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CLASSIFICATION OF DENTAL FILLING MATERIALS: COMPOSITION, PROPERTIES, AND INDICATIONS FOR USE

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АННОТАЦИЯ:

This article examines dental filling materials widely used in clinical dentistry. It outlines their classification, chemical composition, principal properties, and indications for practical use. The advantages and limitations of each material category are discussed, together with recommendations concerning their clinical application. The article is intended to provide dental practitioners and medical students with useful information for understanding filling materials and selecting them appropriately.

1. CLASSIFICATION OF DENTAL FILLING MATERIALS

Dental filling materials are divided into four groups: temporary filling materials, permanent filling materials, liners (protective and therapeutic), and root canal filling materials. Temporary filling materials include artificial dentine and dentine paste.

Artificial dentine

Artificial dentine is mixed with distilled water. During preparation, the powder is gradually incorporated into the water. Its advantages include low cost and setting in the oral cavity within 1–3 minutes. Its disadvantages are poor resistance to mechanical forces and a short service period; it is generally placed for 1–3 days.

Dentine paste

Dentine paste is supplied ready for use and consists of a mixture of peach-kernel oil and clove oil, unlike artificial dentine. At body temperature, the paste remains in the oral cavity for approximately 23 hours. Its advantages include ease of application and greater strength

than artificial dentine. According to the source article, it may be placed for a period ranging from two to six months.

2. PERMANENT FILLING MATERIALS

Permanent filling materials include cements, metallic fillings (amalgam), and composites. Cements are classified into two main categories: mineral cements and polymer cements. Mineral cements include zinc phosphate, silicophosphate, and silicate cements. Polymer cements include polycarboxylate and glass ionomer cements.

2.1. Zinc phosphate cement

Powder composition: ZnO, SiO_2, Al_2O_3, MgO, and CaO. Liquid: phosphoric acid. Advantages include plasticity, good adhesion, low thermal conductivity, relative safety for the dental pulp, and radiopacity. Disadvantages include porosity, susceptibility to saliva, low mechanical strength, a colour that differs from tooth enamel, and an approximately 0.5% reduction in volume during setting. Uses described in the source include temporary fillings, insulating liners, cementation of crowns, bridges and pins, restoration of permanent and primary teeth, and root canal filling.

2.2. Silicate cement

Powder: finely ground glass composed of aluminosilicates and fluoride salts. Liquid: a 30–40% phosphoric acid solution containing aqueous zinc and aluminium hydrates. Advantages include mechanical strength, translucency and lustre resembling tooth enamel, a high fluoride content that may provide a preventive effect, low cost, ease of mixing, and plasticity. Disadvantages include poor adhesion to dental tissues, potentially harmful effects on the pulp, brittleness, susceptibility to fracture and saliva, disintegration, lack of radiopacity, and abrasiveness.

2.3. Silicophosphate cement

Powder composition: 60–95% silicate cement and 5–40% phosphate cement. Liquid: a mixture containing phosphoric acid. Advantages include mechanical resistance, less brittleness than silicate cement, better adhesion than silicate cement, plasticity, low cost, and radiopacity. Disadvantages include a colour that may not match dental tissues, toxicity, and solubility and instability in saliva.

2.4. Polycarboxylate cement

The powder is based mainly on metal oxides and is described in the source as containing approximately 90% ZnO and 10% MgO; some formulations may contain 10–40% Al_2O_3 and a small amount of SnF. The liquid is a 40–50% aqueous solution of polyacrylic acid. Advantages include relatively low toxicity to the pulp and good adhesive properties. Disadvantages include limited resistance to oral fluids, low strength, and unsatisfactory aesthetic properties. Indications include use as an insulating liner and for cementing inlays, crowns, bridges, and orthodontic appliances.

2.5. Glass ionomer cement

Powder: aluminosilicate glass and fluoride compounds. Liquid: an aqueous solution of polyacrylic acid. Glass ionomer cements may be used for permanent restorations because of their restorative and aesthetic properties and adequate strength. Fast-setting formulations may be used as liners, fissure sealants, and materials for filling root canals.

3. METALLIC FILLING MATERIALS: AMALGAM

Silver amalgam

Advantages include high hardness and strength, resistance to oral fluids, and no direct alteration of the colour of the surrounding hard dental tissues. Disadvantages include limited adhesion to hard dental tissues, high thermal conductivity that may adversely affect the pulp unless appropriate protection is provided, dimensional changes, and poor aesthetic appearance.

Copper amalgam

Before use, mercury is added to the amalgam mixture. The source lists good adaptation to cavity margins, low shrinkage, and a bactericidal effect as advantages. Disadvantages include corrosion in the oral cavity and dark staining of hard dental tissues.

4. LINERS AND ROOT CANAL FILLING MATERIALS

Composite materials are also included among permanent filling materials. Liners are divided into two groups: therapeutic liners and insulating liners.

Therapeutic liners are placed at the base of a carious cavity to provide a therapeutic effect. Insulating liners protect the dental pulp from undesirable effects associated with permanent restorative materials.

Root canal filling materials are divided into two main groups: plastic materials and solid materials. Plastic materials may be setting or non-setting, while solid materials may be metallic or non-metallic. Non-setting plastic materials for root canals may be supplied as a powder-and-liquid system; setting materials include cements. Fillers are solid filling components, whereas sealers are flowable materials that fill the space between the root canal wall and the filler.

CONCLUSION

Dental filling materials are among the principal therapeutic materials used in dentistry. Appropriate selection helps restore dental tissues while supporting aesthetic appearance, functional durability, and long-term outcomes. Each material has its own composition, physicochemical properties, advantages, limitations, and clinical indications. Therefore, dentists should consider the patient’s age, the condition of the tooth, oral hygiene, and financial circumstances when choosing the most suitable material. A thorough understanding of filling materials and their correct clinical use is an important factor in improving the quality of dental treatment.

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