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ALTERNATIVE METHODS OF PREPARATION PERMANENT TEETH ON THE EXAMPLE OF CARIOUS BLACK CLASS I CAVITIES

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Abstract
This article describes alternative methods for the treatment of caries of permanent teeth. In addition to mechanical rotary tools, tools with ultrasonic, laser and kinetic abrasive solutions can be used. The effectiveness of the formation of carious cavities with kinetic abrasive solutions was demonstrated by the example of the formation of a Black class I cavity. A light-curing composite resist was used for the restoration. Alternative methods of forming hard tooth tissues have both positive and negative properties. With strict adherence to the indications, alternative methods of preparation are highly effective.

Keywords: Dental dissection, water-air abrasion of enamel and dentin, caries treatment.

Introduction

The preparation of hard tissue defects is the most important stage in the treatment of caries. In this case, the main task is to prepare the latter by removing the affected enamel and dentin, giving the carious cavity the most appropriate shape and strengthening the filling in the tooth. The volume of hard tissues to be removed depends on the activity of the pathological process, the size and depth of the lesion, the localization of the defect and the characteristics of the filling material [2, 8, 10]. Black, based on the chemical and bacterial theory of caries, established the principles of dental preparation, in which not only carious tissues are removed, but also those less resistant to caries. He recommended excision of areas (fissures, carious cavities and necks of teeth); I.G. Lukomsky proposed to be guided by two criteria: biological and technical expediency. The principle of careful treatment of hard tissues implies excision of only carious enamel and dentin. Minimizing the negative aspects from a technical and biological point of view, it is possible to formulate the basic requirements for classical cavity preparation. The walls should be smooth and the base should be smooth. The angle between the base and the wall

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is 90°. This geometry is considered optimal when filling with materials that do not have a chemical or micromechanical connection with tooth tissues. The formation of a cavity is most often carried out using a rotating rod in the tip of a dental unit and is considered a classic method. The preparation includes the following steps: 1. The expansion of the orbit, that is, the opening of the cavity (removal of protruding edges), is carried out using a small diamond or carbide bar that easily enters the cavity; 2. Necrotomy (removal of necrotic formations) - excision of the altered dentin is performed by opening the tooth cavity using a large excavator. 3. Cavity formation - diamond tips of various shapes, sizes and grit are used to create an optimal contour for fixing the seal; 4. the treatment of the walls of the tooth cavity is carried out with a fine-grained diamond bar to ensure good fixation of fillings made of any materials; 5. Provides good fixation of the seal; When forming class I cavities with Black, maximum approximation to the classical rule is required, since it is limited to the zones of fissures and grooves of molars and bicuspids. The purpose of opening the carious cavity is to gain full access to necrotic and demineralized tissues. Preventive expansion includes excision of intact enamel in areas prone to caries (foveal fissures, contact points) and less prone to caries (apex, equatorial region). Necrotomy removes demineralized dentin (softened dentin), eliminates foci of infection and ensures lasting contact with the filling material. The formation of an orbital cavity implies the formation of a parallel flat wall perpendicular to the bottom of the carious nest. The enamel notches formed as a result of using the drill are removed, and the wall is smoothed to prevent the sealing material from fixing. When using composites with micromechanical adhesion to hard tissues, tooth preparation consists in forming the maximum contact area between the filling and the tooth, based on the principles of adhesive preparation [3, 5, 7]. To minimize the effect of polymerization shrinkage of the light-cured composite resin, all corners in the cavity should be rounded. Atraumatic restoration treatment is an alternative to classical mechanical pretreatment [3]. The fear experienced by an individual patient, the pain during dissection and the unpleasant noise of the dental unit can lead to the development of stomatophobia. According to one of the authors, up to 46% of patients experience significant neuropsychiatric stress before and during a visit to the dentist, before grinding the edges of the enamel with the file tool. The destroyed dentin is excised without the use of force, using a spoon-shaped tool that slides horizontally. A three-bladed excavator is used to remove additional layers of dentin at the bottom of the carious recess; a four-bladed excavator is advisable to use in the approximal gingival anterior and subgingival

