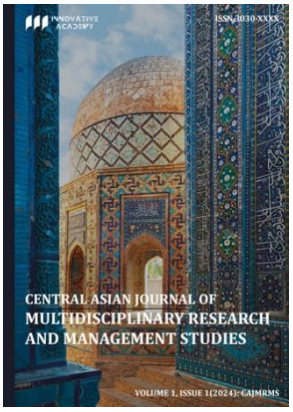


# VARIOUS METHODS OF PREPARATION OF HARD TISSUES OF TEETH AND THEIR COMPARATIVE CHARACTERISTICS

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**ABSTRACT**

*Ultrasound preparation of teeth is an alternative to the traditional one and is characterized by a more gentle effect on hard tissues while preserving clinically healthy tissues. The study of the effect of ultrasound preparation on the morphological structure of hard tissues of teeth in comparison with the traditional method. It is revealed that this method allows to preserve the structural features of enamel and dentin as much as possible, creating optimal conditions for high-quality edge fit and durability of restoration*

Among all carious lesions, fissure dental caries occupies the first place in terms of prevalence, in this regard, the improvement of its treatment methods is relevant. Despite the high quality of the filling materials used, according to the long-term results of treatment, recurrent and secondary fissure caries is observed in 25% of cases. This is due to poor-quality fissure cleaning, stress effects on weakly mineralized enamel of acid etching or insufficient adhesion of the sealing preparation. The cause of the complication may also be excessive expansion of the fissure and weakening of the enamel walls during its mechanical preparation

The kinetic energy of rotating tools is excessive and is distributed unevenly over the treated surface, which causes heating of tooth tissues, uneven preparation, microcracks of enamel and dentin. In modern literature, the principle of gentle preparation of hard tissues, the creation of "tunnels", "bridges", etc. is actively promoted.

In recent decades, oscillating instruments have become widespread, which include air and piezoelectric scalers that create vibrations with sound and ultrasonic frequency. For the preparation of teeth, special nozzles with diamond chips of various shapes and sizes are used. The preparation of hard tooth tissues by ultrasound has a number of advantages compared to a drill. The working pressure of the tip is much less than when processing with rotating tools.

The absence of rough vibration and relatively little heat generation ensures a painless preparation. Currently, it has been proven that when treating carious cavities with ultrasound, only softened demineralized enamel and dentin are removed and healthy tooth tissues are not affected, which in turn determines the principle of biological expediency.

**The purpose of the work.**

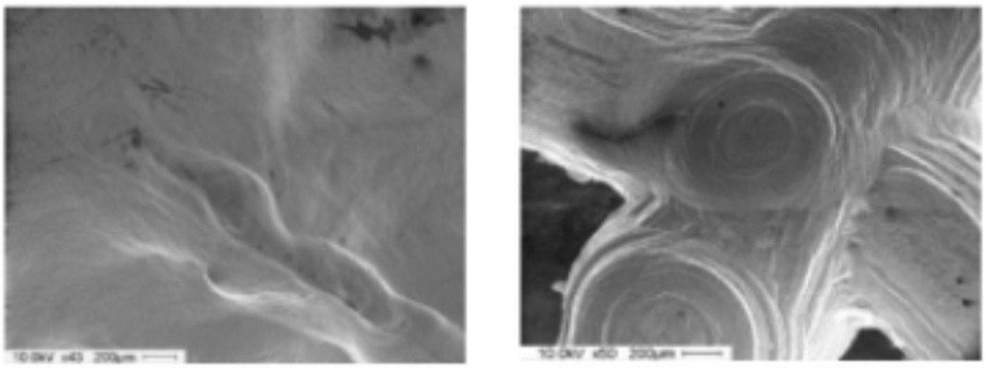
Evaluation of the effect of ultrasound preparation on the morphological structure of hard tissues of teeth in comparison with the traditional method. In the course of the work, 62 freshly removed teeth with fissure caries of dentin of class I according to Black were dissected. The main group consisted of 32 teeth prepared by ultrasound using a piezoelectric apparatus and a special set of ultrasonic nozzles of various shapes with diamond coating. The principle

of ultrasonic dissection is that the affected tissues of the carious cavities are removed under the influence of acoustic cavitation.

