

Resin based materials in prosthetic dentistry

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Resins in dentistry

- Denture base
- Crown and bridge
- Artificial teeth
- Special tray
- Modelling
- Filling materials
- Rebase- reline
- Temporary restorations
- Luting



Requirements for dental materials

- Natural appearance
- Ease of manipulation
- High values of strength
- High surface hardness, low specific gravity
- Ease of repair, combined with dimensional stability
- Absence of odour, taste or toxic agents
- Resistance to water absorption or bacterial growth
- Good thermal conductivity
- Good retention to other materials
- Usable for all types of prostheses
- Inexpensive with good shelf life

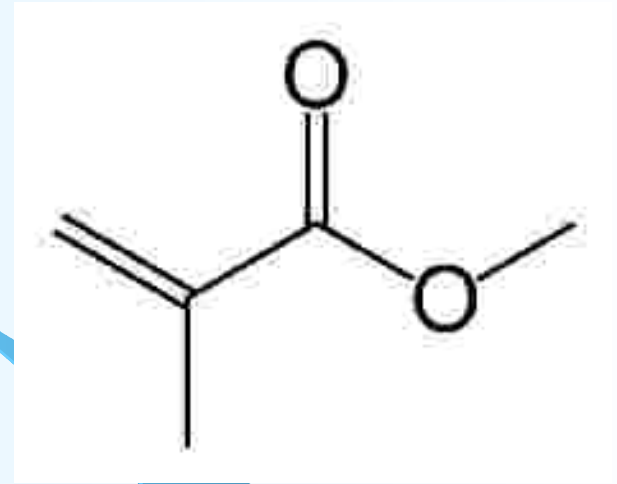
Types of resins

- Cellulose
- Phenol-formaldehyde (bakelite)
- Vinyl resin
- Vulcanite
- Acrylic resin
 - Modified materials as composite, luting resins etc.

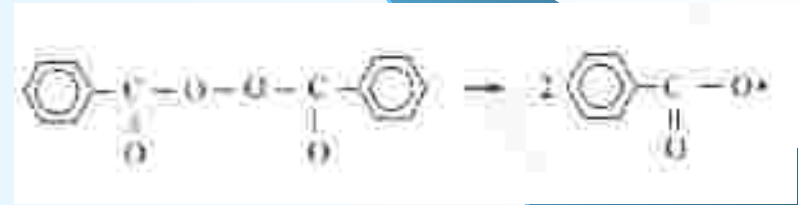
Acrylic resin

- The modern acrylic was introduced in 1937. it contains liquid monomer and powder polymer
- „Dough method”

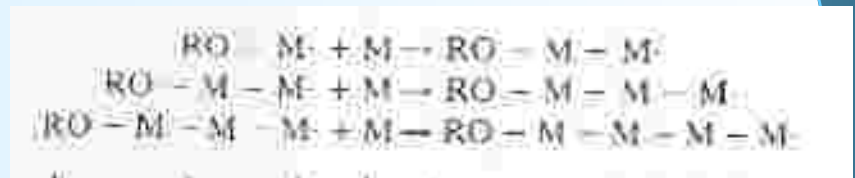
Monomer



- Methyl metacrilate liquid
- Can be activated by
 - heat
 - Light
 - Chemical



- Join together \rightarrow large molecule:
PMMA (solid)



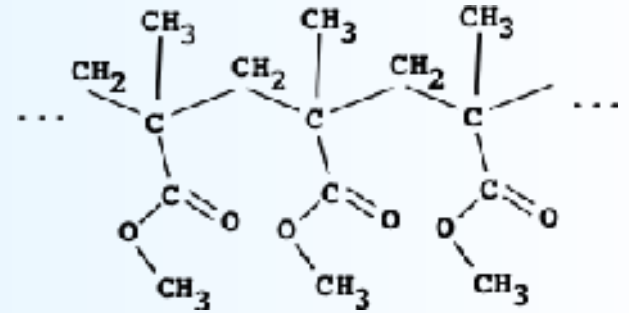
Monomer

- Clear, colorless liquid
- Boiling point: 100,3 °C
- Gravity is: 0,945 g/cm³
- Inhibitor (stabilizer): hydroquinone 0,005%
- Dimensional stability: glycol dimet 1%

