***Dental Technology 4th Semester***

***Paper: Dental Material (Final Term)***

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**Q1 Explain uses of calcium hydroxide cement?**

**Ans: Uses of Calcium hydroxide cement:**

**• Intracanal medicament:**

• It is the most commonly used dressing for treatment of the vital pulp. It also plays a major role as an intervisit dressing in the disinfection of the root canal system . Calcium hydroxide cannot be categorized as a conventional antiseptic, but it kills bacteria in root canal space . Direct contact experiments in vitro require a 24 hour contact period for complete kill of enterococci. Calcium hydroxide not only kills bacteria, but it also reduces the effect of the remaining cell wall material lipo- polysaccharide. It has a wide range of antimicrobial activity against common endodontic pathogens, but is less effective against Enterococcus faecalis and Candida albicans.

**Endodontic sealer:**

• To be therapeutically effective calcium hydroxide must be dissociated into Can++ and OH - Therefore to be effective, an endodontic sealer based on calcium hydroxide must dissolve and the solid consequently lose content.

Pulp Capping Agent: • Calcium hydroxide is generally accepted as the material of choice for pulp capping. Histologically there is a complete dentinal bridging with healthy radicular pulp under calcium hydroxide dressings. When calcium hydroxide is applied directly to pulp tissue there is necrosis of adjacent pulp tissue and an inflammation of contiguous tissue.

**Apexification**:

 •In apexification technique canal is cleaned and disinfected, when tooth is free of signs and symptoms of infection, the canal is dried and filled with stiff mix of calcium hydroxide and MTA. Histologically there is formation of osteodentin after placement of calcium hydroxide paste. There appears to be a differentiation of adjacent connective tissue cells; there is also deposition of calcified tissue adjacent to the filling material

**Pulpotomy:**

•It is the most recommended pulpotomy medicament for pulpally involved vital young permanent tooth with incomplete apices. A pulpotomy is the removal of a portion of the pulp, including the diseased aspect, with the intent of maintaining the vitality of the remaining pulpal tissue by means of a therapeutic dressing

Weeping canals: •For such teeth dry the canals with sterile absorbent paper points and place calcium hydroxide in canal. Calcium hydroxide converts the acidic pH of periapical tissue in the weeping canal to basic pH.

Q2. Write a detail note on properties of mineral trioxide aggregate and also explain manipulation and setting reaction of MAT?

 **Ans : Properties of minral trioxide aggregate**

**•PH**

•initial pH of 10.2 which rises to 12.5 (similar to calcium hydroxide) following setting The high pH is theorized to be responsible for the

antimicrobial action and biological activity of the material

**•Working time** 5 minutes

**•Setting time** 3-4hours(old one) 20minutes

**•Solubility** MTA displays low or nearly no solubility, which is attributable to addition of the bismuth oxide

**•Compressive strength**

•The compressive strength of set MTA is about 70 mpa

**•Biocompatible**

**•good Sealing Ability (resist Micro leakage)**

•Usually a thickness of 3 mm to 5 mm is sufficient to provide a good seal.

**•Retentive strength :**

•MTA is not suitable as luting agent

**•Marginal adaptation** is better than intermediate •Restorative Material (IRM)

•Ethoxy Benzoic Acid (super EBA)

amalgam and GIC•

**Manipulation and setting reaction of MTA:**

The MTA past is obtained by mixing 3 part of powderof water to obtain putty like consistency ( distilled water , local anesthesia, normal saline). Maxing can be done on paper or on a glass slab using a plastic or metal spatula. This mix is than placed in the desired location and condensed lightly with a moistened cotton pellet.

MTA has a pH of 10.2 immediately after mixing and increase to 12.5 after 3 hours of setting which is almost similar to calcium hydroxide.

MTA powder should be stored carefully in sealed containers away from moisture. The mixing time of MTA is crucial .If the mixing of MTA is prolonged, it results in dehydration of the mix.

Sluyk et in 1998 reported that mixing time should be less than 4 minutes.

MTA takes longer Tim to set compared to any other matiral.the exact time taken to set varies between different studies.

