itaconic acid	
AlF3 -	1.5-2.5%	Maleic acid	5%
CaF2 -	15-20%	Tricarboxylic acid	
NaF -	3-6%	Tartaric acid	traces
AlPo4 -	4-12%	Water	50%

Barium in traces

RESIN CEMENTS

They are flow able composites of low viscosity that is used for attaching orthodontic brackets, cementation of fixed prostheses & ceramic crowns to tooth structure

CLASSIFICATION: filled & unfilled
ANSI/ADA No. 27: Class 1: Self cure
Class 2: dual cure; Class 3: light cure

COMPOSITION

Resin matrix with silane treated inorganic fillers

1) Chemical cure: P/L or 2 Pastes

Powder Liquid

Resin matrix (PMMA) Methylmethacrylate
Inorganic fillers Tert. Amines C.A. (organosilane)

2) Dual cure: 2 components

Base paste	Catalyst paste
Resin matrix (PMMA)	Methylmethacrylate
Fillers	Fillers
Chemical/ Light	Activator (for chemical cure)

3) Light cure: one paste , Methacrylate monomers

The adhesive monomer incorporated: HEMA, 4META & an organophosphate like MDP

NO SEPARATE BONDING AGENT IS NEEDED

4META: 4- methyloxy ethyl trimellitic anhydride

MDP: 10- methacryloxydeacmethylene phosphoric acid

PROPERTIES

- **Compressive Strength** – 52 to 224 Mpa
- **Tensile Strength** – 37 to 41 Mpa: MOE – 1.2 to 10.7 Gpa
- **Film thickness** – 10 to 25 μm
- **Biological properties** – irritating to pulp
- Pulp protection with CaOH / GIC if RDT <0.5mm
- **Solubility**: virtually insoluble in oral fluids
- **Polymerisation shrinkage**: high
- **Adhesion**: micromechanical
- Chances of micro leakage
- **Mixing Time**: 20 to 30 sec (chemical cure)
- **Light curing time**: 40 sec
- Increased Water sorption ↓ses strength of cement
  - **Chemical cure**: for prostheses > 2.5mm thick
  - **Dual cure**: for prostheses < 2.5mm thick
  - **Light cure**: for prostheses < 1.5mm thick

For adequate light transmissioncure for 40 sec

Indication: cementation of thin ceramic prostheses, resin based prostheses, direct bonding of ceramic, plastic orthodontic bracket. [11]

MANIPULATION

Designed for specific application

Metal prostheses [12]

Base metal: roughened by grit blasting or electrochemical etching Some system use metal primer (has adhesive promoter)

- Oxides on surface helps in bonding
- Noble metals: no oxide, therefore tin coating done to form oxide
- Silica coating: to improve bonding for noble & base alloys

Orthodontic brackets

- Ceramic bracket: etching & coating with organosilane
- Plastic bracket: primed with solvent containing methylmethacrylate monomer

Bonding of resin based indirect restoration

- Surface for bonding can be grit blasted to increase roughness for bonding
- It can also be treated with designated adhesive
- (Based on same monomer used for prostheses)

Bonding of ceramic prostheses 9

- Availability of water based try-in gels, corresponding to shades
- Veneer checked against tooth with try in gel for shade
- Enamel: acid etch, wash, dry, bonding agent applied
- Ceramic : etch with HF acid (in lab)
- Ceramic (chair side): cleaned, washed &silane bonding agent applied
- Resin cement applied to ceramic & seated followed by light cure
- Cure 60 sec (because of reduce depth of light cure)

Commercial products

- Heliosit orthodontic (ivoclar), panavia

- Variolink (ivoclar), Metacem (metabiomed)
- RelyX luting cement (3M ESPE)
- RelyX ARC adhesive resin cement, RelyX U100 &RelyXUnicem

- These are self adhesive universal resin cements
- Easy to use, virtually for all indication
- Eliminates etching, priming, bonding steps
- Decrease post op sensitivity
- Strong, adhesive, esthetic, moisture tolerant

PULPAL PROTECTION[7,8]

Include : varnish, liner, bases
Function : Chemical

Thermal
Mechanical
Electrical
Pulpal medication

Protective need depends on

- Extent and location of preparation
- Restorative material used

LINERS AND BASES 1, 0

Thin film liners (1 to 50 μm)

- **Solution liners** (Varnish 2 to 5 μm): based on nonaqueous solvents
- **Suspension liners** (typically 20 to 25 μm): based on water

Thick liners (200 to 1000 μm /0.2 to 1 mm)

- **Cement liners** (Calcium hydroxide and ZOE)
- Pulpal medication and thermal protection

