Introduction to Restorative Materials

Dr Paul Becker

November 2008

Dental Materials

- Bases and Liners
- Cavity varnishes
- Dentin-bonding agents
- Restorative materials
- Sealants
- Cements

Bases and Liners

Used in pediatric dentistry to prevent sensitivity to teeth

PULPAL PROTECTION

- Calcium Hydroxide
- Zinc Oxide- Eugenol
- Zinc Phosphate
- Glass Ionomer Cements

Calcium Hydroxide

- Can be either a two paste system or a visible light-cured system

- It's alkaline pH aids in preventing bacterial invasion
- Often used in direct pulp caps

Zinc Oxide- Eugenol

- Provides a ***sedative effect***
- Often used when confronted with multiple areas of excessive decay and sensitivity
- Used as a temporary cementation of crowns
- Used to fill obliterated pulp chambers following a pulpotomy

Video IRM

Zinc Phosphate

- Good to use over calcium hydroxide and under large amalgams as a base
- Used primarily to cement stainless steel crowns

Video- Zn Phosphate

Glass Ionomer Cements

- Popular basing agent
- Releases fluoride
- Less microleakage than ZOE, CaH, or Zinc Phosphate
- Must be mixed exactly as directed to prevent sensitivity of pulp
- Has good coefficient of thermal expansion

Cavity Varnish

- Copalite- Made from natural gums in an organic solvent
- Used with vital teeth in cavity prep prior to placement of amalgams
- NOT used with composites

Dentin-bonding agents

- Relies on a phosphate- calcium bond for retention
- Promotes infiltration of monomers into a zone of demineralized dentin that polymerize and interlock with the dentin matrix
- Every product has their own unique system with different variations

Restorative materials

- Amalgams
- Resin-based composites
- Glass Ionomer
- Compomers

Amalgam restorations

Advantages of Amalgam Restoration

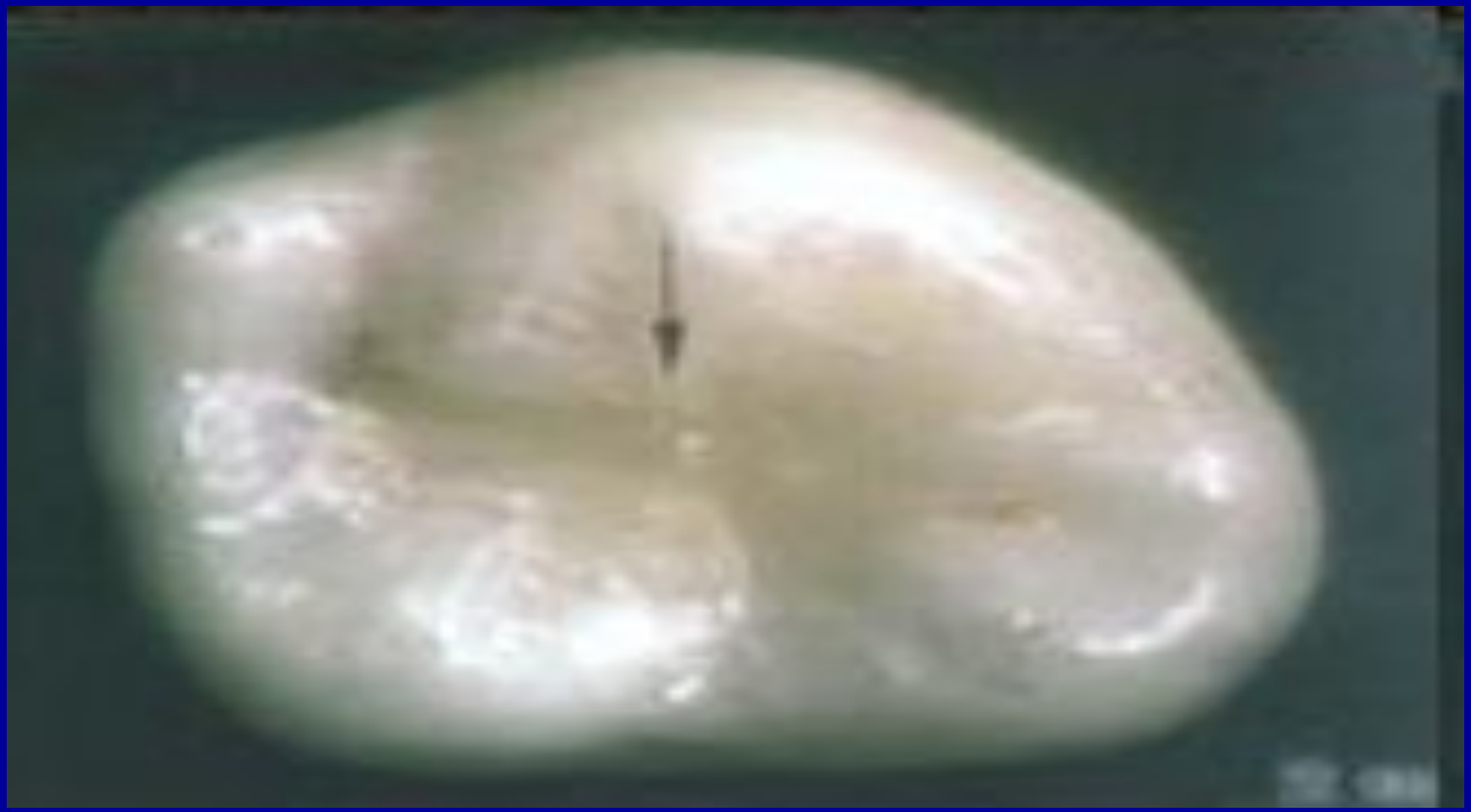
- Strong, durable and withstand occlusal forces
- Placed in one visit
- Lower in expense
- Self sealing with minimal to no shrinkage
- Resistance to further decay is high
- Frequency of repair and replacement is low
- Can be used in wet environment (good in pediatrics)

