



## **MORPHO-FUNCTIONAL FEATURES OF THE METHOD OF PREPARATION OF DEPULPATED TEETH FOR PROSTHETICS**

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**Resume.** *This article presents data from laboratory and clinical studies. A study of the microhardness of dentin was carried out using the Vickers technique in the modification of S.M. Remizov of medically removed intact and depulped teeth, the channels of which were in vivo contoured with gutta-percha pins by lateral condensation, with a single paste (zinc oxide eugenyl) and using the resorcinol-formalin method.*

**Keywords:** *microhardness of dentin, surface sealant, finite element analysis, preparation of the oral cavity for prosthetics.*

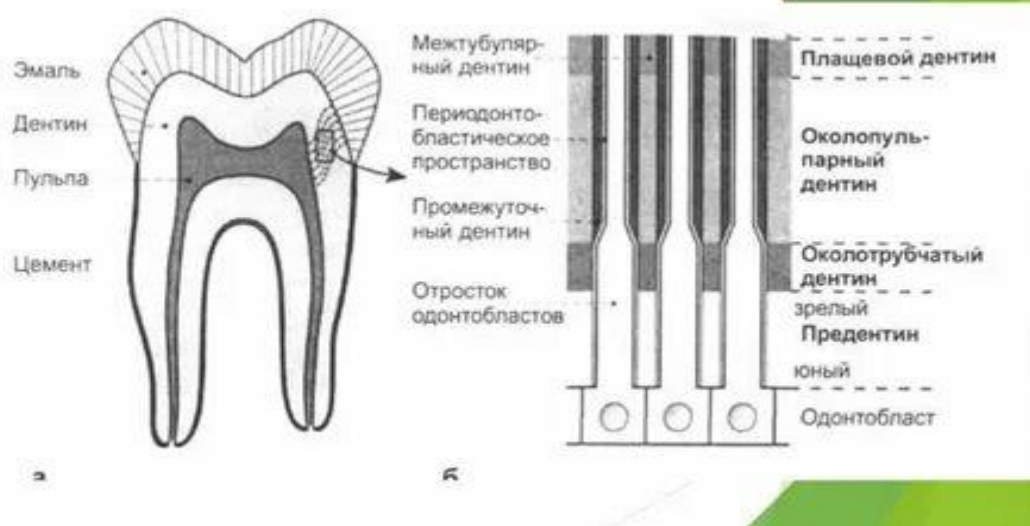
Despite significant advances in dentistry in the replacement of dental defects and dentition over the past decades, the number of failures is quite high [1]. The most common reasons for the low efficiency of prosthetics with pin structures are errors in choosing the type of pin structure, preparation of hard tooth tissues, as well as complications after endodontic interventions [2-5]. When preparing the supporting teeth for prosthetics, endodontic interventions are caused by complications of caries (sanitation of the oral cavity) or the need for their depulped (special preparation) [6, 7]. The latter should be carried out according to strict indications [8, 9]. Depulped leads to a decrease in tooth hardness and resistance to chewing load [10, 11]. Thus, the creation of adequate access to the root canals is accompanied by a significant violation of the architecture of the tooth [12], and the removal of the neurovascular bundle leads to a significant increase in the permeability of hard tissues [13]. In addition, the inflammatory process in the tooth pulp is accompanied by activation of acid formation, which leads to demineralization of dentin, dehydration of the organic matrix with its further denaturation [3]. Therefore, it is necessary to use methods and tools that stabilize the structure of dentin [10]. We consider this task to be very relevant, since after removal of the neurovascular bundle, the inner surface of the dentin of the root canals and the stump of the prepared teeth is easily exposed to bacterial invasion [13]. A relatively new class of materials, surface sealants, allows you to protect dentin [14]. According to a number of authors [2, 15, 16], special attention should be paid to the adequacy of methods for replacing defects in hard dental tissues, since an incorrect technique for restoring the crown part leads to a significant loss of qualitatively endodontically cured teeth in the long term.

The aim of the study is to improve the results of orthopedic treatment of patients with non-removable dentures by improving the methods of preparation of supporting teeth.

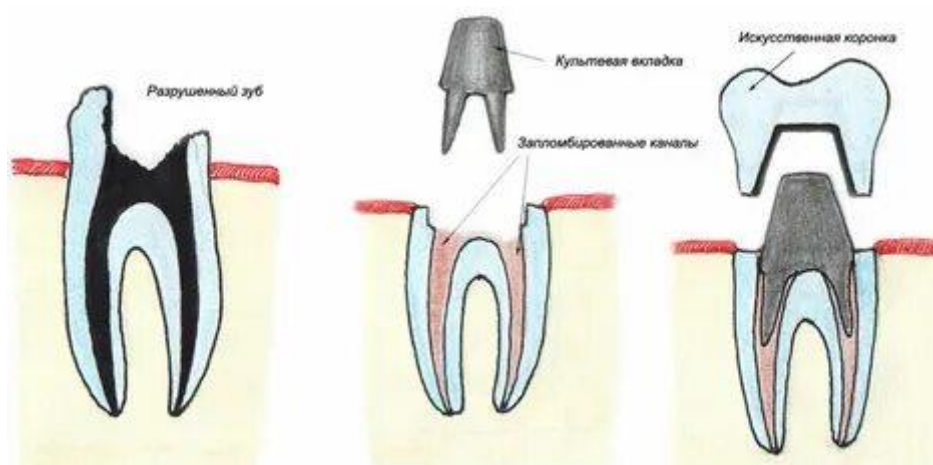
Materials and methods Laboratory and clinical studies have been conducted to achieve the goal. In a laboratory study of the microhardness of dentin, 2 groups of medically removed depulped teeth were identified. The main group included 90 freshly removed teeth due to complications of caries, the root canals of which were sealed with zinc oxide eugenol paste (30), resorcinol formalin paste (30), gutta-

