

Features of Composite Fillers

Akhmedova Malika Kilichovna

Assistant of the Clinical sciences department Asia International University, Bukhara, Uzbekistan

Abstract: In this article we are talking about classification of composite materials and the types of composite fillers. A full explanation of each composite filling materials is given. About chemical and light-curing composite fillers and modern chemical adhesive composites, photopolymers are given information.

Key points: composite materials, chemical and light-curing composite fillers, classification, photopolymers.

Depending on the type of polymerization and the size of the inorganic filler, composite particles differ from each other. F.LUTZ and R.W.PHILIPS (1983) created a classification of composite materials:

- macrophilic composites
- minifill composites
- microfil composites
- hybrid composites
- finely dispersed hybrid composites (microhybrid)
- homogeneous microfil composites.

Currently, this classification is filled with composites with total connection.

The first macrophilic composite was proposed by R.L. Bowen. This composite was made of quartz flour and treated with 30 micron silane.

The color of these composite filling materials does not match the color of the tooth, and the efficiency of the final finish is low. Later observations showed that the color of the filling has changed. Macrophilic composites in the restoration of teeth expecting great masticatory pressure, class II therefore, it is used in the restoration of carious cavities. In some cases, it is recommended to combine macrofilic with microfilic composite in a lamination style.

Minifill composite particles are saturated with particles of 3-5 μm in size, due to which their surface the area is increased. The percentage of inorganic filler in these composites is reduced.

After 10 years from the first composites, a new generation of composites, i.e. microfills, will be created.

The size of filler particles in microfills is 0.04 - 0.4 microns. Fillings made from microfills in the clinic are distinguished from other fillings by their smooth surfaces, matching the color of teeth, elasticity and high smoothness.

In the creation of hybrid composites, microfil composite contain large filler particles. The first created hybrids included microparticles less than 1 μm and inorganic filler macroparticles larger than 8-10 μm . These composites with improved quality are macrophiles like uneven surface, discolored and antagonistic teeth that cause rapid erosion.

Then, in the creation of microhybrid composite particles, micro- and mini-particles of inorganic filler with a size of 1-2 μm are added. These composites are distinguished from others by their high-quality physico-chemical properties. Microhybrid composites are well polished compared to macrophylls, but not smooth compared to microphylls. Microhybrid composites include "Prizma TPH", "Prodidgy", "Brilliant".

In the further development of composite particles, hybrid composites with a total combination were created as a result of extensive research. Due to this, the physical and chemical properties of the composite material and the finishing possibilities have improved.

Total compound composites include Prizma TPH, Spectrum TPH, Valux Plus, Z 100 MP and others.

Classification of I.M. Makeeva:

Class I --_ Called Macrofile. The filler particles in these composites are 1-100 μm in size, they are strong, but the function of adhesion to the tooth tissue is heavy, and the color does not match the tooth. An example is Evicrol.

Class II --_ Microphyll, is called. The filler size in these composites is less than 1 μm . For example -Helioprogress, Heliomolar is calculated.

Class III -- called Hybrid. The particle size of the hybrid filler is 0.004-50 μm . Characteristics of hybrids:

- Hybrids have enamel, dentin and special opaque colors that provide a natural tooth color.
- Hybrids are very durable, less decay.
- After applying make-up, the surface of the hybrid will have a dry shine.
- When the hybrid is burned, the base does not burn, because it has a special hermetic-primer,

Primer is a complex chemical compound that binds tightly to dentin collagen and seals the dentin tubes hermetically and ensures adhesion of the substance to the tooth tissue.

There are the following guidelines for ashing hybrid composites:

- All types of cavities.
- In the preparation of artificial and fixed teeth.
- When closing diastemas and tremas.
- Fast fixation of bridge-like prostheses, etc.

The series of hybrid composites includes "Prizma TPH", "Charizma", "Herculite XRV".

Chemical and light-curing composite fillers.

Composite fillers are characterized by rolling. In particular, it is divided into composites with a chemical coating and a coating with the help of light. Modern chemical adhesive composites have a "paste-to-paste" appearance and are produced mainly in one universal color. It contains two pastes - basic and catalytic. The composition of the base paste includes oligo-ether-acrylate substance, filler, polymerization activator and pigments. Catalytic paste includes filler, benzoyl peroxide. The basic paste and the catalytic paste are applied in a 1:1 ratio for 20-30 seconds. The dough will rise for 5-6 minutes. Chemical polymerization takes place in one measure, and the composite cures directly adheres to the wall of the cavity and rolls.

In this case, the size of the caries cavity and the size of the filling material are considered insignificant for polymerization. The shrinkage of the composite is directed towards the pulp during polymerization.

Based on international standards (ISO4049-1988), chemical bearing composite materials must meet the following requirements:

- Mixing time_not exceeding 30 seconds
- Working time of mixing should not exceed 90 sec
- The object moves for 5 minutes
- Bending resistance_not less than 50 Mpa
- Water repellency_50 $\mu\text{g}/\text{mm}$

The solution should not exceed 5 $\mu\text{g}/\text{mm}^3$

Composite materials that polymerize under light are called photopolymers. Photopolymers are materials with the same consistency, which are extracted according to the color and clarity of the tooth structure. At the time of choosing a composite, cut the enamel according to the colors and clarity of the neck importance is given.

A light-sensitive substance called camphorquinone is added to photopolymers, as a result, radicals are formed, which ensure the polymerization reaction. Light-curing composites are produced as a one-component paste. In order to put this composite in good quality, it is necessary to meet several requirements:

- Photopolymers should not be thicker than 2 mm
- They should be burned layer by layer.
- Polymerization time lasts 20-30 seconds.
- The length of the light beam should be 400-500 nm (nanometers).
- For quality polymerization of the composite, the luminous flux of the lamp should be between 280 and 300 mW cm^2 .

The depth and degree of polymerization of the composite depends on the color and clarity of the composite. A dull colored composite will transmit less light. Therefore, the polymerization time (exposure time) is somewhat longer. Outside of that

The quality of polymerization depends on the size of the filler particles included in the composite.

Light-cured composite items must meet the following requirements:

- The time to move the object should not exceed 60 seconds
- Depth - should not be less than 2 mm
- Resistance to bending - should not be less than 50 mPa
- Water resistance - should not exceed 50 $\mu\text{g}/\text{mm}^3$
- Solubility - 5 $\mu\text{g}/\text{mm}^3$ should not be lumpy.

Taking into account the above, composite items should have the following properties:

- High strength
- Insolubility in oral fluid
- It should have a coefficient of thermal expansion equal to the hard tissues of the tooth.
- Polymerization should be fast
- Must be compatible with enamel and dentin
- It should be polished until smooth
- The color and clarity should match the color of the tooth.

Of course, one of the most important features of composite materials is their durability and aesthetic aspects.

Composite materials are divided into two groups according to the instructions for their use:

Class A (Itip) - used to fill caries cavities of I, II class in chewing teeth (premolar and molar);

Class B (type II) - composites designed for filling cavities of III, IV, V class caries, which have high aesthetic aspects.

At present, foreign companies have started to produce the following composites:

- Flowable composites
- Densified (packaged) composites

Flowable composites are used for filling cavities of Class III and Class II caries. Densified composites are used in aesthetic filling of chewing teeth.

Recently, a composite material has been created that is widely used in the restoration of all dental fillings, as this material is based on organically modified ceramics, it is called ormoker.

Therefore, in the practice of therapeutic dentistry, composite filling materials are used for the filling and restoration of caries cavities of all classes.

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