Properties of monomer

- Extremely volatile
- Flammable
- Special smell
- Have to prevent from heat and light

Polymer



- Transparent, glass-like resin
- Initiator: helps the polymerization
 - Benzoyl- or lauroyl – peroxide 0,02 – 1 %
- Plasticizer: be more readily moulded to shape by heat and pressure
 - Dibutyl-phthalate 2-7 %
- Colouring agents
 - Iron oxide, zinc oxide, cadmium salts

Mixing method

1. Polymer is affected by the solvent action of the monomer and hence becomes softer
2. Consistency is changing: wet sand, stringy, doughy, leathery, hard
3. Applying heat the monomer polymerizes and eventually hardens
4. There is volumetric shrinkage: 20 %
5. Polymerized mass consists entirely of polymer. Soft, but hardens when the flask is cooled – thermoplasticity
6. For optimum result: slowly and under pressure

Polymerisation

- Resins solidify when they polymerise
- A repetitive intermolecular reaction
- A macromolecule, polymer is formed from large numbers of monomers
- Monomers connected by covalent bonds

Polymerisation mechanisms

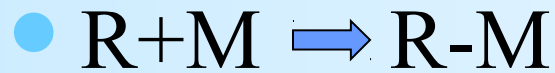
1. Condensation polymerisation

- Esterification with production of water or alcohol
- Accompanied by repeated elimination of small molecules
 - $A + B = C + D$
- Functional groups are repeated in the polymer chain
- Example: polysulfide and condensation polymerized silicone impression materials

Polymerisation mechanisms

2. Addition polymerisation

- Two molecules join together to form a third larger molecule
 - $A + B = C$
- The larger molecule is capable for further reaction with the monomer
- Example: most dental resins



R-reactive species (free radicals)

M-monomer molecules

- Free radical addition polymerization:

1. Activation

2. Initiation

3. Propagation

4. Termination

Molecular shape

- Linear: the simplest form
- Cross-linked: bridges between linear molecules, forming 3 dimensional network

Types of resins

1. Heat curing

- Dough moulding method
- Mixing and curing
- Components: a. powder
b. liquid

- mixing powder and liquid
- „dough” stage
- packing into gypsum mould
- trial closure
- opening, removing flash
- closing the flask under pressure
- curing
- cooling

Types of resins

2. Cold curing

- Called as: cold-curing, self-curing, or autopolymerizing resins
- No need for heat
- Powder (polymer) and liquid (monomer) system
- Chemical activation

Types of resins

- 3. Pourable resins
- Cold curing type
- Mixing powder and liquid
- Curing at room temperature

