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GLASSIONOMER CEMENTS, COMPOMERS

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Glassionomer cements

Meaning: ionomer = ionic polymer

Definition: water based glass-polyalkenoate
ISO terminology: polyalkenoate cement
During setting acid-base reaction takes place, salts are formed

powder: liquid:
glass particles + polyalkenoates

Glassionomer cements

- Matrix (liquid)= polyalkenoates:
  - Al^{3+}/Ca^{2+} polyacrylic acid
  - itaconic acid
  - maleic acid
  - metacrylic acid
- Particles (powder):
  - Ca-Al-F silicate glass
  - Sr-Al-F silicate glass

Matrix

Al^{3+} polyacrylate chains

not soluble, cannot absorb water

strong

Ca^{2+} polyacrylate chains

can absorb water

water balance changes during setting

H_2O uptake

H_2O release

Biocompatibility

- During setting acid-base reaction takes place
- Dentin is good buffer against acidic effect of glass ionomer cement
- Polymer chain is too big to enter through dentin tubules

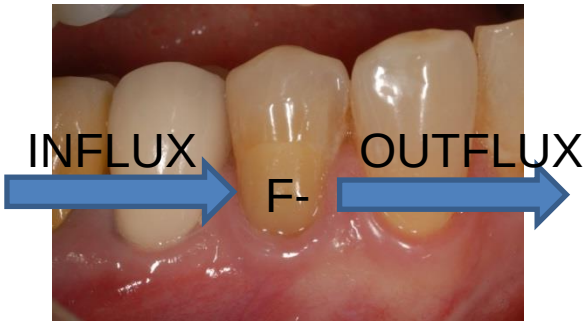
Particles

- Particles = silicate glass
  - La, Sr, Ba, ZnO for radiopacity
  - Ca^{2+} for translucency
  - F^- for caries prevention

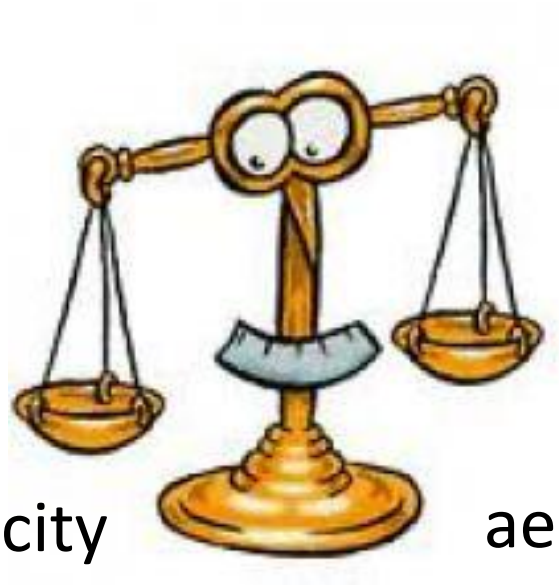
    not part of polymer chain

    constant outflux

    influx with topical flouride



Radiopacity



radiopacity aesthetics

La, Sr, Ba, ZnO Ca^{2+}

Mixing

- Best if mixed in machine for standard powder: liquid ratio

- Mix on glass slabs

- „loss of gloss”= end of working time

Powder:liquid

- Great variety
- Powder:
  - Bigger 50μm aesthetic
  - Smaller <50μm fast setting: luting and lining
- Powder:liquid