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marginal cavities of maxillary teeth. For the treatment of mandibular teeth, the dentist can use a single-blade multi-faceted excavator. It may be physically impossible to bring the patient closer to the dental unit ("bedridden" patients, the disabled). Atraumatik (ART) restoration treatment is used for such patients. To clean carious cavities, hand tools are used that differ in shape and purpose from standard ones. Indications for use are children, the elderly, geriatric patients, severe diseases of the circulatory system, post-infarction conditions and diseases of the nervous system. The method is also used in bedridden patients, patients, pregnant women and outdoors (for example, in military camps, agricultural work). You can refuse mechanical treatment at any age; ART is used in the treatment of baby teeth, hard-to-reach carious cavities (teeth covered with artificial crowns), carious prostheses in weakly mineralized teeth and temporary fillings with delay. The painless method is not indicated for permanent teeth with high mineralization. First of all, it is necessary to expand the entrance to the affected area: in the upper teeth - in 2 planes. Smoothing the edges of the enamel with a file completes the treatment of caries. Before that, the effectiveness of manual pretreatment is increased by using a drug for decalcification of carious dentin, which destroys the degenerated collagen of tissues damaged by caries. After the chemical step, the softened dentin is removed with a hand tool. Glass ionomer cement is used for sealing. The disadvantage of this method is that it does not allow the preparation of inorganic tooth tissues of sufficient quality, which limits the indications. In some cases, ultrasonic pretreatment of caries is also an alternative to pretreatment of teeth for a filling: the Vector (Durr Dental) system is an ultrasonic dental system designed for the treatment of inflammatory periodontal diseases, as well as microinvasive pretreatment of hard dental tissues and finishing treatment of restorations [3]. Piezoelectric ultrasonic systems are equipped with various types of tips, nozzles and abrasive (polishing) powders. The most important link in the Vector system is the resonant ring in the tip head, which vibrates (contracts and unclenches) with a frequency of up to 25,000 Hz and is connected to the workpiece at an angle of 90 °. This allows the tip head to move vertically and prevents damage to undamaged tissues. A special suspension (abrasives and polishing agents) mixed with water transmits ultrasonic energy indirectly into the operating field. A strictly defined frequency and amplitude of the longitudinal vibrations of the nozzle allows the liquid (suspension) to be held on the tip surrounded by a water film. The polishing liquid contains cutting particles of silicon carbide with a size of 40-50 microns and is used for micro-preparation of carious cavities and removal of protruding edges of

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restorations. The polishing liquid contains hydroxyapatite particles with a size of 10 microns and is used for polishing enamel and healing roots without damaging hard dentin; After processing with Vector Fluid polish, Vector Fluid polish is used to create the smoothest possible surface. The Vector system uses metal tools and flexible tools made of modified polymers. Metal tools are used for micro-preparation of teeth, polishing fillings and removing protruding edges of restorations. During operation, the tools are positioned vertically parallel to the axis of the tooth for maximum contact with its surface. It is recommended to probe the working area with the instrument turned off in order to tactilely identify individual anatomical structures of the tooth. Laser pretreatment of hard tissues is a recent development and is also used as an alternative to classical mechanical methods [1, 6, 9]. One of the most important tasks in laser dentistry is the removal of carious teeth and the subsequent restoration of their shape and function. For the formation of hard tissues in dentistry, erbium and CO2 lasers are most often used, an example is the Er:YAG laser (wavelength 2.94 nm). The mechanism of action of erbium lasers is based on "micro-explosions", when the water that is part of the enamel and dentin is heated by a laser beam. This process leads to micro-destruction of hard tissues. The minimal absorption of laser energy by hydroxyapatite does not allow heating the surrounding tissues by more than 2 °C. The mechanism of action of the CO2 laser is based on the absorption of laser radiation energy by water and heating of tissues, which leads to layered ablation. This process is called laser tissue ablation; indications for the use of CO2 and erbium lasers are the formation of small cavities of all classes and enamel treatment to prepare for bonding (etching). The preparation technique is based on the use of pulsed lasers. Each pulse has a strictly defined energy content. When a laser beam hits a hard fabric, a thin layer with a thickness of about 0.003 mm evaporates. Micro-explosions of heated water molecules emit enamel and dentin particles, which are removed from the cavity using a jet of water and air. The process is painless, since the teeth are not affected by intense heat, it is prepared quickly enough, and the doctor can accurately control the process. The most effective for the treatment of tooth enamel are laser beams with a wavelength from 1.69 to 1.94 microns, a pulsed generation mode, a frequency from 3 to 15 Hz and an output power from 1 to 5 J/imp. Softened dentin is prepared with a laser beam with a wavelength of 1.06-1.3 microns, a frequency of 2-20 Hz and a power of 1-3 J/imp, and compressed (transparent) dentin is prepared with a laser beam with a wavelength of 2.94 microns, a frequency of 3-15 Hz and a power of 1-5 J/imp. After laser preparation, a cavity with rounded corners is formed, ready

