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DENTAL FILLINGS IN CHILDREN'S THERAPEUTIC DENTISTRY

Teaching and methodological guide

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Caries in children is a common phenomenon that requires careful treatment. Special cements, composite materials, crowns are used for filling, selected according to the age of the small patient, the degree of pathology and a number of other criteria. Knowledge of the basic criteria for the selection of filling materials in children’s dental practice allows avoiding medical errors and minimizing complications.

This manual contains information for acquiring knowledge and skills of identification and diagnosis of nosological forms of tooth decay in children.

The manual is intended for students studying in the specialty of higher vocational education Dentistry.

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INTRODUCTION

Tooth filling is the process of restoration of the anatomical form of the tooth with dental filling (restoration) materials. The purpose of filling is always to recreate the appearance and function of the tooth and to prevent further development (recurrence) of caries. When choosing filler material in paediatric dentistry, it should be taken into account that the anatomy, biochemistry and physiology of tissues of both temporary and permanent teeth in children differ from those of adults. Caries arising in the period of unfinished post-eruptive («tertiary») mineralization, very often has a sharp current, there is a rapid rate of destruction of solid tissues with a delay of «start» pulp of protective mechanisms in the form of dentin sclerotization and formation of secondary substitution (tertiary) dentin. Under these conditions, at least until the process is stabilized and the caries in the oral cavity improve, bioactive materials are required that can remineralize the hard tissue of the tooth and reduce the risk of developing secondary caries. These circumstances affect the requirements for restorative materials used in children's dentistry. The psychological factor plays a significant role in the work of children's dentist - features of the child psyche make the most simple and fast methods of restoration preferable.

The main requirements for fillings used in therapeutic dental care for children are as follows:

- no toxicity and biocompatibility;
- presence of adhesion to hard tooth tissues;
- strengthening the remaining tooth structure;
- simplicity of installation;
- small cost.

CLASSIFICATION OF FILLING MATERIALS.

Filling materials are divided into 5 groups according to their purpose:

1. Permanent, which are used to restore the anatomical form and function of the tooth;

2. Temporary, which are used for temporary closure of caries cavity during the treatment of complicated or uncomplicated caries;

3. Therapeutic treatments for permanent fillings, often for the treatment of deep caries;

4. Filling materials for filling root canals of teeth;

5. Sealants (silants) which are used to close non-mineralized fissures to prevent caries.

In the clinic of children's therapeutic dentistry, the choice of filling material should be made taking into account the age-specific features of the tooth structure (temporary or permanent), the group membership of the tooth, the state of pulp, as well as the degree of activity of the karyotic process.

From the material science perspective, permanent seals should be divided into 4 groups depending on their nature:

1. Cement
2. Composite fillings;
3. adhesives
4. dental amalgam.

Filling materials shall meet technological, functional, biological and aesthetic requirements, namely:

- do not dissolve in water and oral fluid and be chemically resistant;
- After mixing, be usable for a certain period of time during which plasticity and ability to simulate must be maintained;
- have high adhesion to tooth tissues in a moist environment;
- have a thermal expansion coefficient (TFR) close to the coefficient of thermal expansion of tooth tissues;
- solidify in the presence of water and saliva for 5-10 minutes;
- have a low thermal conductivity to reduce the impact of thermal stimuli on the tooth pulp;
- have minimum moisture absorption;
- be indifferent to tooth tissues and oral mucous membrane;

- have a stable color.
- maximally imitate tooth tissue after hardening;
- do not shrink after curing for a perfect edge fit;
- have pH approaching 7 (during and after solidification);
- have hardness approaching enamel hardness;
- is well resistant to abrasion and has no abrasive properties;
- have antiseptic and anti-inflammatory properties;
- be x-rayed.

Classification of permanent seals

A. HARDENING:

1. Cements:

1.1. Mineral cements (phosphoric acid based):

a) Zinc - phosphate

b) silicate

c) Silicophosphate.

r) phenolate-based cements

1.2. Polymeric cements:

a) Polycarboxylate

b) glass ionomer.

2. Composite filling materials.

2.1. Particle size of the filler:

a) Macro-complete (particle size 8-45 μm).

b) Microfilled (particle size 0.04 - 0.4μm).

c) Composites with small particles (mini-filled) (size Particles 1 - 5 μm).

r) Hybrid (mixture of particles of different sizes: from 0.04 to 5μm);

d) Microhybrid (hybrid composites with particle size

0.04 to 1 μm, average particle size 0.5 to 0.6 μm).

e) Nanocomposite

2.2. Method of curing:

a) Chemical curing

b) light curing

c) Double solidification:

2.3. Consistency

a) «traditional» composites of normal consistency.

b) Liquid (flowing) composites.

c) Condensable composites.