glass particle : polyacrylic acid

glass particle : polyacrylic + itaconic acid + maleinic acid

glass particle + dehydrated polyacrylic : water

glass particle + dehydrated polyacrylic : tartaric acid

easier handling

Powder:liquid

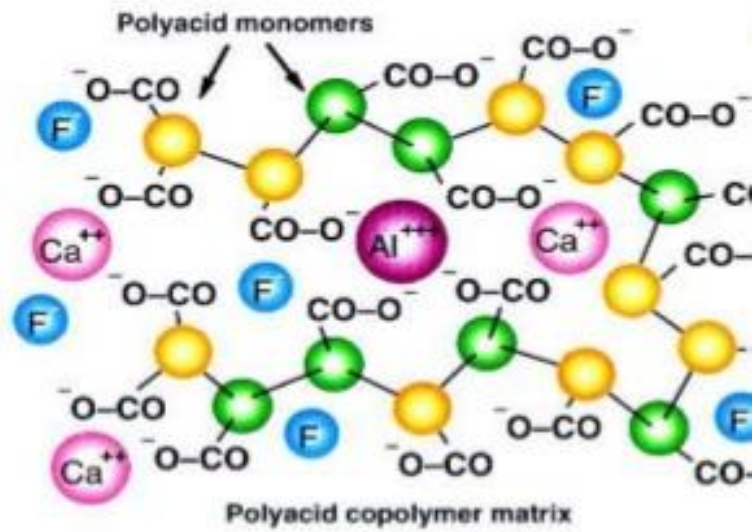
- powder:liquid
  luting cements, liners
  finer film thickness

- powder:liquid
  base, fillings
  thicker film thickness

Setting

Definition:

in water ionic crosslinking of polyacid chains



matrix is already polymer

Glass ionomer cement and its recent advances- By Dr. Jagadeesh Kodityala. ppt

Initial phase:

- Hardening
- Ca^{2+} released from surface of glass particles
- Not stable
- Soluble in water

Second phase:

- Increase in physical properties
- Al^{3+} released from surface of glass particles
- Further crosslinks
- Not soluble

Setting

- Slow setting 24hrs
  - More aesthetic
  - Ca^{2+} provides translucency
  - Sensitive to water uptake
  - No finishing /polishing for 24hrs
  - Waterproof coating for protection until set 24hrs!
  - Coating-air dry-coating 2. layer

- Fast setting ~5min
  - Less aesthetic
  - Stripped of Ca^{2+}
  - Not sensitive to wateruptake
  - Finishing/polishing in 5min
  - Sensitive to drying out
  - No dental treatment for 2 weeks (isolation makes mouth dry)

Finishing and polishing

- Contouring and finishing

  fine diamond

  slow set after 24hrs

  fast set after 5min

- Polishing

  rubber

Classification I

according to Wilson and McLean 1988

I. Luting cements
II. Restorative cements
    1. Aesthetic
    2. Reinforced
III. Lining cements

I. Luting cements

- For luting inlays, crowns, bridges, post&cores
- Powder particle size – fine
- Powder:liquid 1,5:1
- Flowable consistency
- Fast setting
- Snap set
- Sensitive to dehydration
- Low solubility
- Good physical properties
- Radiopacity to detect residue cement around restoration

II/1. Restorative aesthetic cement

- For class I., V., tunnel restoration, fissure sealing
- Larger particle size 50µm
- Powder:liquid 2,5-3:1
- Thick consistency for shaping
- Slow setting
- Sensitive to water uptake – varnish
- Finishing/polishing after 24hrs
- Physical properties for occlusal load not adequate
- Good adhesion to dentin/enamel – no leakage
- Colormatch, translucency exceptable

II/2. Restorative reinforced cement

- For class I., tunnel restoration, core build-up
- Microfine silver particles added 40% by weight (silvercermet)
- Reduced chemical bind – mechanical retention needed
- Radiopacity
- Powder:liquid 3-4:1
- Thick consistency for shaping
- Fast setting
- Finishing/polishing after 5min
- Sensitive to dehydration
- Low solubility
- Good physical properties

III. Lining cement

- For lining under golden inlays, amalgam fillings, covering guttapercha
- Powder:liquid 1,5-4:1
- Flowable consistency preferred
- Fast setting
- Physical properties increase with powder content
- F- release
- Radiopacity

- Maybe etched with 37% phosphoric acid when placing composite as long as enamel

Classification II

according to setting

1. Self-setting
2. Light-curable
3. Triple curing

1. Self-setting cements

- Powder-liquid glass-ionomer cements

  silicate glass+polyalkenoate

  filling, luting, lining

- Water mixed glass-ionomer cements

  silicate glass+dehydrated polyalkenoate+water

  filling I. class

1.Self-setting cements

- Light accelerated setting cements

  setting characteristics accelerated by use of a halogen light curing device for 20-40 seconds (pink shade)

  fissure sealant, temporary filling

- Fast setting cement

  used with AtraumaticRestorativeTechnique (no prep)

  compactible

  decidual molars, class I, temporary filling, lining, core build-up

- Acrylate reinforced cements with catalyst

  Not resinmodified glassionomer, self-setting, NOT LC

2. Light-curable

Resin modified glass-ionomer cement (RMGI)

