

UDC: 611.38-04.16

**THE INFLUENCE OF
ORTHODONTICS PREPARATION
FOR THE UNFIXED
ORTHODONTIC
CONSTRUCTIONS ON THE
TOOTH PULP FROM THE POINT
OF VIEW OF MORPHOLOGY**

*P. A. Gasiuk**, *V. B. Radchuk**, *P. P. Brekhlichuk***, *D. V. Kalashnikov****,
*S.G.Zubchenko****

Summary: To improve the efficiency and quality of dental orthopedic care is very important to minimize the intermediate and long-term complications while doing these or those manipulations and certainly painless treatment. Often, the pain occurs at a reception at the dentist, is the reason for the refusing of treatment. Today is particularly acute the problem of choosing a local anesthesia in orthopedic dentistry, as the frequency of use of fixed orthopedic constructions is quite high. The preparation of vital teeth in their manufacture requires analgesia almost in 100%. In this case, the main aim of a local anesthetic is not only analgesic, but in most cases, prevention of local complications such as inflammation of the pulp. Orthodontic preparation taking into account the protocols of preparation of hard tissues of teeth, has a positive effect on the tissues of the tooth, but does not solve the problem of preventing long-term complications of surgery preparation of hard dental tissues (HDT).

Keywords: local anesthesia in orthodontic dentistry, pulpitis, preparation of hard dental tissues, damage of odontoblasts processes, reparative dentine, pulp hyperemia of blood vessels.

**State Higher Educational Institution «Ternopil State Medical University named by I. Ya. Horbachevsky» Ternopil, Ukraine*

***Uzhhorod National University Faculty of dentistry Uzhhorod, Ukraine*

****Higher State Educational Institution «Ukrainian Medical Dental Academy» Poltava, Ukraine*

Introduction. In current clinical practice of orthodontic dentistry in preparation for orthopedic treatment of solid rubber fixed structures it is necessary to prepare a significant amount of hard tissues of the crown part of teeth, which are used as support structures, covered with porcelain, composite or plastic [2.11].

Preparation of the hard dental tissues (HDT) is widely used dental widespread dental intervention, which is accompanied by a complex of stressful actions on the patient's body: inflammation, specific pain perception and nonspecific reactions of the organism, which are certainly connected with: vegetative, motor, behavioral, endocrine, which negatively influence to the body of the patient, and on tooth tissue [4].

According to the information of many authors, the preparation of hard dental tissues (HDT) causes denaturation of the protein component of tooth structure. During the preparation in the pulp abruptly increases free activity of aggressive acid glycosidase, blood congestion, inflammation, infiltration of odontoblasts, is observed destructive changes of nerve endings, vasodilatation, hyperemia, marginal state of the leukocytes [9].

Hyperemia of pulp blood vessels leads to the hemorrhage and eventually to the formation of cysts. Furthermore, preparation reduces the intensity of blood circulation to the pulp, which is connected with deletion of a part of hard tissues and decreases its consumer and plastic function. The blood overfilling of dilated vessels of pulp causes edema, the output of plasma into the extracellular space, inflammation, and pulpitis [7, 10].

Furthermore, the preparation operation of hard dental tissues (HDT) cases vacuolization of odontoblasts layer, impregnation of its cores in the dentin tubules. This process can be the beginning of the process of atrophy cell layer of odontoblasts. With significant circulatory disorders in the pulp can occur cell infiltration, vessel thrombosis and hemorrhage.

Due to the fact that the resistance of the dentine is much lower than the analogical enamel index, it is quite likely the occurrence of complications connected with the disclosure, damage and impaired dentin tubules and violation in them hydrodynamic processes as well as in the processes of odontoblasts, which are in the dentin tubules from the pulp side.

The damage of odontoblasts processes as well as odontoblasts themselves during the preparation of hard dental tissues (HDT) become an obstacle to the timely launch of compensatory mechanisms in the pulp - the initiation of the formation of secondary dentine substitution. Odontoblasts with their processes are highly differentiated cells that are arranged in several layers on the border with predentine penetrate into the tube of dentine and permeates its entire thickness, create multiple branching and interlacing in a grid, perform trophic and sensory functions, and in addition, create secondary substitutive dentine.

Just because, after considerable damage and loss of odontoblasts during the preparation of hard dental tissues (HDT), odontoblasts are replaced by the maturing cells and migrate to the subodontoblastic layer, which is densely penetrated by nerve fibers. Normally, the dentine tubules are covered by almost impenetrable layers of enamel or cement of the tooth root, but after their disclosure, dentine tubules are extremely attractive to the invasion of microorganisms of the oral cavity.