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for sealing. There is no "seeping layer", chips or scratches on the bottom and walls. The laser kills the microflora and minimizes the risk of deep infection of the dentin. The laser can also be used for small damages that can be directly accessed. The formation of extensive cavities takes a lot of time and effort. Indications for the use of laser treatments are not only limited, but also associated with the high cost of equipment. Microabrasive techniques are used in cases of carious lesions without floating cavities and surface defects of enamel as an alternative to classical mechanical pretreatment [4]. The advantages of these methods are fewer visits to the dentist, higher aesthetics and preservation of the microstructure of the subsurface layer of enamel. The disadvantages of polishing techniques are considered to be the destruction of the surface layer of enamel and, in some cases, their relatively high cost. The enamel microabrasion technique proposed by P.Loughurst includes etching and microdermabrasion. The enamel is treated with a 35% solution of orthophosphoric acid for 30 seconds, rinsed with water and thoroughly dried. The etched enamel is removed with a tungsten carbide finishing bar until a shiny surface appears; the microabrasion method developed by T.P. Kroll (1989) uses a Prema composition containing hydrochloric acid, carborundum and silicone gel. The method allows you to remove the surface layers of enamel using the "Prema" composition containing hydrochloric acid, carborundum and silicone gel. This method is used when the enamel is cloudy and defects are localized on the surface layer. The use of "Prema" includes the use of a cofferdam and protecting the patient's eyes with large glasses, applying "Prema" to the teeth, slowly rubbing with a rubber cup mounted on an inclined tip, and thoroughly rinsing the mixture. Then the teeth are cleaned with fluoridated paste.Kinetic air-abrasive preparation is considered a painless method of removing hard tooth tissues with minimal irritation of odontoblasts and pulp [5].Aquacut and Aquacut Quattro (Velopex), AirFlow Prep K1 (EMS) and the RONDOflex tip (KaVo) are based on the principle of water-air abrasion. Fine powder particles are sprayed onto the tooth surface at a high speed (20 m/s) in a water-air spray. When abrasive particles come into contact with the tooth surface, their kinetic energy removes the treated enamel and dentin. Water increases the cutting force and washes out dust containing particles of tooth tissue. As a result, complete cleaning of the enamel is guaranteed, and when using modern composite resins, a rough surface is created without a smearing layer called microretence. At the same time, mineral metabolism and microstructural changes between enamel and dentin do not occur, and enamel remineralization occurs 1.5 times faster than after impact on the neck part. Preparation using aqueous abrasives