percha pins by lateral condensation (30). The comparison group (control) consisted of 30 intact teeth removed according to orthodontic indications. The hardness of tooth tissues was determined using the Vickers technique modified by S.M.Remizov (1965).

To study in vitro the tightness of the closure of dentine tubules of teeth after their preparation for a pin stump tab, the following groups were identified: the main group – 30 teeth, the channels of which were sealed with gutta-percha with dentin treatment with Seal&Protect (Dentsply) surface sealant (Fig. 1).



The control group consisted of 30 teeth, the channels of which were sealed with gutta-percha pins, but the dentin of the tooth was not covered with a surface sealant. The study of the dentin permeability of the root and stump was carried out by immersing the teeth of the main and control groups in a 2% solution of methylene blue. After 24 hours, longitudinal teeth sections were obtained in the mesiodistal direction along the root canals, and the penetration of the dye into the dentine tubules of the tooth stump was evaluated. To study the stress-strain state of the "depulped tooth – pinned stump tab – cast crown" system, 6 mathematical models have been developed (Fig. 2).



In models with complete destruction of the crown part, the edge of the crown overlapped the hard tissues by 0.8 mm (rim effect). The taper of the stumps in all models was 2°. Computer modeling and strength analysis of the listed mathematical models were carried out on the ANSYS 14.5 software under vertical load, as well as under lateral load (from 5 to 45 degrees relative to the vertical axis in increments of 5 degrees). Data on the components of mathematical models were used to calculate stress-strain states. Based on the data obtained in laboratory studies, we have proposed a method for



preparing supporting teeth for the manufacture of pin structures. The preparation of the tooth stump after endodontic preparation was carried out with diamond drills with maximum preservation of tissues not affected by caries. In the cervical region, a ledge was formed at an angle of  $135^{\circ}$  0.3-0.5 mm below the gingival margin. The cavity under the tab was formed in a box-shaped asymmetric shape, with smoothed edges, without sharp corners and transitions. The thinned walls of the tooth stump (less than 1 mm) were excised, and later they were overlapped with a tab. The root canal was sealed up to  $2/3$  of the root length (but not less than  $1/2$ ) using a non-aggressive rotating tool of the Peeso Reamer type with dimensions from the smallest - No. 1 to No. 4 in such a way that the diameter of the root canal did not exceed the wall thickness. After preparation of the tooth under the pin tab, the dentin of the root canal and the stump of the tooth were twice coated with a surface sealer Seal&Protect (Dentsply). The cavity was closed with a temporary seal made of oil dentine or a temporary crown was made using a direct method. In the following stages, an indirect method was used to produce a pin cast stump tab and after its fixation, single crowns or bridges were manufactured.

The clinical and laboratory stages are presented on the example of the treatment of patient M. The object of the clinical study was 2 groups of patients:

- 1) The main group consisted of 50 patients with defects in teeth and dentition, for whom the preparation of supporting teeth was carried out according to the method described above using a surface sealant.
- 2) The control group consisted of 50 patients to whom the stumps of the supporting teeth were restored with pin stump inserts followed by coating with metal-ceramic or cast crowns, but the preparation of the teeth was carried out without the use of a surface sealant. At control examinations 6, 12, 24, 36 months after fixation, the presence of complaints was assessed, basic (examination, probing, percussion) and additional (radiography – according to indications) examination methods were performed, complications after orthopedic treatment of patients of the main and control groups were recorded, such as: exacerbation of chronic periodontitis, chronic granulomatous and granulating periodontitis, cystogranuloma, root caries, cementation of orthopedic structure, root fracture, root perforation. The edge adaptation of manufactured structures was evaluated directly during the packing of structures, 6, 12 and 24 months after the completion of treatment, using quality criteria developed by A.N. Ryakhovsky and M.M. Antonik (2005) [17, 18]. To assess the quality of endodontic interventions performed before orthopedic treatment, as well as the condition of periapical tissues and hard tissues of the tooth root covered with a crown in the cervical part after treatment, the presence of hidden carious cavities, targeted intraoral and panoramic X-rays were performed.

Thus, the success of treatment of patients with defects in hard tissues of teeth and dentition depends on many factors, the most important of which, in our opinion, are high-quality endodontic treatment, maximum preservation of hard tissues of the tooth, elimination of such adverse factors as a significant inclination of the tooth, achieving tightness of dentine tubules (use of surface sealant) and manufacturing artificial crowns with a sufficient margin of safety due to the formation of a "rim effect" and a ledge in the neck part of  $135^{\circ}$ .

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