The dentine permeability is defined by the quantity of dentine and also by the size of the lumens of tubes, and by the movability of the disposed liquor in them. Brannstrom and Anderson with their researches proved that

the movement of the liquid, for instance, the liquor inside the dentine tubules under the influence of intense external stimuli causes deformation of the mechanoreceptors of the pulp, which are the combination of odontoblasts with fibers of free nerve endings. It is because even of a slight deformation of the above-mentioned complex pain receptors there is an acute pain. Its intensity is weakened with further deeper dissection of hard tissues, but under these conditions the intensity of odontoblasts damage increases [5].

The irritation of odontoblasts in the initial stages of preparation stimulates the formation of reparative dentine. The thick layer of reparative dentin, which is formed after the surgery preparation of hard dental tissues (HDT), determine the amount of prepared tissues, the individual response of the organism, the time elapsed since the intervention. If preparation was within the layer, wherein the amount of the dentine tubules is significantly greater, the gaps are increasing; the reparative potential of dentine under these conditions is significantly reduced.

With the further increase of the volume tissue preparation, the process of formation of reparative dentine is completely eliminated because after a volumetric or traumatic preparation in odontoblasts revealed signs of degeneration. On the restoration of their functions is needed very long period of time.

Many studies have shown that this protective mechanism of pulp provides, firstly, the high absorption capacity of endothelial cells, and secondly, an active inflammatory response of pulp to the irritation and the penetration of non-native substances, and also formation of the capsule of connective tissue, defining damage zone from the remaining intact parts [1].

First and foremost, during the surgical intervention – the preparation of hard dental tissues (HDT) is damaged the mechanism of microcirculation of pulp liquid. Therefore, during the so-called dry preparation of hard dental tissues (HDT) significantly increases the severity of thermal damages of the dentine

complex – pulp, and in the end it causes inflammation and necrosis of the pulp [6].

The preparation, which is done only within the limits of surface layers of enamel, accompanied by a significant shift of the physical and chemical balance of hard tissue with the increase of demineralization, which may help to reduce the stability of the surface layers of enamel and cause caries.

All these symptoms have been observed by many researchers after 6 hours after completion of the preparation. However, precisely the activation of the inflammatory process, its second wave was observed only after 15 days after the intervention. Although, as is well known, the deposition of reparative dentine is completed within 30 days after the intervention, the inflammatory process in the pulp does not subside over time.

The restoration of the pulp state depends on many factors, namely: from its original state before the intervention, the depth, volume, preparation area, the degree of tissue damage and the presence of a sufficient amount of odontoblasts cells capable of differentiation.

However, within 12 months after the intervention in the pulp has not been seen initial signs of reaction to orthodontic preparation, is observed only hyper productivity of secondary dentine, collagen fibers, distortion of the structure of Schwann cells, microcirculation of venous and lymphatic drainage of the pulp, which leads to the violation of the trophic, innervation processes of lymph absorption.

It should be noted, that that in addition to the pulp changes, the preparation of hard dental tissues (HDT) causes the development of marginal periodontal lesions. Occurs expressed fibroblastic reaction, stops migration of leukocytes from blood vessels into the surrounding tissues, is a weak activity of macrophages to phagocytosis of the damaged tissues located adjacent to and at the distance from the blood vessels. There is a growing activity of young fibroblasts with deficiency expressed cytoplasm. It appears much more adventitious and plasma cells in the blood vessels. Their margins are clear, increased in size, there is also the

transformation of cells. The protective reactions of periodontal connective tissue appear in the form of organization of mechanical barrier, but the reactive state of cellular elements has individual organ specificity.

In the periodontium also develop the microcirculation disorders also the form long-term venous congestion, which occurs after a short-term arterial hyperemia. In the bone tissues of jaws is bone edema, which damages non-bone and partially bone layers of the walls of the alveoli. In osteocytes is observed cytolysis with displacement of the nuclei of cells from the outside from the inner walls of the alveoli. In bone tissues – the inflammation symptoms are far longer than in the periodontal.

All reactive manifestations of an organism in response to the preparation of hard dental tissues (HDT) are less expressed if the preparation operation is carried out under local anesthesia, preferably with the use of anesthetics of the amide group, which include adrenaline, taking into account the rules of preparation and the mandatory use of the air, and better water cooling.

In cases of preliminary anesthesia immediately after the end of preparation, the odontoblasts have normal structure and a well-defined layer. The pulp is delicately fibrous structure, blood vessels and capillaries are moderately full-blooded. The walls of the vessels are not changed. There have been only minor changes of the axial cylinders of nerve fibers, which are reversible. These data confirm the protective effect on the structure of the pulp of painkillers, local anesthetics, in particular, and their positive effect on tooth tissues, stopping the processes of disorganization in the layer of odontoblasts. To compensatory processes that occur during anesthesia using local anesthetic, it is necessary to include the observation of high dentine demineralization. Under these conditions, was observed only minor reactive changes, which appeared as an extension of the dentine tubules near the intervention, the reducing amount of mineral salts in the superficial layers of dentine, was observed hyperplasia of inner dentine layers [8].