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usually does not cause discomfort in patients of any age. The direction of the particle flow, according to the recommendations, was perpendicular to the treated surface. Small cannulas with a diameter of 0.46 mm and large cannulas with a diameter of 0.64 mm were used. This method is recommended for the formation of small carious cavities by minimally invasive methods, cleaning deep periorbital fissures and dental cavities before filling, forming support pads for braces and extracorporeal removal of cement residues on the surface of artificial crowns and bridges. Thus, cleaning the surfaces of teeth with hydrokinetic polishing can become an alternative method in clinical practice when cleaning the surfaces of teeth for aesthetic restorations. This paper presents an assessment of the effectiveness of kinetic preparation of the cavity before aesthetic filling of cavities of class I according to Black. The RONDOflex (Kavo) machine was used as a pneumatic abrasive device. The latest version of RONDOflex 2013 is characterized by the presence of a peripheral water supply opening at the distal end of the cannula (Fig. 1). As a result, the entire flow of abrasive particles entering the cannula is absorbed by the water supply. This ensures an accurate concentration of the abrasive flow, reduces the likelihood of contamination of the work area and facilitates the removal of particles. It is recommended to use aluminum oxide as an abrasive (Fig. 2); the RONDOflex system is available in the form of two different powders with different particle sizes and, accordingly, different abrasiveness: 27 microns (low abrasiveness) and 50 microns (high abrasiveness). During the preparation process, it was taken into account that the abrasiveness depends on the working distance (the recommended distance is 1 mm), the air pressure in the container (46-87 pounds per square meter inch) and water pressure (21-23 pounds per square meter inch). A clinical example is shown of the preparation of a Class I black cavity and subsequent sealing with a light-curing composite resin by air polishing (Fig. 3). Two syringes are used to form the restoration: x-tra base and x-tra fil (VOCO). x-tra fil is a light-curing filling material for lateral teeth, has the following indications: filling of pits of class I and II Black and reconstruction of incisors (Fig. 4). The advantages of the material are the possibility of forming a polymerization layer with a thickness of 4 mm, the polymerization time of one layer is 10 seconds, as well as a universal fine polishing technique, which replaces traditional mechanical pretreatment in cases of floating cavities without cavities or with surface defects of enamel. It also shortens the treatment time, especially when used in combination with Futura Bond HP (VOCO) adhesive. Use Clint Paste (VOCO), which does not contain fluoride and oil, and remove plaque mechanically with a brush. Apply enough paste to avoid heating.

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After treatment, the teeth are thoroughly washed with a stream of water and dried with low-fat air. To ensure the cleanliness and dryness of the working area, a cofferdam is installed at each stage of work (Fig. 5). Preparation of hard tissues by air polishing. It includes opening of the cavity, removal of overhanging enamel edges and necrosis of hard tissues (Figs. 6 and 7). The caries marker (VOCO) is used to measure the degree of mineralization of the remaining dentin (Fig. 8). Unlike carious tissue, intact or hardened dentin does not stain. As a result of pretreatment, the middle and distal walls of the cavity are almost smoothed. The air abrasion technique creates smooth walls and rounded corners, which reduces stress in the dentin and prevents cracking due to volumetric shrinkage of the photopolymer (Fig. 9). On the chewing surface of the tooth, a parotid enamel slope is not formed, since the volume of the cavity increases and the probability of occlusal contact at the filling-tooth boundary increases. If bevels are present, a thin composite layer along the periphery of the seal is more likely to be chipped. Filling of the cavity is carried out using resin (Adhesive Bond), which strengthens the bond between the light-curing material and enamel and dentin. A thin layer of Futura Bond self-etching adhesive (VOCO) is applied to the prepared surface with a brush and held for 10 seconds during polymerization with a halogen lamp. Then the bottom of the cavity is covered with a pad made of a liquid-flowing composite X-tra base, photopolymerized with a halogen lamp (Fig. 10). Then the cavity is filled. The missing dentin and enamel are imitated by the universal photopolymerized material X-tra fil. The material is injected from a syringe under pressure into a single layer with a thickness of about 4.0 mm; cracks of the I-II order are modeled using the tip of a thin tool. The composite is illuminated. Excess material is removed with a polishing bar. After removing the cofferdam, the occlusion is checked and the seal is polished with a Dimant (VOCO) tool (Fig. 11 and 12). Teeth are covered with fluoride-containing varnish.

Conclusion:

Preparation of fillings involves one of the most important operations: preparation of hard tooth tissues. In many cases, the classical cavity formation is carried out using a rotating cutting tool - a verser. The development of technical means in dentistry (ultrasound, laser devices) has made it possible to develop alternative methods of processing enamel and dentin, which are free from the disadvantages of mechanical action. Firstly, the effect of polymerization shrinkage of photocomposites decreases, as pain decreases and cavities with rounded corners form in the tooth. In addition,

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the absence of a smear layer improves the adhesion of the seal. The method of preparing teeth for restoration using water-air abrasives demonstrates similar advantages: in the case of teeth with caries of class I according to Black, the effectiveness of hydrodynamic pretreatment of enamel and dentin has been confirmed. High-quality restorations are then obtained by sealing with photopolymerizable materials.

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