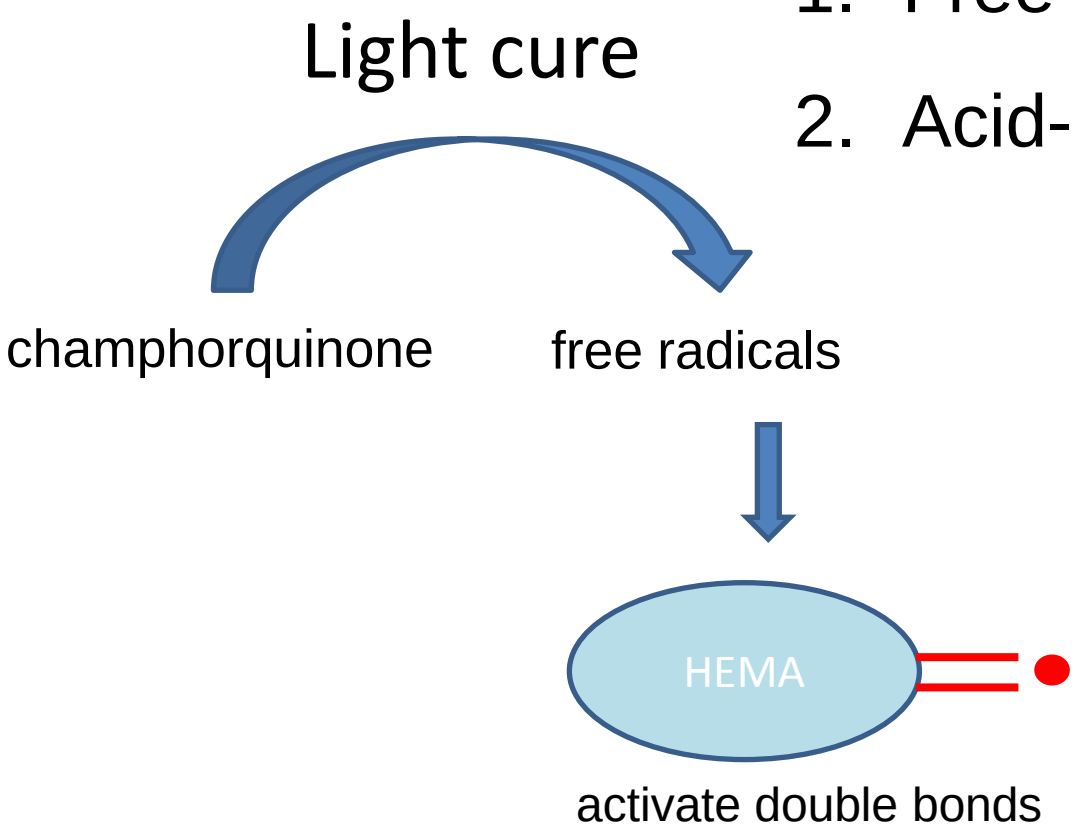
- Main polymer chain contains acrylate side-groups with double binding sites

  (ex. 2-isocianoetil-metacrylate group)
- Camphorquinone as photoiniciator
- Light curable, but sets w/out LC
- Not able to conduct light –

  max. thickness given by manufacturer
- Finishing-polishing right after filling procedure
- 1% polymerization shrinkage

Light-curable=Double curing

1. Free radical polymerization
2. Acid-base reaction



3. Triple curing

- Microparticles release catalyst while mixed
- Triple curing
  1. Self-curing
  2. Light-curing
  3. Catalyst activated curing
- No need for layering = Bulk-fill