So called wet preparation significantly reduces the negative influence on interference on the fabric, as by dry preparation there is formed twice as much "burned dentine" than during the same interference with the use of a water jet. Thermal burns are often caused by inflammation and necrosis of the pulp. The usage of air cooling only in preparation is also harmful to the pulp as a prolonged effect of dehydration of already prepared dentine causes the evaporation of tubular liquid from the dentine tubules. Simultaneously with the movement of the nuclei odontoblasts, the excessive dehydration of tissues occurs, that leads to the leakage of tubular liquid from the dentine tubules on the dentine surface. The negative pressure and movement of the liquid column in the dentine tubules cause deformation of mechanic receptors of pulp. Therefore, in such cases, after the end of the anesthesia there is a sharp pain in patients [3].

Conclusions. Hypersensitivity of surfaces of the prepared tissues remains for two to three days, as long as the displaced nucleus of odontoblasts will not return to its normal position. In other cases, odontoblasts have autolysis, their processes disappear from the lumen of the tubules of dentine, but their place is occupied by cells migrating from

subodontoblastic layer. The use of cooling in the preparation of hard dental tissues (HDT), especially water cooling, preserves biochemical and functional properties of the mitochondria. These organelles are responsible for the synthesis of most molecules of ATP, which are involved in the synthesis of DNA, RNA, proteins, fats, glycerol phospholipids, cholesterol, steroid hormones, vitamin D₃, bile acids, and other biologically important molecules, i.e. water cooling at the preparation of hard dental tissues (HDT) not only thermally, but also biochemically is justified [6].

Therefore, analyzing the literature, we can see that the problem of preservation of all tissues of the tooth and also periodontium is relevant. Orthodontic preparation according to the rules of preparation of hard dental tissues (HDT), namely anesthetic protection, obligatory water and air cooling, a sharp and centered tool, a high speed rotation and intermittent preparation has a positive effect on tooth tissues, but does not solve the problem of preventing long-term complications of surgery preparation of hard dental tissues (HDT).

REFERENCES

1. Абакаров С.И. Результаты исследования функционального состояния сосудов пульпы зуба при препарировании твердых тканей под металлокерамические коронки / С.И. Абакаров, А.В. Панин, А.О. Гасангусейнов // Стоматология. – М., – 2007. – Том 86. – № 2 – С.57-62.
2. Арутюнов С.Д. Одонтопрепарирование под ортопедические конструкции зубных протезов / С.Д. Арутюнов, И.Ю. Лебедеенко. – М.: Практическая медицина, 2007. – 80 с
3. Баарт Ж. Местная анестезия в стоматологии / Ж. Баарт, Х. Бранд. – Медицинская литература, 2010. – 208 с.
4. Вульфес Хэннинг. Современные технологии протезирования. Руководство. – Издание первое / Вульфес Хэннинг – Бремен: Academia dental, 2004. – 279 с.
5. Гайворонский И.В. Анатомия зубов человека: Учебное пособие / И.В. Гайворонский, Т.Б. Петрова. – СПб.: ООО «Ресурс», 2005. – 56 с.
6. Гасюк А.П. Пульпа зуба в норме и при патологии / А.П. Гасюк, М.Д. Король Т.В. Новосельцева. – Полтава, 2004. – 140 с.
7. Иванов В.С. Воспаление пульпы зуба / В.С. Иванов, Ю.Л. Винниченко, Е.В. Иванова. – М.: Медицинское информационное агентство, 2003. – 264 с.
8. Кононенко Ю.Г. Местное обезболивание в амбулаторной стоматологии; 2-е издание, перераб. и доп. / Ю.Г. Кононенко, Н.М. Рожко, Г.П. Рузин. – М.: Книга плюс, 2004. – 352 с.
9. Лесных Н.И. Методики и принципы препарирования твёрдых тканей зубов в клинике ортопедической стоматологии: метод. рек. для врачей-стоматологов, студентов, интернов и клинических ординаторов стоматологических факультетов / Н.И. Лесных. – Воронеж, 2004. – 31 с.
10. Лукиных Л.М. Пульпит: клиника, диагностика, лечение / Л.М. Лукиных, Л.В. Шестопалова. 3-е изд. Н. Новгород: НГМА, 2004. – 87 с.
11. Трезубов В.Н. Ортопедическое лечение с применением металлокерамических зубных протезов / В.Н. Трезубов, В.С. Емгахов, О.Н. Сапронова – М., 2007. – 200 с.