Dental materials and cements, and its use in children
Study objective

- Discuss the role and importance of cements in paediatric dentistry
Calcium hydroxide

- This is a colourless crystal or white powder prepared by reacting CaO (lime) with water through a process known as slaking.
- \( \text{Ca(OH)}_2 \) has a pH of 10 and thus would kill bacteria. Its beneficial effects is due to its high alkaline pH which makes it bacteriocidal. In the absence of infection, natural healing can take place.
Calcium hydroxide - 2

- Ca(OH)\textsubscript{2} retains its antibacterial properties for about 2 months when placed under a restoration after which it degrades to calcium oxide and other less calcium salts eg calcium carbonate.
- Product has limited shelf-life.
Uses of calcium hydroxide

**Lining:** when Ca(OH)₂ is used as a lining, it is placed very thinly over the deepest part of cavity only.
Indirect pulp capping: when caries is deep such that excavation of soft dentine would result in pulpal exposure, indirect pulp is appropriate. The material is placed on the final layer of hard leathery infected dentine. The material sterilises the affected dentine and allows for formation of secondary dentine. It is important that the tooth is vital.
Uses of calcium hydroxide - 3

- **Direct pulp capping**: when there is exposure of the pulp due to instrumentation NOT caries. Only done in permanent dentition. Such a tooth must not bleed spontaneously, no pain, no respond to hot and cold stimulus, no peri-radicular pathology.
Uses of calcium hydroxide - 4

**Root dressing:** can be used in inter-visit dressings of root canals especially weeping canals

**Root canal sealants:** can be used as a canal sealant paste. This is no longer popular because it easily dissolves.

**Root canal filling material:** for use following partial pulpectomy as this is a resorbable material

**Apical closure:** use for apexification or apexogenesis eg hypocal
Limit of calcium hydroxide use

a. It has poor compressive strength and thus unsuitable for use directly under amalgam.

b. It does not bond to dentine and thus cannot prevent subsequent infection spreading pulpally.

c. If used in conjunction with an acid-etch technique it will reduce the area available for bonding.

d. Smears and contaminate the cavity when phosphoric acid is placed.
Mineral trioxide aggregate

- Mineral Trioxide Aggregate (MTA) is a mixture of a refined Portland cement and bismuth oxide
- It also contains trace amounts of SiO2, CaO, MgO, K2SO4, and Na2SO4.
- MTA was first described for endodontic applications in the scientific literature in 1993.
Nowadays, there are two forms of MTA on the market, the traditional gray MTA (GMTA) and white MTA (WMTA), which was introduced in 2002. WMTA has less $\text{Al}_2\text{O}_3$, $\text{MgO}$, and $\text{FeO}$ and, also, smaller particles than GMTA.
• Similar or less microleakage has been reported for MTA compared to traditional endodontic sealing materials [gutta-percha and pastes] when used as an apical restoration, furcation repair, and in the treatment of immature apices.
Mineral trioxide aggregate - 4

- In vitro and in vivo studies support the biocompatibility of freshly mixed and set MTA when compared to other dental materials
Uses of MTA

- Direct pulp capping
- Vital pulpotomy
- Root-end filling
- Root repair (resorption and perforations)
- Apexification.
Use of MTA for pulp capping

- Clinical prospective studies suggest that both GMTA and WMTA have similar results as traditional calcium hydroxide in non-carious mechanical pulp exposures in teeth with normal pulp tissue.
Use of MTA for pulp capping - 2

- Histological analysis has suggested a more homogenous and continuous dentine bridge formation by MTA than calcium hydroxide at both 4 and 8 weeks after treatment and less inflammation associated with MTA than calcium hydroxide.
Use of MTA for vital pulpotomy

- Clinical prospective studies using MTA as pulpotomy dressings for primary and permanent teeth reported similar or better results for MTA materials compared to formocresol or calcium hydroxide with respect to the formation of dentine bridges and continued root development.
Use of MTA and root repair

- There are several case reports in which MTA has been successfully used to repair horizontal root fractures, root resorption, internal resorption, furcation perforations and apexification and/or apexogenesis which was confirmed clinically and radiographically.
Use of MTA and root repair - 2

- 3mm of MTA is recommended as the minimal amount when used as a root end filling and 5mm in apexogenesis.
Successes with MTA

- Overall results on the use of MTA in endodontics are favourable, but more well-designed and controlled clinical longitudinal studies are needed to allow systematic review and confirmation of all suggested clinical indications of MTA.
• Repair of root perforations during root canal therapy
Perforations are the result of procedural error in which a communication between the pulp canal and the periradicular tissue occurs. ProRoot® MTA can be used to seal perforations.

• Repair of root resorption
Internal root resorption is an idiopathic condition resulting in the breakdown or destruction of root structure. ProRoot® MTA can seal the resorptive defect.

• Root-end filling
Root-end filling is required when an endodontic case can best be treated or retreated with a surgical (extra-radicular) rather than an intra-radicular approach. ProRoot® MTA has excellent sealing ability and allows periradicular healing when used as a root-end filling material during periradicular surgery.

• Pulp capping
Vital pulp therapy may be indicated in certain clinical situations. Placing ProRoot® MTA over the exposed area often allows healing and preservation of the vital pulp without further treatment. Because of its unique features and benefits, ProRoot® MTA offers distinct advantages over other materials for these root canal repair procedures.

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• Apexification
ProRoot® MTA is an excellent material for apexification because ProRoot® MTA creates a permanent apical plug at the outset of treatment.
Quiz 1

MTA:

a. Known as Mineralised Trioxide Aggregate
b. Can be used for vital pulpotomy in children
c. Can be used as a root canal medicament
d. Can be used for direct pulp capping
e. Limited used due to associated toxicity
Quiz 2

Calciuin Hydroxide:

a. Can be used as a lining under amalgam
b. Can be used for direct pulp capping in primary teeth
c. Can be used as a root end sealant
d. *Can be used for* direct pulp capping in permanent teeth
e. Limited used due to associated toxicity
Acknowledgement

- Slides were developed by Morenike Ukpong, Associate Professor in the Department of Paediatric Dentistry, Obafemi Awolowo University, Ile-Ife, Nigeria.
- The slides were developed and updated from multiple materials over the years. We have lost track of the various references used for the development of the slides.
- We hereby acknowledge that many of the materials are not primary quotes of the group.
- We also acknowledge all those that were involved with the review of the slides.