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The use of composites in restoration of teeth

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Resin-based composites

Today resin-based composites (*composite resins*) are the most popular restorative material used, especially in Esthetic Restorative Dentistry.

Description

- Formerly or commonly known as “**composite resins**”.
- They are heterogeneous blends of *organic resin* and *inorganic filler* rather than combination of resins.
- They are polymers (i.e. monomers joined together by polymerization process).

Composition

1. Resin matrix: Bis-GMA, or Urathané Dimethyl Acrylate monomers.
2. Filler particles:
Type: Glass, barium, quartz.
Size: *macro or micro*. (*hybrid=mixture of both*)
Function: *Reinforce the matrix and make it harder*,
Reduce polymerization, shrinkage,
Reduce water absorption,
Reduce thermal expansion,
Increase surface hardness,
Increase radiopacity.
3. Coupling agent: Silane (*binds fillers particles to matrix*).
4. Activator: e.g., *aromatic amine*.
Responsible for production of free radicals from a catalyst such as benzoyl peroxide.
5. Initiator: Methyl acrylic acid: *Increase rate (initial-) of polymerization.*
6. Inhibitors: Hydroquinoline: *Inhibits self/early polymerization, shelf-life increased*
7. Colouring agents (pigments)
8. Colour stabilizers

Classification

I According to size of filler particles used

Unfilled resin-based composite

Macro-filled resin-based composite

Micro-filled resin-based composite

Hybrid resin-based composite

II According to the curing (activation) system

Light cured resin-based composites

Chemical cured (self cured) resin-based composites

III According to site of application:

Anterior,

Posterior, or

Anterior and posterior (i.e. both...)

Indications (Application) for light-cured composites

Specific

1. Pit and Fissure sealing
2. *Restoration of teeth (fillings)*
3. Correction of some types of tooth developmental defects
 - = peglateral buildups
 - = closure of diastemas
4. *Veneers*
 - = fluorosis
 - = severe discolouration/staining
5. Treatment of fractured crowns (esp. incisors and canines)
6. Luting (? bonding) material for crown/bridge
7. Core built-up material
8. Direct composite bridges
9. Obturation of root canals
10. Bonding (Orthodontic)

Contra-indications to the use of resin-based composites

1. Poor oral hygiene
2. Pathological wear
3. Parafunctional activity
4. Poor enamel
5. Bruxism (heavy occlusal contact)
6. Allergy
7. Can not place rubber-dam
8. Denture abutment
9. Large restorations
10. Replacement of large enamel restorations
11. Class II restorations with gingival seat below the gingival margin

Advantages of resin-based composites

- Different shades/good match
- Simple cavity preparation
- Easy application
- Easy repair
- Multipurpose

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- Long lasting ? (4-5 years? or more)

Disadvantages of resin-based composites

- Degradation in the oral environment
- Toxic over a long period
- Plaque accumulation
- Expensive
- Polymerization shrinkage
- Handling/manipulation problems (i.e. technique sensitive)
- Allergy

? Replacement amalgam with composite

1. Resin-based composites should replace amalgam ONLY when:

Esthetics is necessary

Old amalgam restoration needs repair

New cavity is prepared

Patient insists (! should write down)

Do NOT replace amalgam with composite unnecessarily.

The direct composite resin veneer

Materials used for veneer

- a) Porcelain (commonly); or
- b) Composite

Techniques used in fabrication

- a) Direct
- b) Indirect

Tooth surface coverage

- a) Full veneer
- b) Half veneer

Indications for veneers

- Trauma to the crown (crown fracture, abrasion.)
- Correction of developmental defects e.g. peg laterals, malpositioned teeth, hypoplasia, amelogenesis imperfecta
- Discolorations due to:
 - Developmental disturbances in enamel or dentine due to an obliteration of the pulp chamber,
 - Amalgam restorations
 - Endodontic filling materials
 - Tetracycline staining
 - Necrosis of the dental pulp
 - Fluorosis

Advantages of direct composite veneer

- Considered acceptable
- Relatively easy to place
- Inexpensive
- Highly esthetic
- Have moderate longevity

Advantages over porcelain veneer

- Fabrication is done at the clinic (chair-side). Not dependent on laboratory
- Correction/adjustments are easier
- Less brittle than porcelain veneers
- Easier to handle than porcelain veneers
- Less expensive than porcelain veneers

Preparation of sequence/steps

1: Isolation of the working area and separation.

- a) Isolation: rubber dam or cotton rolls in combination with suction
 - Separation of the tooth to be treated
 - Straight matrix strip or a contour strip. Contour strips:
 - Prevents development of marginal gap,
 - Protects the tooth surface from contact with the gingiva
 - High viscous composite (applied under pressure under the strip)
 - Helps to gain some crown length.

2: Shade selection

Is done before tooth dries out. Drying out will result in a much lighter shade.

Done, essentially, under ambient light (natural light)

Procedure:

- 1) Compare the shades with opposing and neighbouring teeth.
- 2) Perform esthetic *mockup* to determine/confirm the shade.

Esthetic mockup

- No grinding, no etching nor bonding is to be done
- Apply composite resin over the area in the desired thickness, shape and cure
- Compare the shades with the neighbouring and opposing teeth.
- Patient should have the final say on this.
- If shade acceptable, flick-off the composite with a hand instrument

Note: Canines to have a darker shade than incisors or premolars.

3: Preparation of the tooth

a) Non-discoloured

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- Polish the enamel surface using pumice mix and wash and dry using air-spray

b) With mild/moderatediscolouration

Slightly grind off (less than 0.5mm) of the buccal enamel. The preparation must be in the enamel. Use the chamfer bur

Not through the contact line. Limited incisal/occlusal bevel at the incisal area (not complete coverage, not over the edge).

- Protect the neighbouring teeth from the etchant using Mylar strip

c) Severe discolorations

- Grind off (0.5-0.7mm) of the buccal enamel. The preparation must be in the enamel. Use the chamfer bur

Not through the contact line. Limited incisal/occlusal bevel at the incisal area (not complete coverage, not over the edge).

- Protect the neighbouring teeth from the etchant using Mylar strip

4. Etching agent

- Apply phosphoric acid (30-50%), preferably a gel, for 30's over the prepared
- Wash it away with a stream of water for 15-20s
- Air dry the preparation with air stream for 15 seconds. A frost appearance will be seen indicating effective etching. If not, repeat.

5. Bonding

- Apply a thin layer of bonding agent over the etched surface
- Thin the bonding agent by an air stream
- Cure it for 20 seconds.

6. Masking agent

- In paste form
- Applied only when there is serious discoloration
- Only after applying bonding agent
- Apply the masking agent in a thin layer and cure
- Apply another thin layer and cure
- Continue until discoloration is completely covered (Note: Don't place one thick layer of masking agent. It will show through the composite on top)

7. Tint

- In liquid form
- Applied only when tooth polychromacity (many colours) are necessary
- Applied after application of the bonding agent
- Applied as a very thin layer (in most cases at the cervical area) and cured for few seconds.

8. Building up the veneer with composite

- Place *dentine composite*; follow with *enamel composite*;
- The restoration should conform to the *anatomical form* of the tooth
- Cure the composites
- Finishing (final corrections, shaping and polishing, check occlusion)