Disadvantages of Amalgam Restorations

- Special handling required for disposal (mercury content)
- Amalgam can darken over time
- Tooth preparation may require removal of some healthy tooth structure
- Rare but possible localized allergic reaction to amalgam
- Short term sensitivity to Hot and Cold

Video 2 Amalgam Trituration

Composite restoration



Composite Resin

- Mixture of acrylic resin + powdered glass-like particles
- May be self curing or light activated
- Used for restorations, inlays and veneers
- Can be used for replacement of portion of broken or chipped tooth

Advantages of Composite resins

- Color and shading can be matched to existing tooth
- Withstands moderate occlusal pressure
- Utilized in anterior and posterior regions
- Restorations completed in one visit

Advantages of Composite resins

- Moderately resistant to breakage
- Permits greater preservation of tooth structure
- Low risk of leakage if bonded to enamel
- Frequency of repair or replacement is low to moderate

Disadvantages of composite resins

- Usually wear out more frequently than metal restorations- need to be replaced more frequently
- Placement more time consuming
- Can not be used in wet environment
- More expensive than amalgams
- May wear faster than dental enamel
- May leak when bonded on dentinal layer

Types of Composites generational advancement

- **Macro filled** 8-12 micron
  Adaptic, Consise
- **Mini filled** 1-5 micron
  Estilux
- **Micro filled** .04-0.1 micron
  Durafil VS
- **Macro Hybrid** 8-12 micron/ 0.04-0.1 micron
  Prisma

Types of Composites

- **Micro- hybrid** 1-3micron / 0.04-0.1 micron

  Herculite, Charisma
- **Total Complete Composite** 5-8 m / 1-5m / 0.01-0.1 micron