2.4. Purpose:

a) for filling chewing teeth.

b) for filling of front teeth.

c) Universal composites.

3. Compomers - composite ionomer systems.

4. Metal fillings: amalgam.

B. PRIMARY HARD:

1. Crowns (standard).

GENERAL CHARACTERISTICS OF PERMANENT FILLINGS USED IN CHILDREN'S THERAPEUTIC DENTISTRY

1. Cements

1.1. Mineral cements (phosphoric acid based):

Dental cement is still widely used in pediatric therapeutic dentistry, especially for filling temporary teeth, as well as pads to protect pulp.

a). Zinc-phosphate cements («Phosphate-cement», «Adhesor»; «Phosphate cement containing silver»; «Dioxicephate»). The positive properties of these cements are good thermal insulation properties, low toxicity and the correspondence of the material to the coefficient of thermal expansion of hard dental tissues. However, they have some disadvantages: powder, significant shrinkage and solubility, small mechanical and chemical resistance compared to silicate, silica-phosphate and other types of cements. Recently, silver salts and other substances have been added to the composition of zinc-phosphate cements, which give the cement antimicrobial and anti-carious properties.

Phosphate Cement. In child dental practice, phosphate cement is often used for insulating pads and sometimes as a permanent filling material for temporary teeth at the root resorption stage.

Bactericidal phosphate cement containing silver. Silver salt is added to conventional zinc-phosphate cement, which gives it bactericidal properties. In children's therapeutic dentistry, bactericidal phosphate cement is used as a permanent filling material for temporary teeth at the root resorption stage, as well as as an insulating strip.

The cement phosphate powder is 75-90% zinc oxide, the rest are magnesium, silicon, calcium and aluminum oxides. The liquid is an aqueous solution of ortho-phosphoric acid partially neutralized by aluminium oxide and zinc hydrates.

The cement mass for gaskets or seals is prepared by mixing the liquid with powder for 1-1.5 min. The criterion of readiness is such a consistency of the resulting mass when it does not reach for the spatula, but breaks off, forming teeth no higher than 1 mm. Do not add liquid to the densely mixed mass.

б). Silicate cements («Silicium, «Silicin-2», «Fritex») differ from phosphate cements in their composition. Silicate cement powder is crushed glass consisting of aluminosilicates, fluorine components and dyes. The liquid is similar to that of phosphate cements, but differs in proportionate composition. Silicate cements have better physical and mechanical properties compared to phosphate cements: they are resistant to oral cavity conditions, have a color and gloss, close to enamel. However, they are quite fragile, poorly withstand the chewing load, can negatively affect the tooth pulp. Silicate cements are used primarily for filling caryotic cavities of classes I, III and V. It is not recommended to use these cements for contact seals and for Class IV cavities.

Silicate cements are mixed for 1 min. The mass is considered to be cooked correctly if, under light pressure, its surface becomes wet (shiny) and does not reach for the spatula. When working with silicate cements, it is not advisable to use a metal spatula and metal matrices.

c) Silicophosphate cement («Silidont») is a mixture of phosphate (20%) and silicate (80%) cement powders.

Silidont has good adhesion, plasticity. It’s hard and steady. Silidont has less toxic properties than silicin, but may differ in color from tooth tissue. This limits its use. Silidont is used in pediatric therapeutic dentistry for filling caryotic cavities in grades I, II and V in temporary molars, grades I, II and V in permanent molars and premolars. Insulation gasket is mandatory when working with silidont.

The method of making cement from silidont is similar to silicine.

Silicophosphate cements are intended exclusively for temporary teeth («Lactodon», «Infantid»). They are of low toxicity due to the increased zinc oxide content in the powder and the lower amount of orthophosphoric acid in the liquid. This allows them to be used without insulating pads, which is especially convenient for filling shallow carious cavities in temporary teeth in young children. However, these cements have less mechanical resistance, so in the case of sealing contact cavities, their use is limited. Permanent teeth can be used for insulating pads.