In the comparison group, the traditional preparation of 30 teeth with diamond borons with red and yellow markings was carried out. The microrelief was studied by electron microscopy using scanning electron microscopy. It allows you to conduct a direct study, with magnification from 32 to 20,000 times, followed by photo registration. The analysis of electronograms of the surface of the hard tissues of the tooth was started with small magnifications and brought to the upper limit.

To register enamel damage, the following criteria were used: assessment of the extent of damage at the border of preparation and the depth of damage. The results of damage to the preparation boundary were evaluated in points: 0 points – the preparation boundary without structural changes; 1 point – limited damage to the perimeter of the prepared cavity; 2 points – damage occupies from ⅓ to ⅔ the perimeter of the prepared cavity; 3 points – more than ⅔ the perimeter of the cavity have enamel damage

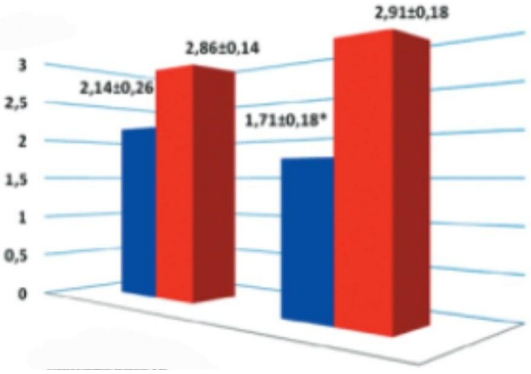
The depth of enamel damage was also assessed in points: 0 points – no damage; 1 point – damage takes up to ⅓ the thickness of the enamel; 2 points – damage takes up from ⅓ to ⅔ the thickness of the enamel; 3 points – damage takes up more than ⅔ the thickness of the enamel. Qualitative and quantitative characteristics of dentin structural units were studied after preparation and after etching with 37% orthophosphoric acid: 0 points – the lubricated layer covers the entire bottom of the prepared cavity; 1 point – the apertures of the dentine tubules are visible, closed with plugs of the lubricated layer; 2 points – up to ⅓ the surface of the prepared cavity with open mouths of the dentine tubules; 3 points – dentine tubes are open from ⅓ to ⅔ the area of the prepared cavity; 4 points – more than ⅔ the bottom surface is occupied by open dentine tubes. Then the percentage of the area occupied by open dentine tubes in the field of view was calculated. As a result of studying the electronograms of the tooth surface in the first group after ultrasound preparation, the cavity boundary was characterized by a smooth relief and a smooth transition to intact tissues (Fig. 1). At the same time, separate areas with traces of the edges of the diamond chips of the ultrasonic nozzle in the form of furrows were noted, which corresponded to type III – the damage occupies from ⅓ to ⅔ the perimeter of the prepared cavities (coefficient 2). On average, the damage to the enamel was 2.14 ± 0.26 points. The depth of damage in this group also did not exceed ⅔ from the surface, which corresponded to type III. The average values of the depth of damage were equal to 1.71 ± 0.18 points (Fig. 2). When analyzing electronograms in the comparison group during diamond boron preparation, the presence of pronounced furrows in the enamel, multiple chips in the form of usures formed under the influence of diamond chips and spreading along the entire perimeter of the cavity was noted. This corresponded to type IV – more than ⅔ of the perimeter of the cavity have enamel damage (coefficient 3). The average value of the enamel damage coefficient was 2.86±0.14 points.



a) b)

