

Morphological Features of Dental Preparation in Therapeutic Dentistry

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Annotataion:

Dental dissection is a dental procedure involving the removal (sanding) of surface dental tissues and giving the dental crown a shape that would allow it to be easily covered with a prosthesis. The review analyzes the current literature on dental dissection using various methods. Modern approaches to the treatment of dental caries from the perspective of dentistry with minimal intervention are highlighted.

Keywords: dental caries, dental dissection, ART technique.

The prevalence of dental caries in the country is very high and reaches 99%. Currently, the treatment of caries is reduced to excision of pathological tissues and replacement of the defect with filling material. Preparation is the most time-consuming stage, its features depend on the localization of the carious cavity (KP), the volume of the lesion and the group affiliation of the tooth, the hygienic condition of the oral cavity, the aesthetic requirements of the patient, as well as the properties of the filling material. Improving the quality and efficiency of dental preparation is one of the important problems of modern dentistry, the solution of which will reduce the incidence of caries and reduce the cost of repeated treatment [9, 10, 14, 31]. In recent years, the understanding of demineralization has deepened, as well as the potential of remineralization of tooth tissues in the aspect of eliminating and curing caries.

The surgical approach with the creation of box-shaped cavities, proposed by Black, is not relevant today due to the spread of minimal intervention dentistry. Its modern concept is based on the identification of the initial lesion for preventive measures; surgical intervention is required only in the presence of a cavity. Taking into account the possibility of remineralization, it is necessary to preserve as much natural tissue as possible, thereby minimizing further damage to the tooth. In modern literature, the principle of gentle dissection, the creation of "tunnels", "bridges", etc. is actively promoted. [8, 12, 13, 29]. According to other authors, one can only partially agree with the "minimally invasive" approach to CP preparation: it is justified with small cavities in patients with a "safe" oral cavity and low dental caries (CP index < 5) [15].

During odontopreparation, there are a number of factors that can cause local and general complications. Common factors include stress, psychoemotional tension, pain, impaired functions of the cardiovascular and neuroendocrine systems, allergic reactions, and an infected aerosol cloud. Local complications include mechanical and thermal trauma, vibration, and microbial invasion [21, 28]. Rotating tools (drills, cutters) have not undergone fundamental changes. Diamond bores are considered more effective, when used, the number of cracks and chips of enamel decreases.

However, their disadvantage is the rough surface. In addition, when working on dentine, the gaps between diamond grains are clogged with organic substances, therefore necrectomy is better performed with carbide borons with a small number of blades, the main stage of KP formation is diamond, and the final stage is carbide with a large number of faces (finiers), diamond borons with red markings or ceramic abrasive [7, 12]. Even with the optimal choice of boron and the high-speed mode of preparation, the kinetic energy transmitted by the tool to the tooth is excessive and is distributed unevenly over the surface. Hence, the heating of tooth tissues, microcracks of enamel and dentin, vibration and sound, which cause negative emotions in the patient. When preparing with diamond borons without cooling, the temperature increase reaches 225-257 ° C, and with metal borons – 300-320 ° C. In this case, irreversible changes occur in the tissues: violation of odontoblasts, vasodilation, hemorrhages in the pulp, round-cell infiltration, predentin necrosis. Violation of the preparation technology leads to asymptomatic forms of pulpitis in 40-60%, and the presence of infected dentin makes boron the main vector of cross-infection [2, 3, 6, 12, 23].

The analysis of traditional methods of preparation (according to the KOSRE test, acid biopsy of enamel, X-ray spectral microanalysis and scanning electron microscopy) revealed a significant decrease in calcium content and a tendency to decrease phosphorus content in the surface layers of enamel, which is a negative sign [9, 10, 22].

The disadvantages of traditional preparation require the search for new types of processing of tooth tissues, allowing to minimize the violation of their structure. At the same time, the development goes in two directions:

- 1) improvement of techniques and tools for traditional dissection;
- 2) development of alternative technologies: chemomechanical, laser, ultrasonic, air- and water-abrasive [1, 8, 25].

