COMPLICATIONS OF VOLUMETRIC ODONTOPREPARATION

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Abstract

Odontopreparation in orthopedic dentistry is the most important stage in the treatment with fixed orthopedic structures and is a mechanical process of removing hard dental tissues in order to form a stump that retains the signs of belonging to the corresponding group of teeth, and the planned design of a fixed prosthesis [1-3]. It should be noted that during the process of odontopreparation, a significant removal of tooth enamel, which plays the main protective role, occurs, followed by exposure of dentin.

Keywords: tooth preparation, metal-ceramic prostheses, temporary cements, dental pulp, orthopedic dentistry

Odontopreparation is accompanied by both thermal and mechanical trauma to the dental pulp, which depends on the doctor's compliance with the features of the tooth processing process [1, 3, 9, 10,11]: •selection of the type, size of the abrasive and the condition of the burs; •speed of rotation of the bur; •time and force of bur pressure on the tooth; •type and quality of cooling; •knowledge of the location of the dental pulp and safe zones; •control of the depth of preparation.

Thermal trauma

In 1962, M.M. Berman established that the critical temperature for the prepared tooth is 42°C [6]. These data have been repeatedly confirmed and cited in other sources [4]. Increasing the temperature by 5.5°C to critical values reduces the reactivity of the pulp and leads to a thermal burn of the pulp, and subsequently to its necrosis [4, 5]. Dentin performs a protective function, absorbing the heat released during preparation, but with a decrease in dentin thickness, its protective function also decreases. The optimal thickness of peripulpal dentin is 1.0-1.2 mm, the critical one is 0.7 mm [3]. The literature draws attention to the fact that the use of coarse-grained (150 μm) diamond burs leads to a significant (by 3.2°C, up to 40.5°C) increase in the temperature of tooth tissues, therefore, to protect against pulp overheating, coarse- and medium-grained burs should be used only to remove enamel and superficial layers of dentin. Low-abrasive diamond and carbide burs should be used to remove deeper layers of dentin. The quality of the surface of the cutting instrument is of great importance, since with increasing wear of the bur, its cutting quality decreases and compensating pressure is created, which leads to a significant increase in the temperature of tooth tissues [5]. A pressure of 20 g on the tooth is optimal. It should be taken into account that the contact time of the cutting instrument also affects heat generation and should not exceed 3 seconds [1]. The most effective prevention of burns during odontopreparation is air-water cooling in a volume of 50-70 ml/min with a temperature within 35±3°C. Vibration injury Excessive vibration of the cutting instrument during odontopreparation can lead to vacuolar dystrophy of odontoblasts due to osmotic shock. To prevent excessive vibration, attention should be paid to factors such as centering and wear of the bur, the condition of the tip sleeve, and the pressure during the preparation process [1, 4]. Traumatic injury During preparation for structures with a large preparation volume, there is a risk of opening the dental pulp and subsequent development of traumatic pulpitis. For successful processing of a vital tooth, it is necessary to take into account safety zones, the risk of opening the dental pulp in these zones is minimal. In dangerous zones, where the thickness of hard tissues is significantly less, it is recommended to carry out economical excision [1, 3]. The use of special marking burs and silicone templates from pre-made silicone impressions allows visual control of the volume of removed tissues, but these methods do not give an accurate idea of the location of the dental pulp [1]. Additional research methods, such as radiography and computed tomography, allow displaying the structure of all dental tissues. However, radiography creates only a two-dimensional image with possible projection distortions. In turn, computed tomography provides a complete three-dimensional image, but carries a significant radiation load, so frequent use of this method to control preparation at different stages is impossible [1]. The Prepometer DTM-800 device allows measuring the thickness of dentin at a certain point by measuring its electrical resistance, proportional to the thickness of the peripulpal dentin [10]. The result of the study was the development of a Russian analogue of the EndoEst-3D device, which is a multifunctional device for determining the thickness of suprapulpal dentin, apexlocation and electroodontodiagnostics. Microbiological factor Tooth preparation is accompanied by exposure of a significant layer of dentin and opening of dentinal tubules, the diameter of which can vary from 0.5 to 5 μm [7, 8]. In dental practice, great importance is attached to the penetration of mi-