г). **Phenolate-based cements contain zinc oxide and purified eugenol or clove oil (85% eugenol).** There is a chemical reaction between zinc oxide and eugenol in the presence of water to form a zinc eugenolate. The hardening reaction is very slow, so substances capable of accelerating it (for example, zinc salts) are added to the cement composition. Industrial cements solidify for 2-10 minutes, gaining enough strength after 10 minutes. This allows a permanent seal of any permanent material to be placed on the gasket of such cement.

The advantage of zinc-eugenous cements is their beneficial effect on pulp. They have odontotropic and anti-inflammatory properties. However, high rotary solubility and low mechanical strength allow such cements to be used only for gaskets and temporary filling. Do not use zinc-oxide-eugene cements to directly cover the pulp, as Eugenol is a strong irritant. It is also a potential allergen. It should be remembered that composite materials are incompatible with gaskets that contain Eugenol.

Chelate cements with calcium hydroxide «Dycal» (Dentsply), «Life» etc. These are phenolate-type cements based on calcium hydroxide hardening reactions with other oxides and salicylic acid esters. These cements consist of two pastes. One contains calcium hydroxide and the other contains chemical compounds that provide rapid solidification.

Cements that contain calcium hydroxide are widely used in the treatment of acute deep caries and for the direct coating of the open horn pulp, their advantages are ease of use, rapid hardening, favorable effect on the pulp.

The shortcomings of cements that contain calcium hydroxide are insufficient hardness, the possibility of plastic deformation, solubility in the presence of edge permeability in the case of leaky filling.

1.2. Polymeric cements:

a). Polycarboxylate cements (Poly-F-Plus; Carbocement; Adgesor-Carbofine). The powder contains zinc oxide with magnesium and calcium salts additives, the liquid is 30-50% aqueous solution of polyacrylic acid. The advantages of these cements are safety for hard tissue and tooth pulp, as well as their ability to chemically bind to enamel and dentin. Polycarboxylate cements are ideal for filling temporary teeth, as they do not require insulating pads and have a pronounced adhesion to hard tooth tissues.

In permanent teeth, polycarboxylate cements are used as lining materials, as well as materials for temporary filling.

The mixing time of powder and liquid should not exceed 20-30 s, and should be used for 2 minutes to maximize the adhesive properties. If the surface of the cement mass becomes dull and thin strands appear in it, this portion of cement is unacceptable for further use.

b) Glass ionomer cements are modern filling materials that combine the properties of silicate and polyacrylic systems.

Glass ionomer cements are composed of powder (fine grinding fluoro, calcium and aluminum) and liquid (50% aqueous solution of copolymer polyacrylic-polyitaconate or polyacrylic acid). In some materials copolymer is added to the powder, and water is used as a mixing fluid.

According to the common classification (K W. Phillips, 1991), there are several types of glass ionomer cements:

Type I - cements for fixing crowns, prostheses, orthodontic devices (Aqua Cem, Fuji I, Ketac-Cem);

Type II - restoration (for restoration) (Fuji II, Ketac-fil, Chemfil).

1st subtype - for aesthetic restorations;

The 2nd sub-type is for loaded restorations (Fuji IX).

III тип — цементы для подкладок (Baseline, Aqua Ionobond). Glass ionomer cements are highly adhesive to hard dental tissues, they are firmly bonded to dentin and composite fillings without prior etching, have high biocompatibility with tooth tissues. The bond of the filling material with enamel and dentin is due to the chelating of the carboxylate groups of the polymeric acid molecule with the calcium of the hard tissue of the teeth.

In addition, fluorine is released from the mass of the glass ionomer for a certain time, which dissociates into the tooth tissue, increasing their caries resistance and preventing the development of secondary caries.

Indications for the use of traditional SICs in the treatment of cavities of temporary teeth are:

1) Restoration of the cavities of classes I, II, III, V;

2) ART-technique application;

3) «tunnel» equipment;

4) Preventive glass ionomer restoration;

5) «delayed» filling during acute course of caries;

6) Multiple caries, below-level solid tissue lesions gums;

7) The technical impossibility of performing a composite restoration;

8) Use as an amalgam lining.

Indications for the use of traditional SICs in treatment tooth decay:

1) Restoration of carious cavities of classes III, V;

2) «tunnel» equipment;

3) Filling of small carious cavities in technical

Possibility of preparation without destruction of edge comb;

4) «therapeutic sealing» - treatment of tooth decay enamel

Class I cavities without enameling;

5) preventive glass ionomer restoration;

6) Sealing of the fissur and pits;

7) Temporary filling in the first stage of the indirect pulpotherapy;

8) Use as an amalgam lining;

9) Substitution of dentin in «closed sandwich» restoration technique;

10) «delayed» filling during acute course of caries.

