GIC AND CAVITIES FOR TOOTH COLOURED RESTORATIVE MATERIALS

DR WAN ZARIPAH WAN BAKAR
PPSG, USMCK
GLASS IONOMER CEMENTS (GIC)

- Glass ionomer materials
- GIC is a water-based material.
- Developed in Britain, and firstly described by Wilson and Kent in 1972
- Early versions for Class V abrasion lesion – lack of aesthetic and translucency.
- Conserve tooth structure, assist in remineralisation while maintaining aesthetic appeal.
- Formed from the reaction of an ion-leachable calcium aluminosilicate glass powder and a polyalkenoic acid.
  “Glass polyalkenoate cements”.

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Glass polyalkenoate cements
GLASS-IONOMER CEMENT

- Types:
  1) Conventional GIC
  2) RMGIC

- Conventional GIC – subgroups are glass polyalkenoates and glass polyphosphonates.

- RMGIC – consist of the components of a glass-ionomer, modified by the inclusion of a small quantity of additional resin-mostly HEMA.
  - set partly by an acid-base reaction and partly by a photochemical polymerization.

Conventional GIC – chemically cured; acid-base reaction.

RMGIC – consist of the components of a glass-ionomer, modified by the inclusion of a small quantity of additional resin-mostly HEMA.
  - set partly by an acid-base reaction and partly by a photochemical polymerization.
COMPOSITION

- Powder: Calcium fluoroaluminosilicate glass which contain quartz, alumina, fluorite, cryolite, aluminium fluoride, aluminium phosphate.
  - Fused, quenched, ground and sieved to obtain particles in size 4 - 50µm.
- Radiopacity – lanthanum, strontium, barium, amalgam alloy, ZnO.
- Abrasion resistance – sintering metals such as silver or gold to glass particles.
- Fluoride
- Color – titanium oxide up to 5%

- Liquid: 2:1 acrylic- acid-itaconic-acid copolymer in water or a copolymer of maleic acid and acrylic acid – 40-55%
  - Tartaric acid – assist the extraction of ions from the glass powder, retain w time, sharpen setting time.
  - RMGIC – addition of resin mostly hydroxyethyl methacrylate (HEMA) – 15-25%

Encapsulated GIC need to be mixed by crushing and agitating the capsule for a prescribed time.
**PROPERTIES**

Ability to bond chemically to mineralized tooth structures through an ion-exchange mechanism – mountain formation.

Release of fluoride.

Ability to reabsorb fluoride ions and therefore react as a fluoride reservoir.

Limitations – susceptibility to brittle fracture
- unable to withstand undue occlusal-incisal loading.
SETTING REACTION

GIC: Ca polyacrylate chains form first followed by Al PA chains
RMGIC : HEMA (resin) included-additional chain superimposed over the acid-base reaction.

Fluoride release
CLASSIFICATION

- Type I – luting
- Type II – restoration
  - Type II.1 – restorative aesthetic
  - Type II.2 – restorative reinforced.
- Type III – lining or base

INDICATIONS FOR GIC
- Temporary restorations
- Base and liners
- Permanent restorations – not load bearing areas.
- Core build-up for crowns.
- Cervical caries – “Sandwich technique”
- Erosion lesions
- Root caries
- Hypersensitive cavity
- Rampant caries
- High caries risk
**STEPS**

- Removal of caries and prepare the cavity surface as smooth as possible.
- Clean tooth surface using a slurry of plain pumice and water.
- Condition cavity with cavity conditioner – 20% polyacrylic acid for 10 seconds.
- Wash vigorously with water spray for 30 seconds.
- Dry for 5 seconds lightly but not dehydrate the surface.
- Application of the GIC materials with the help of celluloid strip or matrix.
- Light cure for RMGIC.
COMPOSITE RESIN

- Materials created when inorganic fillers are added to synthetic resins.
- Introduced commercially in mid-1960s.
- The use of intense visible light for polymerization developed in the late 1970s.

