RESTORATIVE MATERIALS USED ON PEDIATRIC DENTISTRY

STATUS OF COMMON RESTORATIVE MATERIALS

Advances in the development of improved biomaterials for dental restorations have been rapid, and they continue to occur at a fast pace. The more common restorative materials used in pediatric dentistry are composite and other resin systems, glass ionomers, silver amalgam alloys, and stainless steel alloys.

Porcelain, zirconia, and cast metal alloy materials are also used in pediatric restorative dentistry but less frequently.

Resin-based composites, glass ionomers or some combination of the two are being used progressively more and silver amalgam progressively less in pediatric restorative dentistry; many pediatric dentistry practices do not use silver amalgam at all; instead, some form of resin-based composite or glass ionomer is used.

It has been suggested that these materials and their combinations on a continuum, with glass ionomer on the left, resin-based composite on the right, and the combined materials somewhere in between, depending on the relative amounts of each material in the mix. Two major categories on the continuum are described as "resin-modified glass ionomer" and "compomers". A fifth formulation has been added on the right side of the continuum in the form of "flowable resin-based composite."

Knowing the particular strengths and weaknesses of each type of material will enhance the clinician's ability to make the best choices for each individual restorative situation.

Use of any of these restorative materials generally requires more effort and time than those needed for conventional amalgam restorations.

COMPOSITE

Composite (componere = to combine) is the universally used tooth-colored direct restorative material developed in 1962 by combining dimethacrylates (epoxy resin and methacrylic acid) with silanized quartz powder.

Factors that influence the composite resin polymerization process

- *Curing time: It depends on: resin shade, light intensity, box depth, resin thickness, curing through tooth structure.*

- *Shade of resin: Darker composite shades cure more slowly and less deeply than lighter shades (60 seconds at a maximum depth of 0.5 mm).*
- *Temperature: Composite at room temperature cures more completely and rapidly.*
- *Thickness of resin: Optimum thickness is 1 to 2 mm*
- *Type of filler: Microfine composites are more difficult to cure than heavily loaded composites.*
- *Distance between light and resin: Optimum distance < 1 mm, with the light positioned 90 degrees from the composite surface.*

Light source quality: Wavelength between 400 to 500 nm.

- *Polymerization shrinkage: Depends on the amount of organic phase.*

Types of Composite:

- ***Hybrid composite resins:***

– These composites are so called because they are made up of polymer groups (organic phase) reinforced by an inorganic phase.

– The characteristic properties of these materials are:

availability of a wide range of colors and ability to mimic the dental structure, less curing shrinkage, low water absorption, excellent polishing and texturing properties, abrasion and wear very similar to that of tooth structures, similar thermal expansion coefficient to that of teeth, universal formulas for both the anterior and posterior sector, different degrees of opaqueness and translucency in different tones and fluorescence.

- ***Flowable composites:***

– These are low-viscosity composite resins, making them more fluid than conventional composite resins.

– The percentage of inorganic filler is lower.

– Their main advantages are: High wettability of the tooth surface, ensuring penetration into every irregularity; ability to form layers of minimum thickness, so improving or eliminating air inclusion or entrapment; radiopaqueness and availability in different colors.

– The drawbacks are: High curing shrinkage, due to lower filler load, and weaker mechanical properties.

– These are indicated in Class V restorations, cervical wear processes and minimal occlusal restorations or as liner materials in Class I or II cavities or areas of cavitated enamel.

➢ ***Condensable composites:***

– Condensable composites are composite resins with a high percentage of filler.

– The advantages are: Condensability (like silver amalgam), greater ease in achieving a good contact point and better reproduction of occlusal anatomy.

– Their disadvantages are difficulties in adaptation between one composite layer and another, difficult handling and poor esthetics in anterior teeth.

– Indication is Class II cavity restoration in order to achieve a better contact point.

➢ ***Compomer:***

– The word "Compomer" comes from composite and glass ionomer in an attempt to take advantage of the desirable qualities of both materials; the fluoride release and ease of use of the glass ionomers and the superior material qualities and esthetics of the composites.

– Compomer restorations have been shown to have insufficient retention without pretreatment of the dental hard tissue with an adhesive system.

– They are most suitable for restorations in the deciduous dentition due to their low abrasion resistance.

– In cervical restorations, compomer restorations performed better than resin-modified glass ionomers but not as well as hybrid composites.

Indications of composite (in general):

- *Classes I, II, III, IV, V and VI restorations*
- *Foundations or core build-ups*
- *Sealants*
- *Preventive resin restorations*
- *Esthetic enhancement procedures integrity such as:*
  - *Partial veneers*
  - *Full veneers*
  - *Tooth contour modifications*

– Diasthema closures

• Cements (for indirect restorations)

• Temporary restorations

• Splinting

Contraindications:

• If the operating site cannot be isolated from contamination by oral fluids

• If all of the occlusal load will be on the restorative material

• Economics

• Restorations that extend onto the root surface may result in less than ideal margins.