Mix cement for 30-40 seconds. The working time is 1 min after mixing. The drying of the cement mass surface and the appearance of thin filaments indicate that the hardening is beginning and that the portion is unsuitable for filling.

Disadvantages of glass ionomer cements are slow solidification, relatively low strength, sensitivity to moisture, X-ray transparency, and possible negative effect on pulp. In the case of acute deep caries, it is recommended to cover the bottom of the cavity with a calcium-containing gasket and then a layer of glass ionomer cement with a thickness of 1.5 mm. Currently available glass ionomer cements light curing (Fuji Lining LG (GC), Vitrimer (3M)), which are more convenient and economical to work. They contain elements of a composite base, therefore they are considered hybrid.

2. Composite filling materials.

Composite materials are a modern class of dental filling materials, high physical-mechanical and aesthetic properties of which contribute to their wide application in practice.

Composite fillings consist of three main components:

- Organic matrix (polymer matrix)
- inorganic filler,
- Surfactants (silanes).

Organic Matrix. In any composite filling material, the organic matrix is represented by a monomer. It also contains an inhibitor, a catalyst and a light-absorbing agent (in photopolymers).

*The monomer is BIS-GMA, or bisphenol-glycidal methacrylate, which has a high molecular weight and serves as the basis of composite materials. This composition was first used by Dr. Rafael L. Bowen in 1962, so in the literature it is sometimes described as «Boven resin». Other monomers, such as urethane-*dimethyl *methacrylate (UDMA), triethylene glycol dimethylate (TEGDMA), may also be used.*

The polymerization inhibitor (mono-methyl ether hydroquinone) is added to the polymer matrix to ensure the preservation and working time of the filling material.

Toluidine dehydrate accelerates the polymerization of chemical hardening composites, methyl ether benzoyl is an activator of photopolymerization and is a component of photopolymer composites. Activator (catalyst) is a substance that is used to initiate, accelerate and activate the polymerization process

The compound absorbing ultraviolet light is added to reduce the dependency of the composites on sunlight.

Inorganic Filler. As filler composites can include quartz, barium glass, silicon dioxide, porcelain flour and other substances. It is the filler that determines the mechanical strength, consistency, X-ray contrast, shrinkage and thermal expansion of the composite.

The configuration, size and shape of the filler particles can be varied, but they determine the properties of the material and therefore the size of the filler particles is the basis of the classification of composites.

Surface - active substances. These are silanes that are added to the composition of composite materials to improve the binding of inorganic particles to the organic base and to form a chemically bonded monolith.

Композиционный материал приобретает благодаря этому повышенную механическую и химическую устойчивость и прочность, снижается поглощение влаги, повышается устойчивость к стиранию и адгезия к твердым тканям зуба.

Macro-filled composite materials (macrophyls) are materials with particle size 1-100 μs (more often 20-50 μm). They include the first generation of materials Evicrol (Spofa Dental), Consize (3M), Adaptic (Dentsply), Visio-Fill, Visio Molar, etc.

These materials have high mechanical strength, chemical stability, good edge fit, but they are almost polished and quickly change color. This is because the process of exploitation destroys the organic basis. It is partially dissolved and this leads to you dropping the filler particles from the organic matrix. This process determines a further increase in the roughness of seals. Colorants, food residues, bacteria quickly settle on such a surface. The seal is stained and becomes aesthetically unsuitable. The seal loses shape and interdental contacts are disrupted.

In this regard, macro-filled composite materials are recommended to be used mainly for filling cariose cavities of Class I and II, as well as V class in side areas where it is necessary to have a mechanically strong seal and aesthetic is not important.

Micro-filled composite materials (microfils) - materials with the size of filler particles 0.04-0.4 μm. These materials include Isopast (Vivadent), Degufill-SC, Degufill M (Degussa), Durafili (Kulzer), Helio Progress (Vivadent), Helio-Molar (Vivadent), Ux Plus (3M).

Fillings from these materials have high aesthetic properties. They perfectly imitate tooth tissues, are well polished and retain color for a long time. However, microphiles have a low mechanical strength, which is due to the low content of the filler. Therefore, they are mainly used for filling carios cavities in classes III and V, as well as enamel defects of non-carious origin in places where the chewing load is minimal.