  Prisma, Herculte XRV

Glass Ionomer Filling Material

Ketac™ Fil Plus Aplicap™

Indications

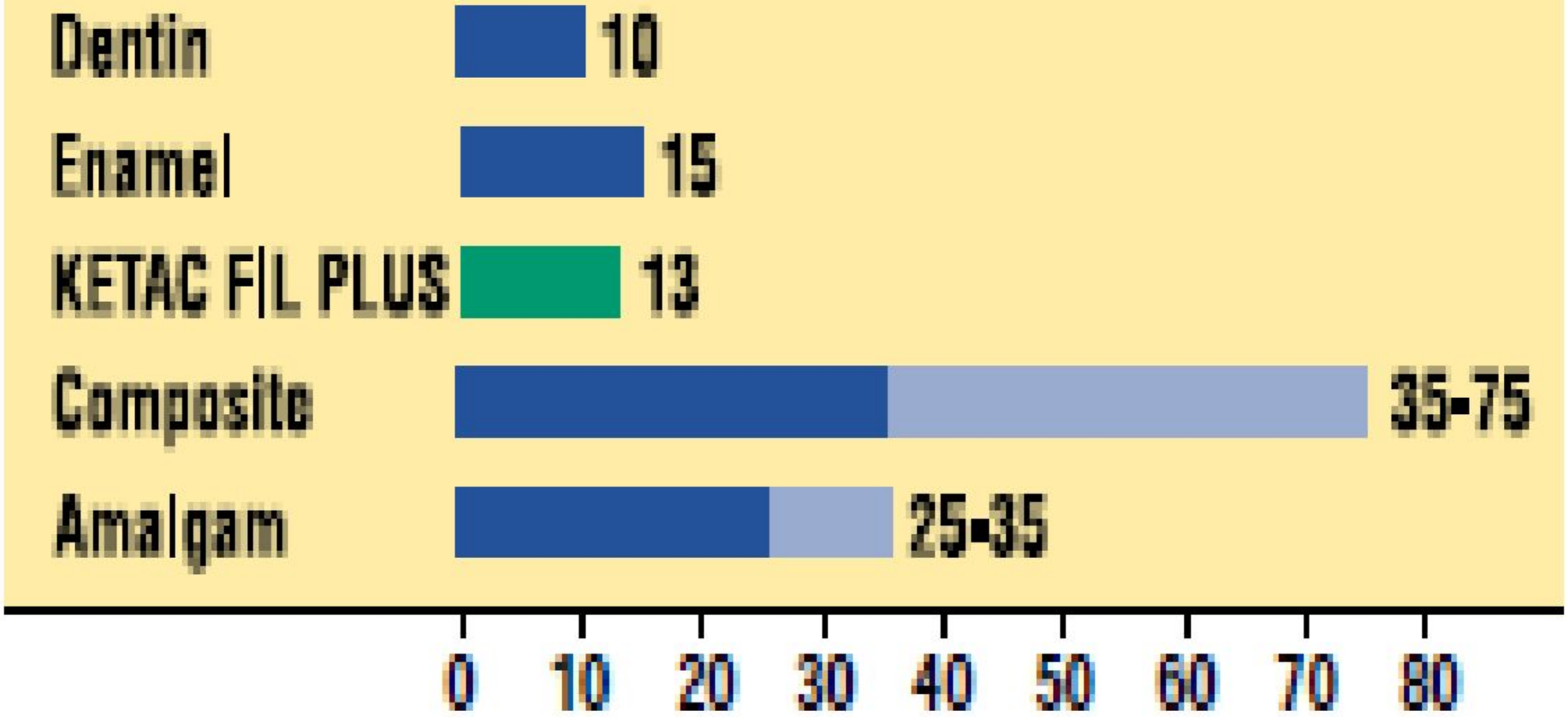
- Class III and V restorations
- Erosions or Wedge-shaped defects
- Small Class I fillings
- Core build-ups
- Minimally Invasive Dentistry (MID)

Clinical Advantages

- Ideal for pediatric and geriatric patients
- Indicated for cervical erosion or lost restorations
- Less shrinkage than traditional composites
- Chemical bond to enamel and dentin
- Coefficient of thermal expansion close to that of enamel and dentin
- High fluoride release
- Radiopaque
- Good system of delivery