croorganisms harmful to the dental pulp and their metabolic products through open dentinal tubules [7, 8]. The use of isolation of the working field and weak antiseptic solutions as water cooling helps prevent microbial invasion during odontopreparation. PROTECTION OF THE TOOTH PULP AFTER ODONTOPREPARATION The process of odontopreparation is associated with trauma to the dental pulp, however, the penetration of chemical, thermal and microbial factors through open dentinal tubules is possible even after odontopreparation, which leads to the development of postoperative sensitivity, and sometimes to the development of inflammatory reactions of the dental pulp [4]. One of the main factors determining the success of prosthetics is the use of protective coatings and the manufacture of temporary crowns [11]. The use of adhesive varnishes ensures tooth protection by closing the dentinal tubules and providing antimicrobial action. The use of provisional structures for protection from external irritants ensures an aesthetic replacement of the defect and prevents displacement of adjacent teeth. According to the manufacturing methods, provisional structures are usually divided into direct and indirect [4]. The direct method involves manufacturing directly in the oral cavity using a previously removed silicone key and quick-hardening plastic or set teeth. It should be noted that the use of fast-hardening plastics, which include polymethyl methacrylate, is traumatic for the dental pulp, since the curing process is accompanied by the release of a significant amount of heat with an increase in temperature by 4-11 ° C [4]. The use of such plastics in clinical practice is possible only with the manufacture of an additional model from fast-hardening plaster and a silicone key. The disadvantage of fast-hardening plastics is shrinkage during the curing process, and as a result - a violation of the marginal fit. The laboratory method of production is more accurate and aesthetic, but it entails taking additional impressions, and production requires at least 24 hours, which is unacceptable for prosthetics on vital teeth [21, 24, 25, 45]. Recently, a significant number of studies have been aimed at creating and studying various methods of protecting dental pulp by adding various substances to the composition of temporary cements for fixing crowns [11, 12]. In the course of his study, E.V. Teplov proposed a drug consisting of sodium diclofenac, calcium and zinc - "Diccalcin" in the composition of temporary cement for pharmacological protection of dental pulp after odontopreparation, which excluded all symptoms of acute pulpitis in the study group, and the pain reaction to temperature and physical stimuli disappeared by the 7th-10th day [39]. At the same time, with mechanical protection with repin and dentin paste, removal of dental pulp was required in 23% of cases. In recent studies, great importance is attached to the use of fluorapatite and hydroxyapatite in temporary cements, as well as laser radiation. It has been established that fluorapatite crystals in temporary eugenol-free cement block dentinal tubules up to 1 μm in diameter, which helps to normalize vascular tone after odontopreparation [10]. According to the same data, fluorapatite is most effective in combination with Temp Bond. In the study by P.A. Kashnikov, the use of ultrafine hydroxyapatite as a component for fixing crowns after 8 weeks reduced dentin permeability by 41%, while the use of temporary cement with ultrafine hydroxyapatite in combination with laser radiation reduced dentin permeability by 52% compared to the control. In a comparative study of the use of deep fluoridation, laser radiation and a desensitizer, the most desensitizing effect was found in the group using laser radiation. When using laser radiation, moisture evaporates from the dentinal tubules, resulting in a hermetic closure of the dentinal tubules, while no relapses were observed over the course of a year, and after two years, compared with the control group, the pain intensity was 10 times lower [12].

CONCLUSIONS

When performing prosthetics on vital teeth, orthopedic dentists should take into account all factors affecting the dental pulp at all stages of prosthetics, as well as use the entire modern arsenal of possibilities for the prevention of inflammatory reactions of the dental pulp. It should be noted that the development and creation of new methods for protecting and restoring the dental pulp after odontopreparation are relevant. The proposed method should have both a reparative, anti-inflammatory and odontotropic effect on the dental pulp, and activity against pulpitis pathogens.

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