Hybrid composite materials are materials whose particle size ranges from 0.04 to 100 μ. They combine the qualities of macro- and microfils. Hybrid composites contain filler particles of different sizes and qualities. Changing the ratio of large and small particles allows to purposefully change properties of composites. The most common today are such hybrid composite materials: Valux Plus (3M), Prisma (Dentsply), Hercuiite XPV (Kerr), Charisma (Kulzer), Tetric (Vivadent), Arabesc (VOCO).

Microhybrid Composites. They are created on the basis of a submicron filler with the addition of larger particles measuring 1.0-3.5 μm. Materials have acceptable physical properties (strength, grinding resistance, low water absorption, thermal expansion coefficient close to tooth hard tissues) and aesthetic characteristics (good polishability, color resistance, wide range of material shades)X-ray: Artemis (Ivoclar Vivadent), FiltekZ250 (3M ESPE), GC Gradia Direct (GC Europe) Miris (Tenecol Whaledent), Venus (Eus Kulzer)

These composites are considered universal, so can be used for filling cariosis cavities of all classes, as well as for complete restoration of the crown of the tooth and reconstruction of the tooth row.

Seals from these materials have many advantages, such as:

- maximum mechanical strength,
- chemical stability,
- high aesthetic and color resistance,
- minimal shrinkage and high adhesion.

Nanocomposites are a class of restoration materials that use a fundamentally new type of inorganic filler made on the basis of nanotechnology.

Nanotechnology operates with values of the order of a nanometer, 1 nanometer = 10~9 m. This is an infinitesimally small quantity, hundreds of times smaller than the wavelength of visible light and comparable to the size of atoms. Nanocomposites include particles of silicon-zirconium filler of spherical shape (per number) with a size from 1 to 100 nm.

In nanocomposites, filler particles are chemically modified in such a way that their spontaneous bonding becomes impossible. Consequently, the fullness of the composite can be significantly increased, which improves the physical properties of the material and reduces polymerization shrinkage (1.5-2.3%).

Nanocomposites are easily and quickly polished to a "dry" mirror shine and retain this shine for a long time. On the other hand, the high filling density of nanocomposites provides high strength characteristics, which makes these materials versatile.

The representative of this group of materials is Filtek Supreme HT (ZM ESPECIALLY). At the same time, so-called nanohybrid composites are produced using nanotechnology, which, along with traditional larger filler particles (up to 3 microns), contain nanoparticles: Premise (Kerr), Ceram-X (Dentsply), Synergy Nano Formula (Coltene Whaledent), Grandio (VOCO).

Depending on the polymerization mechanism, all composite and polymer materials are divided into:

- hemically polymerizing (or self-solidifying);
- heat polymerizing (used to make deposits in the laboratory);
- light polymerizing.

The self-adhesive composites are produced in the form of two pastes or powder and liquid. They include an initiating system of benzoyl peroxide and aromatic amines. The advantage of chemical curing composites is uniform polymerization regardless of the cavity depth and thickness of the seal.

However, chemical solidification composites have a number of disadvantages: unfitness of mass for filling after mixing components, limited working time, inefficiency in work.

Composite materials that are polymerized by light are increasingly used. They are polymerized by the light energy of a halogen lamp, which gives a high-intensity blue light with a wavelength of 450-550 nm, which penetrates a depth of 2-3 mm.

The radiation intensity of all halogen lamps should be checked by special radiometers. It is known that a luminous flux of 450-500 mW/cm2 (milliwatt per square centimeter) provides effective polymerization of the material at a depth of up to 3 mm in 20 seconds, and with a luminous flux of 300 mW/cm2, full polymerization does not occur.

The disadvantage of all composites is polymerization shrinkage, which is approximately 2 to 5 volumetric percent. The reason for the shrinkage is the reduction of the distance between monomer molecules during the formation of the polymer chain. The intermolecular distance to polymerization is 3-4A (angstrom), and after polymerization approximately 1.54A. That is why the next step in the improvement of composite materials was the creation of adhesive systems for enamel and dentin.

To reduce the polymerization shrinkage of the material when working with photopolymer materials, the following recommendations should be followed:

- Make small portions of the material into the cariosis cavity, so that the thickness of its layer is 1.5 - 2.0 mm. ,

- Use an adequate polymerization light source with a wavelength of 450-500 mm;
- Direct the light source from the opposite side filling material, start the illumination through the enamel; stick to the polymerization time of each layer according to the recommendations in the instructions.

Table 1.