Advantages

• Esthetic

• Conservative of tooth structure removal

• Tooth preparation is simple

• Have low thermal conductivity

• Used almost universally

• Bonded to tooth structure

• Exhibit greater occlusal wear in areas of high occlusal stress

• Repairable

Disadvantages

• May have a gap formation and marginal leakage

• Time-consuming

• Costly

• Establishing proximal contacts, axial contours, embrasures may be more difficult

• Technique sensitive

SILVER AMALGAM

Despite its declining use; silver amalgam remains one of the most durable and cost-effective restorative materials. Success in the use of this filling material depends on adherence to certain principles of cavity preparation.

Classification

• Based on copper content

– High copper content: Copper content more than 12 percent

– Low copper content: Copper content less than 6 percent

• Based on zinc content

– Zinc containing alloy with more than 0.01 percent zinc

– Zinc free alloys with less than 0.01 percent zinc

• Based on particle shape and type

– Lathe-cut: Irregularly shaped filings produced by cutting an ingot of alloy on a lathe.

– Spherical particle: Produced by atomizing the alloy, whilst still liquid into a stream of inert gas.

Indications of Amalgam

- *Moderate-to-large restorations*
- *Restorations that are not in highly esthetic areas of the mouth*
- *Restorations that have heavy occlusal contacts*
- *Restorations that cannot be well isolated*
- *Restorations that extend onto the root surface*
- *Abutment teeth for a removable partial denture*
- *Temporary or caries control restorations.*

Contraindications of Amalgam

- *Esthetically prominent areas of posterior teeth*
- *Small-to-moderate classes I and II restorations that can be well isolated*
- *Class VI restorations.*

Advantages of amalgam

- *Ease of use*
- *High tensile strength*
- *Excellent wear resistance*
- *Favorable long-term clinical research results*
- *Lower cost than for composite restorations*

Disadvantages of amalgam

- *Non-insulating*
- *Non-esthetic*
- *Less conservative and weakens tooth structure*
- *More difficult tooth preparation*
- *Initial marginal leakage*

Operatory Prevention

• The operatory should be well ventilated.

• All excess mercury, including waste, disposable capsules, and amalgam removed during condensation should be collected and stored in well-sealed containers containing water.

• Proper disposal through reputable dental vendors is mandatory to prevent environmental pollution.

• Amalgam scrap and materials contaminated with mercury or amalgam should not be incinerated or subjected to heat sterilization.

• If mercury comes in contact with the skin, the skin should be washed with soap and water.

• Use of carpeting is limited as it may incorporate mercury vapors and waste.

BONDED AMALGAMS

Some renewed interest in silver amalgam has occurred because of the development of "bonded amalgams."

They are silver amalgam restorations that have been condensed into etched cavity preparations lined with a dentin-bonding agent and some material on the glass-ionomer–composite resin continuum.

Properties

• Bonded amalgam restorations have significant advantages over both conventional amalgam restorations and posterior composite resin restorations.

• Cavity design: Conventional amalgam restorations are retained by mechanical retention like undercut cavity design but bonded amalgam incorporation technique reduces the need for removal of sound tooth tissue to create mechanical retention.

• The ability to bond to enamel and dentin by the acid-etch technique.

• No polymerization contraction.

•Marginal leakage and loss of marginal integrity around conventional amalgam restorations have been recognized as serious disadvantages. Bonded amalgam restorations, however, show significantly less marginal leakage than conventional amalgam restorations.

• The use of bonded restorations in posterior teeth has been shown to reduce cuspal flexure and increase the structural integrity of the tooth when compared to conventional restorations.

• Bonded amalgams require considerable extra effort and expense to place compared with conventional amalgam restorations.

• In general, the use of bonded amalgams seems difficult to justify for the routine restoration of primary teeth, because traditional silver amalgam should provide comparable quality more efficiently and cost-effectively in most situations.

Clinical Technique

Etchant:

• Apply Etchant to enamel and dentin—wait 15 seconds.

• Rinse.

• Remove excess water with an air syringe or by blotting.

Activator/Primer:

• Mix one drop each of Activator and Primer.

• Apply to etched enamel and dentin — wait 15 seconds.

• Dry gently for 5 seconds.

Adhesive Application:

• Mix one drop each of Adhesive and Catalyst.

• Apply the mixed adhesive to the primed enamel and dentin.

• Triturate amalgam

Completing the Restoration:

• Condense and burnish the amalgam.