Herculite - Kerr

Filtek supreme
**TYPES**

- **Type 1**: Macrofilled composite resin
  - glass, quartz, ceramic
  - crushed, grinded, sieved to achieve splinter-shaped particles.
  - particle size 5-30µm

- **Type 2**: Microfilled CR
  - amorphous silica diameter average 0.04µm.

- **Type 3**: Hybrid CR
  - particle size 0.5-8µm
  - Lutz and Philips (1983)

- Nanocomposite.
  - particle size: nanometer
  - nanoparticles and nanoclusters

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a – macrofill; b - microfill, splintered prepolymerised particles;

a-microfill, homogenous; d-microfill, spherical prepolymerised particles;
e-microfil, agglomerated complexes; f- hybrid composite
**COMPOSITION**

- Matrix – organic resin: diacrylates, bis-GMA, TEGDMA, EGDMA, HEMA.
- Inorganic filler: glass, quartz, ceramic, silica powder. - 52% - 88% (wt.)
- Coupling agent – silane - to unite the resin with the filler
- Initiator system – di-ketone and tertiary amine - photosensitive – camphorquinone - to activate the setting mechanism
- Stabiliser (inhibitor)
- Pigments.

**INDICATIONS FOR RESIN RESTORATIONS**

- Interproximal (Cl. III) lesions of anterior teeth.
- Facial (Cl. V) lesions of anterior teeth.
- Facial (Cl. V) lesions of premolars.
- Loss of incisal angles (Cl. IV).
- Fracture of anterior teeth.
- Rebuilding of teeth to support castings.
- Alternative to amalgam restorations. - Cl. I, Cl. II, Cl. VI.
**Direction of Shrinkage**

Light activation occurs towards light
- 60% occurs within 60 seconds
- balance within 2 days
Chemical activation directed towards centre of restoration.
- occurs slowly and evenly throughout restoration.

**Incremental build-up**

Types of failure at the margin of a composite resin

Lamination technique – 2mm thickness.
POLYACID-MODIFIED COMPOSITE RESINS – ‘COMPOMERS’

- Contain resins and fillers
- Resin – contains functional groups of polycarboxylic acid and methacrylates combined in one molecule.
  - carboxyl gps. for acid-base reaction (as in GIC)
  - methacrylic gps. for cross-linking (as in CR)
- Filler – fluoride containing glass.
- Eg. : Dyract, Compoglass
CLASS III CAVITY

- Interproximal cavity.
- When feasible, the preparation should be designed from the lingual with the incisal part of the contact point is not removed.
- Moisture control and isolation – rubber dam, cotton-role, saliva ejector.
- Local anesthetic if needed.
- Access – palatal approach for esthetics.
  - round bur size 1, jet 330.
- Caries removal – large SS bur # 2, 3
  - spoon excavator
- Outline form
- Resistance and retention form – round bur # $\frac{1}{4} @ \frac{1}{2}$
- Bevels – margin trimmer, bur.
- Shade selection
- Etch, prime and bond (adhesive)
- Celluloid strip insertion
- Composite resin placement – ‘press and pull’ technique.
- Light cure.
- Polishing – white stone bur, soflex disc, rubber cup and diamond paste.
Burs: Jet 330, F20, L10, TC 169L.
CLASS IV CAVITY

- Cavity involving edge of incisal tip or fractured teeth.
CLASS V CAVITY

Cavities at buccal or cervical surface of the tooth.
Erosion cavity – superficial loss of dental hard tissue due to a chemical process not involving bacteria.
Abfraction – erosive lesion due to excessive buccal or lingual occlusal load through either compression or tension in the cervical region of the tooth.
CLASS II CAVITY
Other Tooth Coloured Restorations Suitable Cases
TUNNEL CAVITY

External Tunnel Preparation

Internal Tunnel Preparation

occlusal access channel

TUNNEL PREP.

2.5mm

2-3mm

glass ionomer cement

composite resin
SLOT CAVITY

POLISHING BURS
REFERENCES