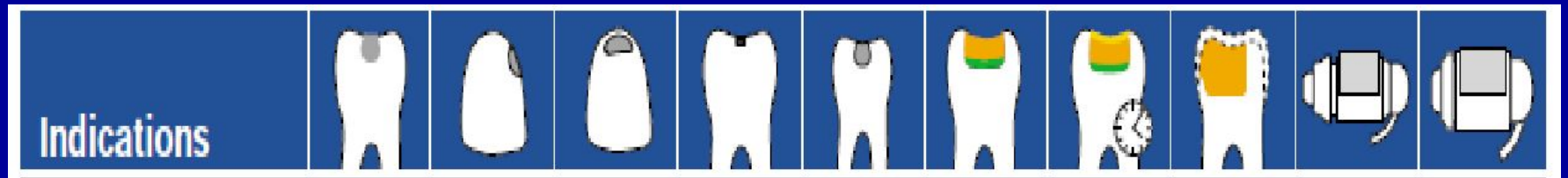
Ketac Fil Plus mirrors natural tooth structure.

Coefficient of Thermal Expansion



Source: Internal data 3M ESPE AG

Taken from 3M ESPE 2008



Indications	Small Class I	Class III	Class V	Minimal Invasive Dentistry (MID)	Primary Teeth	Base Under Composite	Temporary Treatment	Core Build-up	Aplicap™ Delivery	Maxicap™ Delivery
CONVENTIONAL										
Ketac Molar Quick	●		■	●	●	●	●	●	★	
Ketac Molar	●		■		●	●	●	●	★	
Ketac Fil Plus	●	●	●	●	●			●	★	
RESIN MODIFIED										
Photac Fil	●	●	●	●	●		●		★	
Vitremer™	●	●	●	●	●	●	●	●		
METAL REINFORCED										
Ketac Silver	●		■		●		●	●	★	★

■ = non esthetic

Comparison of Dental Cements

Cement	Composition	Working Time	Setting time	Compressive Strength	Bond Strength to Dentin	Release of Fluoride	Pulpal Response	Clean up of excess
Ideal		Medium	Short-medium	Very high	High	Yes	None	Easy
Zinc phosphate	Zinc oxide Phosphoric acid	Medium	Medium	Medium	None	No	Low-medium	easy
Polycarboxylate	Zinc oxide Polycarboxylate	Short	Short	Low-medium	Low-medium	No	None	Medium-difficult
Glass ionomer	Silicate glass containing Ca, Al, F	Short-medium	Short	High	Medium	Yes	Low	Moderate
Zinc silicophosphate	Zinc oxide and silicate, Phosphoric acid	Medium	Medium	High	None	Yes	Medium	Easy
Zinc oxide and eugenol	Zinc oxide Eugenol	Long	Medium	Low-medium	None	No	None	Easy
Reinforced zinc oxide and eugenol	Zinc oxide reinforced with alumina or polymer Eugenol	Long	Medium-long	Low-medium	None	No	None	Easy

Compomers

- **Good for pediatric patients**
- **Blend/ combination of resin based composite and glass ionomers**
- **Combination of Acid+ Base reaction and light activated**
- **Used with bonding agent – manufacturers say etching of enamel is optional**

Compomers

- Combines wear resistance/ rapid light set 40 seconds/ fracture resistance
- Releases fluoride (glass ionomer property)

- Vitremer Tri-Cure (**3M**)
- Photac-Fil (ESPE)
- Fuji II LC

Sealants

- Preventative
- Used to close Pit and Fissure areas
- May contain fluoride
- Either A +B system or Light activated

Dentsply FluroShield

- Tooth colored or
- Opaque
- Contains Fluoride

Necessary Items for working with all restorations

- A great assistant
- Pleasant room temperature 21-24 C^0
- Isolation- Rubber Dam
- Good Visibility
- Clean oral environment