Physical properties of fillings compared to dental hard tissue

Material	Resistance to bending, MPa	Modulus of elasticity, gPa	Vickers hardness, MPa	Compression rate, MPa	Coefficient of thermal expansion, pPra
coefficient of thermal expansion	60-110 60-110	2,5-6 9-20	200-500 600-1200	300-400 250-400	50-70 40-60
coefficient of thermal expansion	65-100	40-50	1300-1600	360-600	22-28
coefficient of thermal expansion	1300-1500	45-55	2200-2800		12,5-14,5
coefficient of thermal expansion	80-120	50-70	5000-6000	120-200	12-14
coefficient of thermal expansion	115-125	1,3-1,9	115-125		80-100
coefficient of thermal expansion		20-100	2000-4500	200-400	11-12
coefficient of thermal expansion		12-20	600-800	250-350	8-9

It should be remembered that darker colors polymerize longer than light colors; the light source should be installed as close as possible to the surface of the filling material; while working with a halogen lamp, follow safety rules: Work with protective goggles and shielding; after completion of sealing, final (finish) illumination of the material should be performed. In particular, in the cavities of Classes I and V respectively with chewing and vestibular surfaces, in the cavities of Classes II, III, IV - with vestibular, oral, chewing surfaces.

R. Pinkham, P. S. Casamassimo et al. (2005) recommend the use of composite materials for the restoration of I, II, III, IV and V Classes of Black in temporary and permanent teeth.

The indications for the use of composite materials are:

– small occlusive caries requiring preventive composite restoration (both in temporary and permanent teeth);

– occlusive caries spreading to dentin;

– class II cavities in temporary teeth, non-transitioning proximal angles;

– class II cavities in permanent teeth, occupying from one third to one second of the buccal-lingual interbugortic space of the tooth;

– cavities of classes III, IV, V in temporary and permanent teeth;

– restoration of temporary and permanent teeth using Strip crowns.

The method of application of photopolymer composite materials provides for a number of stages:

1. Anesthesia

2. Professional hygiene of all teeth surfaces.

3. Insulation of the operating field (cofferdam, rabberdam)

4. The choice of shades of filling material, which is carried out using the colour scale "Vita". At the same time, the surface of the tooth and the scales should be slightly moistened, the selection of color should be carried out in daylight natural light.

5. Cavity preparation. The basic principle of tooth preparation for restoration is gentle preparation. The high adhesive properties of composite materials make it possible to produce cariose cavities less radically than Black's principles. The basic requirement for pre-composite material analysis is the careful removal of necrotized, softened or pigmented dentin.

During the preparation of enamel, the non-viable, discoloured enamel should be completely removed. In addition, on the enamel edge formed bevel enamel at an angle of 45 -so-called faltz. It is formed for vertical opening of enamel prisms, which is necessary to increase the contact area of enamel with adhesive and composite, as well as to mask the transition zone of enamel composite. During the preparation of the cavity I and II classes, the formation of the falcon is not necessary.

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6. Etching of enamel and dentin is an extremely important step, as errors in the treatment of hard tooth tissues can lead to complications. The time for etching is 30 seconds, of which 15 s etched dentin. Etching gel is first applied to the enamel, and 15 seconds later - dentin. Rinse the etching gel with normal water for 45-60 s.

7. The cavity is dried very carefully so as not to damage the surface of the etched dentin. The air jet is directed at an angle to the enamel surface (usually through a dental mirror) to avoid drying out the dentin.

8. Insert the primer. The first portion of the primer is brought into the karyosis cavity with a special brush with a small surplus and left for 30 seconds. During this time, the primer penetrates deep into the dentin and impregnates collagen structures. Then apply the second layer of the primer, slightly dry it with an air jet and polymerize under the influence of light for 20 seconds.

9. Adhesive Application. The adhesive is also applied with a brush to the surface of enamel and primer-treated dentin and with special care in the area of enamel falcon. The adhesive is slightly dried with an air jet and polymerizes for 30 seconds.

10. Insertion of a composite. The filling material is inserted into the cariosis cavity with the help of Teflon or titanium coated irons and stoppers. The thickness of each layer of the composite shall not exceed 1.5-2 mm.

The layered technique of composite application allows maximum polymerization and reduction of shrinkage. When irradiating a composite, it should be polymerized through enamel or through previously applied layers for maximum "welding" of the composite to enamel and previous layers. The second irradiation is carried out perpendicular to the surface of the composite. It should be remembered that the shrinkage of the material is directed to the light source.