Fig.1 Border of preparation: a) by ultrasound method, b) by boron

scores

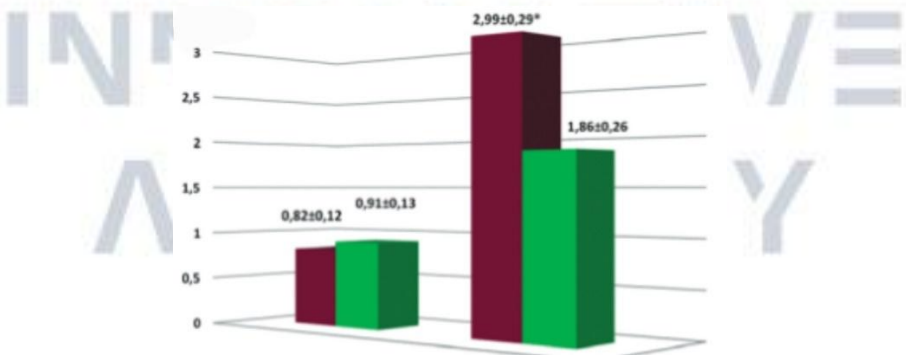



*damage extent coefficient:* *damage depth coefficient*

ultrasound dissection traditional dissection

*Note – * the difference is significant compared to traditional dissection (p<0.05)*
Fig. 2 The values of the coefficients of enamel damage in different methods of preparation in points M + m

The depth of the chips exceeded ⅔ of the enamel thickness, which corresponded to type IV damage (coefficient 3), averaging 2.91± 0.18 points. When characterizing the structure of dentin in the area of the bottom of the prepared cavity, it was revealed that in the main group, almost all the samples showed the apertures of dentine tubules closed with plugs of the lubricated layer. This corresponded to 0.82±0.12 points. After etching, the smeared layer was absent on the studied surface, which was from ⅓ to ⅔ area (coefficient 3), which on average was equal to 2.99 ± 0.29 points (Fig. 3).




scores

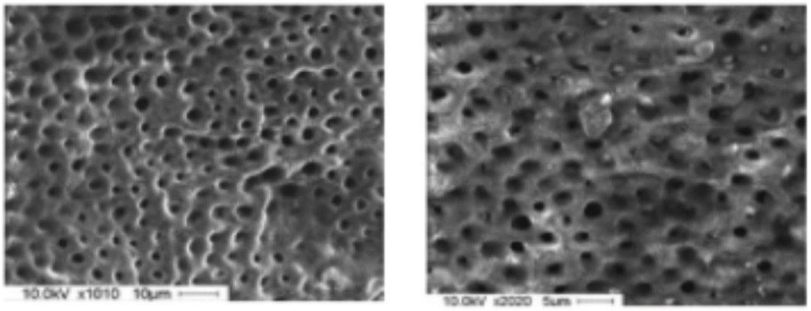
*after dissection* *after etching*

ultrasound dissection traditional dissection

*Note – * the difference is significant compared to traditional dissection (p<0.05)*
Fig.3 Values of coefficients of qualitative characteristics of dentin structural units at various methods of preparation in points, M+m

In the group of teeth prepared with boron, a thick lubricated layer covered the entire bottom of the cavity on electronograms, traces of the tool in the form of circular furrows were traced. After exposure to 37% orthophosphoric acid, the open mouths of the dentine tubules were determined only on the surface (coefficient 2), which corresponded to 1.86 ± 0.26 points. Quantitative analysis revealed that in the main group, after etching, the area occupied by open

dentine tubes in the field of view was 13.06 ±3.33%, and during preparation with boron 2.5 times less – 5.03± 0.66% (Fig. 4).



a) b)

Fig. 4 Dentine tubes in the field of view after etching: a) ultrasound method b) with boron

Thus, ultrasound preparation is characterized by a more gentle effect on the hard tissues of the tooth, compared with diamond boron, which provides low-traumatic treatment of caries and maximum preservation of the structure of the hard tissues of the teeth. After processing, the surface looks smoothed, without chips and enamel usures. At the same time, separate furrows and stratifications are preserved, which are formed under the influence of a diamond ultrasonic nozzle. In dentin, the lubricated layer is less pronounced before etching and is eliminated by orthophosphoric acid almost throughout the prepared dentin. These advantages of the ultrasonic method of preparation allow us to create optimal conditions for filling carious cavities with high quality of the edge fit, which contributes to the durability of the restoration.

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