Bases (1 to 2 mm)

- **Cement bases** (ZnPO4, GIC, PCC, modified ZOE)
- Thermal protection and mechanical support

CAVITY VARNISHES[8]

- Varnish is a solution of one or more resins from natural gums (copal or rosin), synthetic resins.
- Organic solvents used are chloroform, ether, alcohol, acetone
- Copalite – 10% copal resin in ether, alcohol and acetone
- Volatile solvents evaporate leaving a thin film

USES OF VARNISH

- To provide a barrier against the passage of irritants (acids) from zinc phosphate cements
- To reduce penetration of oral fluids at the restoration-tooth interface into the underlying dentin
- Reduce postoperative sensitivity when applied to dentinal surfaces
- Retard the penetration of discolored corrosion products from amalgam into dentin

CONTRA-INDICATIONS OF VARNISH[7]

- Not used under composite restorations
- Solvent in the varnish may soften the resin
- Coating prevents proper wetting of cavity by BA
- Not used with GIC/PCC cements
- Would eliminate the potential for adhesion
- Not used when therapeutic action is expected

E.g. ZOE, CaOH

LINERS

- Provide barrier against passage of irritants from cements or other restorative materials
- Reduce sensitivity of freshly cut dentin
- Provide therapeutic benefits to pulp (RDT< 1mm)
- E.g. CaOH, ZOE, GIC,
  Polystyrene & methylcellulose liner
  (Polystyrene + ZOE + CaOH)
  F^- liner dropsin (25% H3PO4 + AlOH + Water)

CALCIUM HYDROXIDE LINER [2]

- Facilitates dentinal bridging for physiologic protection
- Used in deepest portion of cavity – direct or indirect pulp capping
- pH 11 (alkaline) neutralize the acid of ZnPO4
- When ionized in low conc. stimulates formation of reparative dentin

COMPOSITION

- Calcium hydroxide suspended - in an organic liquid such as methyl ethyl ketone or ethyl alcohol – or in an aqueous solution of methylcellulose
- Methylcellulose functions as a thickening agent
- Also contain acrylic polymer beads or BaSO4
- On evaporation of volatile solvent, liners form a thin film on prepared tooth surface.

PROPERTIES

- No mechanical strength
- No thermal insulation
- Should **not** be applied at the margins as they are soluble

MANIPULATION

- Fluid in consistency
- Easily flowed or painted on dentinal surfaces
- Solvent evaporates

ZOE LINERS[7]

- Relieves pulpal inflammation, pH 7
- Sedative effect on pulp
- Used in moderately deep cavities
- Eugenol in very low conc. has obtundent action on pulp
- Eugenol in high conc. is a chemical irritant

- 2 paste systems or P/L
- ZnO and Eugenol in inert oils and fillers
- Sets to a hard mass when mixed
- Setting reaction accelerated by moisture and increase in temperature

GIC LINER[10]

- Used in P/L or light cure formw
- LC form is stronger & less moisture sensitive
- Used for pulp protection, to seal tubules&used under composites

CEMENT BASES[3]

- It is a layer of insulating cement placed in deep portion of the preparation to protect pulpal tissue from thermal & chemical injury.
- In contrast to liners, it is much thicker >0.75 mm
- It protects pulp from thermal injury, galvanic shock, chemical irritation
- They are indicated when RDT < 2mm

TYPES: 1) High strength base

e.g.: ZnPO4, PCC, GIC, reinforced ZOE
2) Low strength base
e.g.: ZOE, CaOH

PROCEDURE

- Consistency – thick
- Only on pulpal floor, axial wall
- Base selection depends on RM

Amalgam: ZnPO4
Composites: CaOH, GIC

DFG: high strength base

- If varnish applied : ZnPO4 - varnish first

PCC, GIC – varnish after base

TEMPORARY RESTORATIVE MATERIALS[5]

Temporary cement

1) High solubility, last for short time
2) Promotes healing of pulp
3) Uses – To lute provisional restn
- Deep cavities till pulp doesn't heal
- In RCT, in between visits

TYPES OF MATERIALS USED[4]

1) Temporary Restorative Material

- CEMENTS : ZOE, ZnPO4, PCC
- CaOH
- Gutta-percha
- Light cure acrylic resins

2) **Temporary luting agents**

- Conventional ZOE
- Modified ZOE
- Nonsetting ZOE

3) Intermediate RM

- Modified ZOE

Conclusion

It is apparent that no single type of cement satisfies all the ideal characteristics. A thorough knowledge & understanding of these materials is mandatory for a dentist, in order to make the correct choice of which material to be used for a particular situation.

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