Adhesion to tooth

6-12MPa

- Chemical adhesion
  by self-etching

- Ionic bond with Ca^{2+} ion of
  OH-apatite

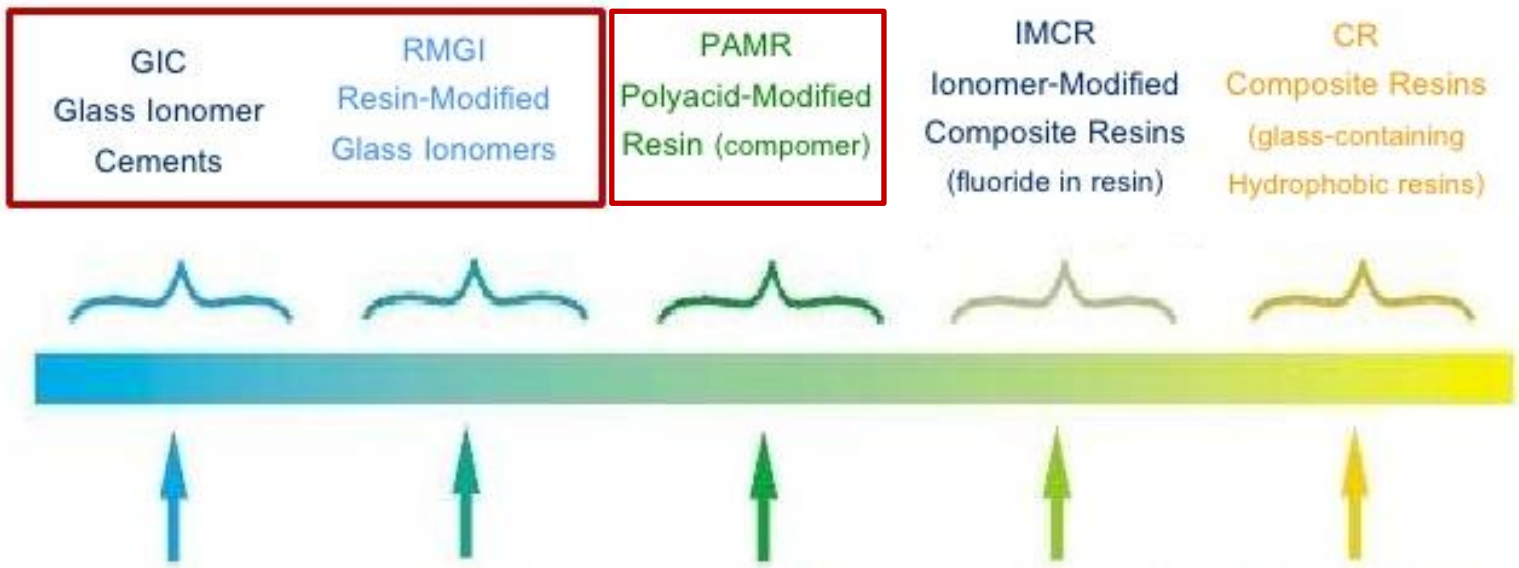
Preparing cavity surface for glass-ionomer cement

- Smear layer should be removed
- Weak, organic acids are used

  Ex. polyacrylic acid
- 10 sec

etching = microporous are formed

conditioning = only smear layer is removed



acid-base
setting reaction

hydrophylic resin
w/ polyacid matric

composites
w/ polyacid

F- containing
composites

composites

Compomers

Composite+glassionomer-cement

- **Poliacid modified resin**
- Not glass ionomer cement
- Reactive glass particles+monomer with carboxyl side group
- Setting:
  1. Free radical polymerization
  2. Acid-base reaction
- Does not bond to tooth with ion exchange
- F- reservoir possible
- Minimal F- release
- During setting absorbs water → expansion to compensate for polymerisation shrinkage

Compomers

- According to setting
  - Self-curing- 2 compoent
  - Light-curing- 1 component
- Primary teeth fillings, fissure sealant, core build-up
- Cavity preparation like for composite
- Cavity must be etched, has its own primer

THANK YOU FOR YOUR ATTENTION!

Graham JM. An atlas of glass-ionomer cements. B.C. Decker Inc. USA. 1990.