11. The purpose of grinding and polishing the composite seal is to give it final shape and gloss. For this purpose, fine diamond borns, carbound finishing borns are used. For approximal surfaces are used straps and flos.

The final step is polishing, which is carried out using special polishing heads of various shapes and polishing pastes.

While working with composite materials, complications may occur:

1. Possible tooth pains after a total pickling procedure. This often happens when the diagnosis of chronic pulpitis is incorrect. In this case, total etching causes its exacerbation.

2. Post-operative sensitivity of dentin, microflow of fluid from dentin tubules and sealing depressurization.

Dentin's sensitivity is defined as acute, prolonged, localized pain arising in response to tactile, temperature or osmotic stimuli. This pain is not spontaneous and ends when the irritant is removed. Sometimes, the cause of pain can also be chewing load.

The causes of the hypersensitivity of dentin can be the violation of the technique of total etching, insufficient leaching of the acid from the karyotic cavity after etching, drying of dentin, deep adhesion to dentin tubules and its insufficient polymerization. Primers that reliably "seal" dentin tubules should be used to prevent micro-flow and depressurize seals. Directed polymerization techniques are used to reduce the polymerization shrinkage of the composite.

3. Compomeres

Compomers are a new class of filling composites that combine the qualities of composites and glass ionomer cements. They are characterized primarily by high adhesion to tooth hard tissues, especially dentin, due to the use of adhesive systems, as well as the positive effect on tooth solid tissue by prolonged fluorine secretion. They do not require pre-etching of hard tooth tissues. This reduces the risk of complications and simplifies the method of working with them.

The chemical structure of compomers is generally the same as that of composites. However, the monomers that make up the compomers have been modified to include acid functional (carboxylic) groups that can give acid-fundamental reactions to fluoroaluminium-bearing glass after water absorption.

The best choice of color of the compomer is achieved during aesthetic restorations by polymerizing a small amount of material on the untreated tooth or by comparing the tint of the polymerized material with the tint of the untreated tooth before starting restorative procedures.

The most famous representatives of this class of materials are "Dyrect" (Dentsply), "Dyract Seal" (Dentsply), F-2000(3M), "Elan" (Kerr), Hytac (ESPE), Compaglass (Vivadent). They are used for filling cavities of all classes in temporary teeth and cavities III, V classes of permanent teeth. Compomers are now considered an alternative to amalgams in the treatment of temporary molars.

In the treatment of children, it is important not only to observe the technique of restoration, but also to cooperate with the patient. From this point of view wins material that provides not only quality treatment, but also motivation of the child to conduct it. These materials include the color compactor "Twinky Star" (VOCO), whose palette includes 7 bright colors with twinkling glitter (white, gold, lemon, pink, blue, orange, green). The use of Twinky Star helps to reduce dental phobia in children and provides a high-quality and comfortable treatment for the patient’s uncomplicated forms of cavities of temporary teeth, and also allows to motivate the child to visit a dentist and provide treatment.

The technique of preparing for compomers is reduced to the removal of tissues affected by caries. The corners of the cavities should be rounded. Elements of classical preparation (flat bottom, sheer walls) to enhance the retention of the seal are required only when the recoverable part is exposed to high occlusive loads. To prevent chipping, the enamel edge is finished.

4. Amalgam

Amalgam is a self-solidifying metal alloy that is produced by mixing mercury and powder containing different metals in certain proportions. The basis of the powder in traditional amalgam is a silver alloy with Ag_3Sn tin (y-phase). The share of silver ranges from 65-75%, tin- 23-33%. In addition, the powder contains copper (2-8%) and traces of other metals (zinc, lead). The amalgamation process (mixing of mercury and powder) generates a silver-mercury Ag_2Hg, (in phase 1), as well as tin and mercury Sn_7Hg (in phase 2). The unreacted y-phase particles are distributed in amalgam and play the role of filler.

Amalgam powder particles are small, medium and large. The smaller the particle size, the faster the amalgam is captured, but still more non-responsive mercury remains free.

Amalgam is still a benchmark for comparison with modern filling materials due to a number of advantages:

- durability (the average service life of amalgam seals is about 10 years);
- high strength and wear resistance;
- lower cost in comparison with other restoration materials;
- simple, fast and low-demand application technique for working conditions;
- less dependence on the state of oral hygiene;
- the ability to create a good contact point, save its the entire service life of the seal;
- high radiopacity.