The method of chemomechanical preparation, or atraumatic technique (ART technique), involves chemical and instrumental processing of CP. In this case, a gel based on organic acids and sodium hypochlorite is placed in the cavity. As a result, carious dentin coagulates, softened tissues are removed with a hand-held cutting tool. Healthy dentin is not chemically injured, as the mixture is quickly inactivated. The treated KP is sealed only with glass ionomer cement. The advantages of low-cost ART technique are minimal invasion, absence of pain, preservation of healthy tissues. The technique is shown to patients with an insurmountable fear of a drill, in childhood, with severe somatic and mental pathology. The disadvantages include high time costs compared to preparation with a drill, the possible toxic effect of the gel on the pulp, as well as the inability to use composites [1, 14, 20, 32].

After laser dissection, there are no chips or scratches in the cavity. Electron microscopy revealed a compaction of the enamel structure, hydroxyapatite crystals had no distinct boundaries, interprism spaces and their contents were not visible. The absence of a "greased layer" gives a clean surface that does not need etching. The microflora dies under the action of the laser, which minimizes the risk of cross-infection. At the same time, the CP does not need antiseptic treatment. The laser is acceptable for small lesions with direct access. Dissection of more extensive cavities can be time-consuming and time-consuming. The procedure is painless, since there is no strong heating of the tooth and the duration of the laser pulse is approximately 200 times less than the time threshold for pain perception [17, 19, 30].

In recent decades, oscillating instruments have become widespread, which include air and piezoelectric scalers that create vibrations with a sound (7000 Hz) and ultrasonic (up to 35000 Hz) frequency. Special nozzles with diamond chips of various shapes and sizes (EMS, NSK, Acteon) are used for preparation [1, 9]. The preparation of hard tooth tissues by ultrasound (ultrasound) has a

number of advantages. The working pressure of the tip is lower, the heating of the tooth is insignificant compared to the preparation of borons. The absence of rough vibration and relatively little heat generation provides a low-pain sensation. Studies of tooth grinds with sections of ultrasound preparation under a microscope showed that the walls of the CP appeared to be finely toothed, without cracks and destruction of enamel prisms and dentine tubules. Studies of the pulp reaction have shown the absence of its necrosis and changes in the structure of odontoblasts. At the same time, reversible vascular hyperemia and pulp edema were noted. Currently, it has been proven that when CP is treated with ultrasound, only softened demineralized enamel and dentin are removed and healthy tooth tissues are not affected, which corresponds to the principle of biological expediency [1, 9]. The technique of kinetic air-abrasive preparation consists in the ultrafine destruction of tissues by a point-focused flow of small particles of aluminum oxide powder (27 and 50 microns), which is accelerated to 600 m/s using air-abrasive devices (Sandman Futura, Mach4.0 (Quintronix)). The air-abrasive method has a number of advantages: painless non-contact preparation with preferential removal of only affected tissues, which eliminates vibration, overheating of tissues, reduces the risk of microtrauma, chips and cracks in enamel and dentin, makes it possible to dissect ultra-small cavities and deep cleansing of fissures without opening them. The treated surface remains dry, rough, and a thick lubricated layer is not formed, thereby increasing the effectiveness of adhesive systems [2, 9, 11, 16, 25-27]. However, this technique has some disadvantages, such as mechanical contamination and bacterial contamination of the workplace, as well as minor blockage of the dentine tubules with dust [18].

In the treatment of fissure caries, the water-abrasive method provides complete cleaning with the creation of a local rough enamel surface without a greased layer. This creates conditions for ideal microretence when working with modern composites without additional etching. The treatment does not involve local anesthesia, does not cause overheating and preserves healthy tooth tissues as much as possible. Dynamic monitoring of the results of treatment using the water-abrasive method showed its effectiveness, the absence of relapses and complications in the long term. After dissection, scientists found no changes in the mineral metabolism and microstructure of enamel and dentin, and enamel remineralization occurred 1.52 times faster than when exposed to borons [2, 9, 10, 22]. However, in KP, there may be limitations in the application of the method on the contact surfaces due to the characteristics of the tip. In such situations, the authors recommend using a combined treatment: opening the cavity and removing detritus using borons, and the final preparation of the KP with an abrasive aerosol. Water-abrasive preparation usually does not cause stress, on the contrary, it has a beneficial effect on patients of any age [2, 9, 10].

The use in clinical practice of each of the above types and methods of odontopreparation should be justified by a comprehensive scientific study of their effect on the condition of hard and soft tissues of the tooth, periodontal tissues using generally accepted clinical techniques and the results of modern high-tech methods that take into account the peculiarities of the microstructure of hard tissues.

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