According to Torabinejad and colleagues in 1995, the setting time of gery MTA is about 2 hours and 45 minutes ( + 5 minutes), whereas lsalmet in 2006 reported 2 hours and 55 minutes for very MTA and 2 hours and 20 minutes for white MTA .

Extended setting period of MTA is one of its main drawbacks. It is suggested by many investigators that the incorporation of accelerators Such as sodium phosphate dibasic ( Na2HPO4) and calcium chloride ( CalCl2) many reduced the setting time.

MTA being hydrophilic requires moisture to set, making absolutely dryness contraindicated. Presence of moisture during setting improves the flxural strength of the set cement.

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**Q:NO:(3) Discus manipulation of amalgam, write indication and contraindication of amalgam?**

**Ans. Manipulation of amalgam:**

1) Selection of alloys 2) Proportioning and dispencing 3) Trituration 4)Condensation 5)Carving

**2. Selection of alloys**: For restorations subjected to occlusal forces, an amalgam with high resistance to marginal fracture is desirable. If strength is needed quickly the best chice is spherical or high copper alloys, but they require a fast operator. It is estimated that the majority of the dental amalgams currently placed are high copper alloys, spherical – unicompositional or admixed types.

**3. Proportioning and Dispensing:** Proportioned capsules containing alloy particles and mercury in compartments separated by a disk or membrane are available.

**4. Trituration:** Trituration is the process by which mercury is allowed to react with the alloy powder. This procedure allows the rubbing of the surface oxide on amalgam particles, exposing an active surface to react with mercury. Trituration: 1) hand trituration 2) mechanical trituration

**5. Hand Mixing**: > A glass mortar and pestle is used. The mortar has its inner surface roughened to increase the friction between amalgam and glass surface with carborundum paste. A pestle is a glass road with a round end.

**6. Mechanical Mixing:** The disposable capsule serves as a mortar. Some capsules have a cylindrical metal or plastic piece in the capsule which serves as the pestle. Reusable capsules are available with friction fit or screw – type lids. Amalgamators have automatic timer and speed control device. The speed ranges from 3200 to 4400 cycles per minute. High copper alloys require higher mixing speed.

**7. Mechanical amalgamator for proportioned capsules** (left) Close-up the mechanical arm that grips and vibrates the capsules.

**8. Effect of over trituration and under trituration:** Working time decrease with over trituration. Setting contraction increases with over-trituration. Compressive and tensile strengths increase with over- trituration of lath cut alloys; however they decrease with over- and under-trituration of spherical alloys. Creep increases with over-trituration.

**9. Condensation:** The amalgam is placed in the cavity after trituration, and condensed using suitable instrument. Proper condensation increase the strength and decrease the creep of the amalgam. Condensation must always be done within the four walls and floor. If one or more walls of the cavity are missing, a steel matrix may be used to compensate for it.

**10. Manual Condensation:** The mixed material is condensed in increments. Each increment is carried to the prepared cavity by means of a small forceps or an amalgam carrier. Once inserted, it should be condensed immediately with sufficient pressure (approximately 3 to 4 pounds).

**INDICATIONS OF AMALGAM**:

Class I and class II cavities.-moderate to large restorations.

 As a core build up material.

 Can be used for cuspal restorations (with pins usually) In combination with composite resins for cavities in posterior teeth.

Resin veneer over amalgam.

 As a die a material.

 Restorations that have heavy occlusal contacts.

 Restorations that cannot be well isolated In teeth that act as an abutment for removable appliances

Class 3 in unaesthetic areas eg.distal aspect of canine.

especially if Preparation is extensive with minimal facial involvement Class 5 lesions in nonesthetic areas especially when access is limited and moisture control is difficult and for areas that are significantly deep gingivally.

**CONTRA INDICATIONS OF AMALGAM** :

Anterior teeth where esthetics is a prime concern

Esthetically prominent areas of posterior teeth.

Small –to-moderate classes I and II restorations that can be well isolated.

Small class VI restorations.