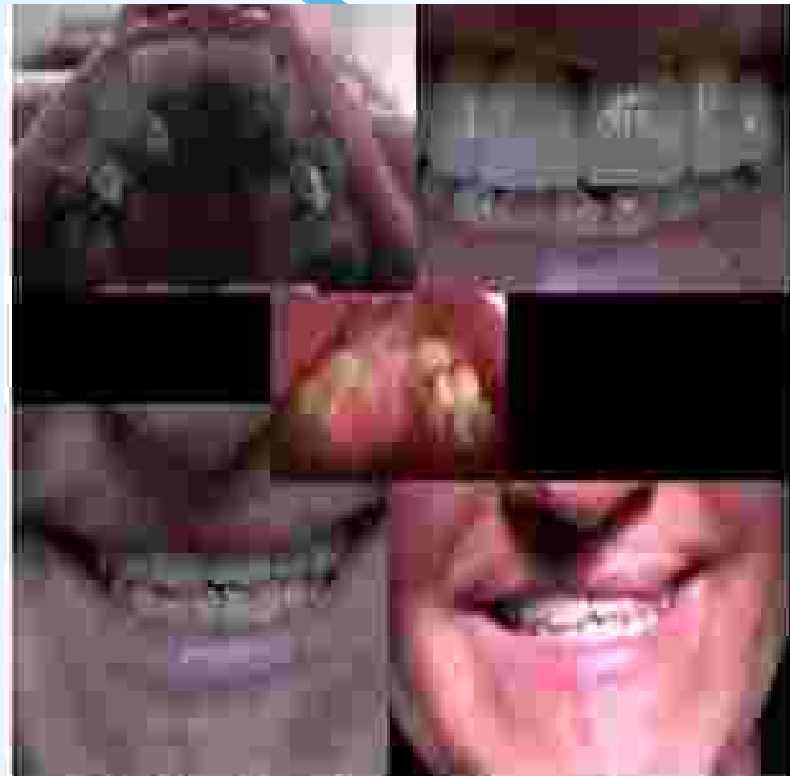
Types of resins

3. Light curing

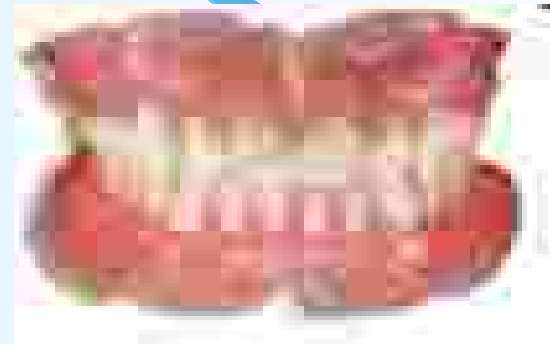
- Activated by a certain wavelength visible light
- A single component composite having a matrix of urethane dimethacrylate, microfine silica, and high molecular weight acrylic resin monomers
- Initiator: camphoroquinone

Resin types by application:

- Baseplate of the removable denture
- Artificial teeth, gum
- Covering metal frames
- Correction: relining, rebaseing
- Temporary appliances
- Ductile clay – pattern resin
- Tray-material
- Splints
- Filling materials



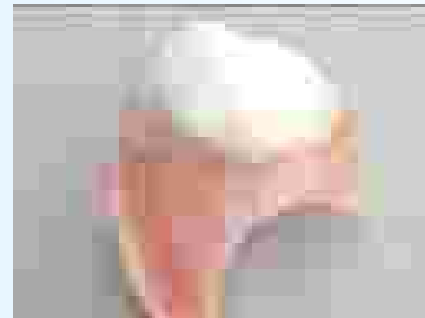
Baseplate, gum and teeth material - removable dentures -



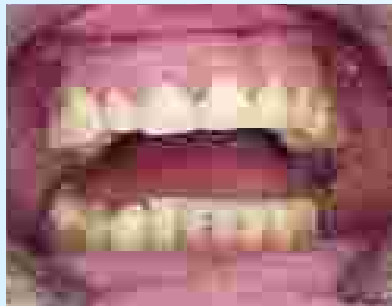
Covering metal frames



Correction material

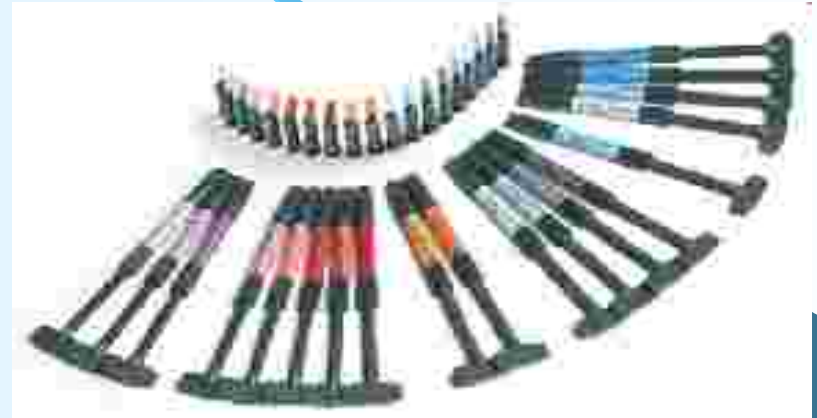


Temporary appliances



Ductile clay





Processing resins

- Injection moulding
 - Pressing the preheated polymer (granulates) to the cast and let to cool
 - Prefabricated elements



Processing resins

- Deep-drawing
 - Prefabricated thermoplastic foils
 - Applied to the cast
 - Special trays, splints



