DENTAL MATERIAL

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GLASS-IONOMER CEMENTS (GICs)

B. Metal reinforces GICs:

The aim of metal reinforcement:

The aim behind metal reinforcing of the conventional GICs is to overcome their drawbacks-brittleness, low abrasion is resistance, and low fracture toughness- to enable using them as posterior filling materials.

Methods of metal reinforcements:

1) Silver alloy admix: prepared by simply hand mixing of silver amalgam alloy powder to the conventional GIC.

2) Cerement cement: prepared by sintering of fine silver particles to the glass during manufacturing of the glass powder.

Advantages:

1) Increase in abrasion resistance.

2) Little increase in compressive strength.

3) Reduction in solubility.

Disadvantages:

1) Reduction in fluoride release.

2) Reduction in bond strength with tooth structures.

Uses:

1) Core build up material.

2) Posterior filling material for deciduous teeth.

C. Hybird (resin modified) GICs:

The aim: The aim behind modifying conventional GICs with resins is to overcome some of the slow acid base reaction such as:

1. Short working time and long setting time.
2. Cracking on desiccation and moisture sensitivity.
3. Poor resistance to acid attack.

The material is supplied as:

1- A powder/ liquid system with the powder and a photoactive liquid kept in a dark bottle (to protect it from ambient light).

2- Or in capsule form in which the powder/ liquid ratio is determined by the manufacturer and the mixing is carried out mechanically.

The powder, in both forms, have been modified in most material in order to incorporate a heavy metal (e.g. strontium which imparts radio-opacity) and glass.

The liquid includes:

1.Methacrylate resin to enable setting by polymerization.

2. A polyacid which reacts with ion-leachable glass to bring about setting by an acid-base mechanism.

3.Hydroxyethl methacrylate (HEMA), a hydrophilic methacrylate which enables both resin and acid components to co-exist in aqueous solution, the HEMA also takes part in the polymerization.

4. Water: allowing ionization of the acid component.

5. Polymerizing initiator and stabilizer.

Manufacturing of the liquid:

They may be produced by two methods:

1) Some products are simply formulated by blending together polycids and dimethacrylates in aqueous solution.

2) Most products, however, contain specially formulated resins in which both methacrylate and acid groups are present as active groups on a single polymer chain.

Setting reaction:

1) When the powder and liquid are mixed, the acid- base reaction can begin immediately as the acid groups are able to react with the glass in presence of water.

2) Polymerization takes over as the primary setting reaction as soon as sufficient free radicals become available to initiate the reaction.

For light-activated products this corresponds to the time at which light irradiation occurs. The light source used to activate polymerization is the same type as that used for light activated composites.

3) They set faster than conventional GICs. This is because they contain pendent methacrylate groups (C=C), necessary for free radical polymerization.

4)Most of resin-modified GICs contain chemical activators enabling them to polymerize even in absence of light activation.

In this case tri cure setting mechanisms included: a) Acid base setting, b) Light-activated polymerization, and c) Chemically-activated polymerization (dark-cure).

Properties of resin modified GICs:

1) **Using this approach, we can get materials combining:**

(a) The advantages of GICs, (F release+ chemical bonding to tooth structures).

(b) The advantages of the resin component (prolonged working + rapid setting times (command cure) + higher strength).

2) Dimensional changes in sitting: All the modified materials whether resin modified GICs or acid-modified composites undergo a significant shrinkage on setting mainly due to polymerization shrinkage of methacrylate groups in the resin component. Acid-base setting makes a minor contribution to the observed shrinkage.

Dimensional stability: The resin-modified GICs undergo a rapid and marked expansion when comes in contact with water due to sorption by hydrophilic monomer, HEMA, present in its composition. This compensates the shrinkage, or even may exceed and causes restoration expansion.

The end