**Q:NO(4) Discus composition of calcium hydroxide with advantage and disadvantage?**

**Ans. Composition of calcium hydroxide:**

**composition Acidic paste :**

• Alkyl salicylate (iso-butyl salicylate or 1-methyl triethylen salicylate)

• Inert fillers – titanium oxide 12-14%

• Radiopacifer – barium sulphate32-35%

• Calcium tungstate or calcium sulphate14-15%

**Basic paste:**

• Calcium hydroxide 50-60%

• Zinc oxide 10%

• Zinc stearate 0.5%

• Ethylene toluene sulphonamides and paraffin oil 39.5%

 Alkyl salicylate is dysfunctional chelating agent. On mixing this with paste containing zinc oxide and calcium hydroxide, amorphous calcium disalicylate is formed.

• The sulphonamide compound used in the paste is present merely as a carrier.

• Some cements contain paraffin oils instead of sulphonamides. These elements are more hydrophobic and release their calcium hydroxide more slowly.

• Some commercially available calcium hydroxide products are Dycal, life, Hydrex, care VLC, Dycal (light cured)

Light Cured paste formulation:

• Dimethacrylate eg. Bis GMA

 • Hydroxy ethyl methacrylate (HEMA)

• Calcium hydroxide

• Polymerizing activator

• Barium sulphate The purpose of HEMA is to produce a relatively hydrophilic polymer, which can absorb water and release, calcium hydroxide to create an alkaline environment.

**Advantage:**

Initially bactericidal then bacteriostatic. Promotes healing and repair. High pH stimulates fibroblastsNeutralizes low pH of acids. Stops internal resorption. Inexpensive and easy to use.

**Disadvantage:**

Does not exclusively stimulate dentinogenesis. Does exclusively stimulate reparativedentin. Associated with primary tooth resorption. May degrade during acid etching. Degrades upon tooth flexure. Marginal failure with amalgam condensation. Does not adhere to dentin or resin restoration.

**Q:NO(5 Write component of composite resin and also discus uses of composite resin?**

**Ans.**

Components, Matrix, Filler, Coupling Agent, Initiators and accelerators, pigments

**Resin Matrix**

• Bis-GMA (bisphenol-A glyceril methacrylate)

• UDMA (urethane dimethacylate)

• TEGDMA (triethylene glycol dimethacrylate) If the composite is made up of just the resin matrix, it is called Unfilled Resin

**Matrix**

• Phase that polymerizes to form a solid mass and that bonds to the tooth structure.

• Weakest and the least wear resistant phase

• Absorbs water, stain and discolor

• Minimize the filler content

• = stronger composite material

 **Filler Particles**

• Silica particles

• Quartz

• Glass ( Ba, Sr, Zr) If the composite is made up ofthe resin matrix AND fillers, it is called Filled Resin

**Factors for durability of Co ResinFiller Size Filler Content**

• Determines the

• As the filler content surface smoothness. increases, the resin

• Larger particles = content decreases rougher surface

• Hardness and

• Composites are most abrasion resistance often classified by increases the filler size.

 **Filler Particles**

• Increase fillers, increase % Filler Volume mechanical properties 2 Fracture Toughness – strength 1.5 – abrasion resistance 1 – esthetics 0.5 – handling 0 0 28 37 48 53 62 Ferracane J Dent Res 1995

9. Coupling Agent

• Chemical bond – filler particle - resin matrix

• transfers stresses

• Organosilane (bifunctional molecule) – siloxane end bonds to hydroxyl groups on filler – methacrylate end polymerizes with resin CH2 OHBis-GMA CH3-C-C-O-CH2-CH2-CH2-Si-OH Bonds with resin Bonds with filler O OH Silane Phillip’s Science of Dental Materials 2003

10. Coupling Agents

• Chemical bond – filler particle - resin matrix

• Improves physical and mechanical properties

• Inhibits leaching by preventing water from penetrating along the resin-filler interface

11. Optical Modifiers / Pigments

• Provides the opacity or translucency needed to make the composites similar to the natural tooth tissue

• Metal oxide particles – Titanium dioxide – Aluminum oxide

**USES:**

1.Direct and indirect restorative material

2.Fiber Reinforced composite posts

3.Luting agents

4.Core build up in post endodontic restorations

5.Pit and fissure sealants

6.Bonding of orthodontic brackets

7.Splinting of mobile teeth

 ***The End***