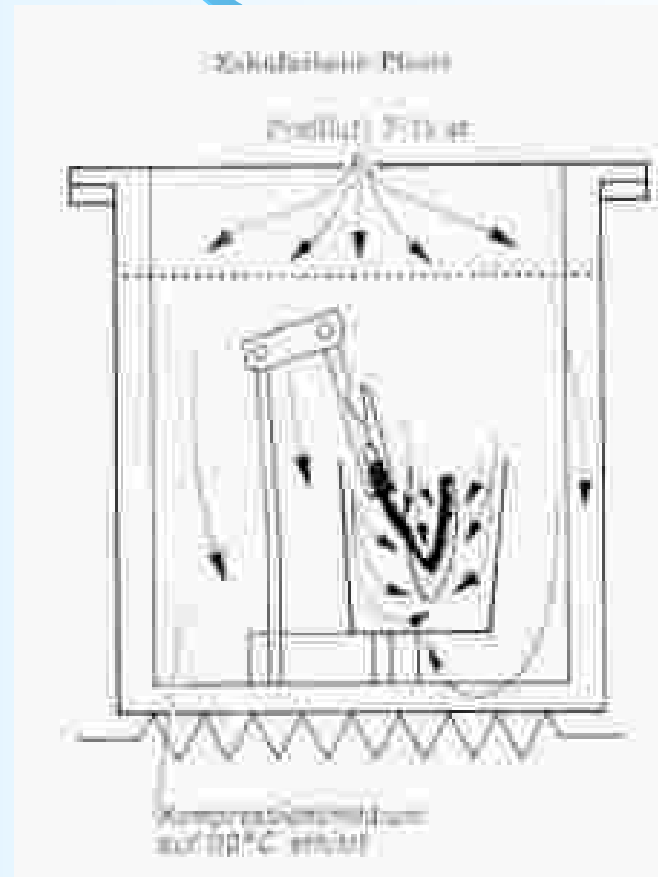
Processing resins

- HPH
 - Hydraulic, pneumatic heating
 - The soft polimer
 - Brush
 - Hot glycerine bath
 - Under pressure
 - 100 C, 7-15 atm



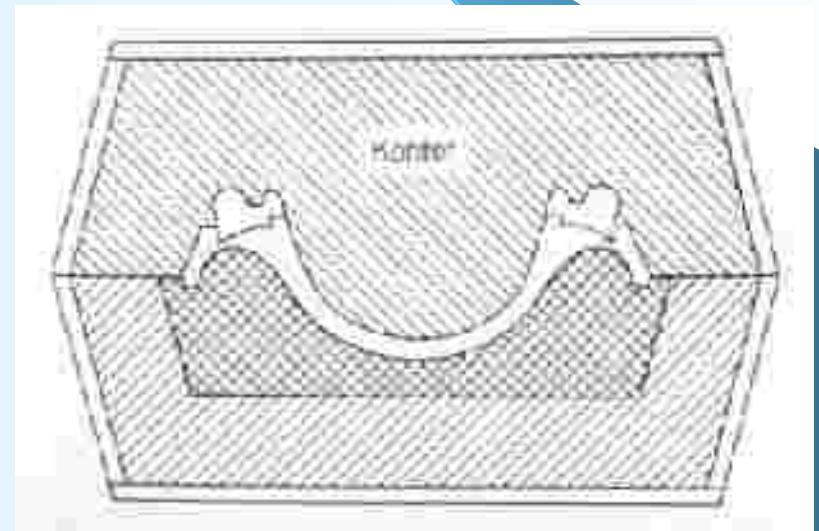
Processing resins

- Pyroplast technique
 - Thermoplastic monomer-polymerization
 - Hot chamber
 - Under pressure
 - 140-170 C, 7 atm



Processing resins

- Wet technique
 - Acrylic dough (wet)
 - Pushed to a negative flask
 - Hot water bath
 - Under pressure
 - Partial dentures



Processing resins

- Resin „casting”
 - Puring acrylic posh into a special machine
 - 6 atm
 - Acrylic elements of rpd





**Thanks for Your
attention!**