The disadvantages of amalgam are:

- non-compliance with the requirements of aesthetics;
- low adhesion to tooth tissues and the need to create retention points of the cavity, which often requires the removal of healthy tissues (the requirement for the preparation of cavities according to Black);

- high thermal and electrical conductivity, the potential to cause the effect of galvanism in the oral cavity.

Indications for the use of amalgam:

1. Treatment of carious defects of classes I, II, IV of medium and large size.

2. Treatment of class V cavities in molars and premolars in the absence of high aesthetic requirements.

Amalgam is the preferred material for dental restoration:

- in patients with inadequate oral hygiene;

- in cases where the control of the dryness of the working field is difficult or impossible.

Currently, there is a downward trend in the use of amalgam in all countries. This is largely due to advances in the prevention of dental caries, as well as the emergence of new restoration materials.

Standard crowns

In case of cariosis breakage of large sizes to prevent tooth fracture it is better to carry out restoration using restorative metal crowns.

Indications for the use of standard metal crowns:

1. Restoration of temporary and permanent teeth with intensive carious destruction; caries of three or more surfaces of temporary teeth, destruction of contact surfaces of temporary molars.

2. Hypoplasia of temporary and permanent teeth.

3. Restoration of temporary teeth after pulpotherapy.

4. Imperfect amelo-, dentinogenesis.

5. Poor oral hygiene, especially in disabled children.

6. Saving space in case of early removal of a baby tooth (as a structural element).

7. Traumatic damage to the crown of a temporary tooth.

Standard crowns are made taking into account the anatomical shape as well as the size of baby teeth. The most common are thin-walled crowns made of stainless steel or nickel-chrome alloy. Today, metal crowns with composite veneers are also available, which are produced by standard sets. They are more aesthetic than metal crowns.

Technology of application

1. Assessment of the nature of teeth closure.

2. Anesthesia, tooth isolation using cofferdam.

3. Preparation of the cavity and performing interventions on the pulp of the tooth (if required).

4. Tooth Surface Treatment. Starting with the preparation of approximate tooth surfaces so thick that a probe passes between the exposed surface and the adjacent tooth. Vertical walls are formed, slightly converging in an occlusal direction. Contact with the adjacent tooth should be broken and the treated surface should be smooth, without protrusions and irregularities.

5. The occlusal surface is prepared by deepening the occlusal furrows by 1-1.5 mm. The boron is then placed in an inclined position and the hard tissues of the occlusal surface are evenly removed on 1-1.5 mm, maintaining the shape of the lumps.

6. Rounding of all linear angles and quality control of preparation. The occlusion-cheek and occlusion-distal angles are rounded, holding the boron at an angle of 30-45° to the chewing surface, moving it in a mesio-distal direction. The cheek and lingual proximal angles are rounded, holding the boron parallel to the tooth’s long axis. It is necessary to make sure that an adequate volume of tissue has been removed, without ledges. Rounding of all linear angles and quality control of preparation. The occlusion-cheek and occlusion-distal angles are rounded, holding the boron at an angle of 30-45° to the chewing surface, moving it in a mesio-distal direction. The cheek and lingual proximal angles are rounded, holding the boron parallel to the tooth’s long axis. It is necessary to make sure that adequate volume of tissue has been removed, without ledges.

7. Selection of the smallest crown, completely covering the exposed tissue. It is necessary to correctly set the mesiodized and splenic size of the crown prior to the preparation of the solid tissue, and its edge should be formed according to the contour of the marginal gum. Initially, the crown should be stored on the oral part of the tooth, then the crown is pressed in the cheek direction. The crown must be "snapped" on the tooth at low pressure. If necessary, the crown is cut at a height with contour scissors, so that it goes into the denture groove for 0.5-1 mm. After that, the sharp edges of the crown should be cut with abrasive stone.

8. Contouring of the crown with tongs (Johnson or Adams can be used for the purpose of fully adapting the gingival edge of the crown to the neck area of the tooth).

9. Installation of the crown on the tooth and inspection with the help of probe proximal contacts and secure fit in the neck area. Then the crown is removed from the tooth.

10. Cofferdam removal.

11. Cleaning and drying of crown and tooth. For fixing, the crown is filled with cement (polycarboxylate or glass ionomer) for approximately 2/3 of its volume.

13. Insertion of crown (can be used with a knuckle stick) and closing of tooth rows in the central occlusion position

14. Removal of cement from the gingival groove by probe, from interdental spaces additionally - floss.

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