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MODIFICATION OF THE STRUCTURE OF ENDODONTIC SEALERS

Abstract

The incorporation of nanoparticles into endodontic sealers aims at increasing antimicrobial activity of the original material. The aim of this study is to incorporate the nanostructured silver vanadate decorated with silver nanoparticles (AgVO₃, at 2.5%, 5%, and 10%) into three endodontic sealers and evaluate the antibacterial activity of freshly sealers, surface topography and chemical composition, and setting time. The AgVO₃ was incorporated into AH Plus, Sealer 26, and Endomethasone N at concentrations 0%, 2.5%, 5%, and 10% (in mass).

All the achievements of modern therapeutic dentistry are based on many years of experience in scientific research, supported by the practical activities of doctors. Numerous data on the formation of dentistry in different eras make it possible to track the development trend of endodontics as an independent discipline from the earliest stages of the development of medicine. The discovery was made in northern Italy by an international team of archaeologists. The carious cavity was exposed to abrasive materials, as evidenced by numerous notches on the walls. The filling consisted of a resinous compound - bitumen mixed with various plant fibers and hair

Key words: *endodontic, dentistry, abrasive materials, filling, treatment, root canal*

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Endodontik sillerlərin strukturunun modifikasiyası

Xülasə

Nanohissəciklərin endodontik möhürləyicilərə daxil edilməsi orijinal materialın antimikrobiyal aktivliyini artırmaq məqsədi daşıyır. Bu tədqiqatın məqsədi gümüş nanohissəciklərlə bəzədilmiş nanostrukturlu gümüş vanadatı (AgVO₃, 2.5%, 5% və 10%) üç endodontik möhürləyiciyə daxil etmək və təzə möhürləyicilərin antibakterial fəaliyyətini, səth topoqrafiyasını və kimyəvi tərkibini qiymətləndirməkdir. AgVO₃ 0%, 2.5%, 5% və 10% (kütləvi) konsentrasiyalarda AH Plus, Sealer 26 və Endometazon N-ə daxil edilmişdir.

Müasir terapevtik stomatologiyanın bütün nailiyyətləri həkimlərin praktiki fəaliyyəti ilə dəstəklənən elmi tədqiqatlarda çoxillik təcrübəyə əsaslanır. Müxtəlif dövrlərdə stomatologiyanın formalaşması ilə

bağlı çoxsaylı məlumatlar, təbabətin inkişafının ən erkən mərhələlərindən müstəqil bir elm kimi endodontiyanın inkişaf tendensiyasını izləməyə imkan verir. Kəşf, İtaliyanın şimalında beynəlxalq arxeoloqlar qrupu tərəfindən edilib. Çürük boşluq aşındırıcı materiallara məruz qalmışdır, bunu divarlardakı çoxsaylı çentiklər sübut edir. Bu da, müxtəlif bitki lifləri və tükləri ilə qarışdırılmış doldurm qatranlı birləşmələrdən ibarətdir.

Açar sözlər: endodontiya, stomatologiya, abraziv materiallar, plomb, müalicə, kök kanalı

Introduction

All the achievements of modern therapeutic dentistry are based on many years of experience in scientific research, supported by the practical activities of doctors. Numerous data on the formation of dentistry in different eras make it possible to track the development trend of endodontics as an independent discipline from the earliest stages of the development of medicine [1,2]. The discovery was made in northern Italy by an international team of archaeologists. The carious cavity was exposed to abrasive materials, as evidenced by numerous notches on the walls. The filling consisted of a resinous compound - bitumen mixed with various plant fibers and hair [3]. Earlier traces of intervention in the dentoalveolar system were not accompanied by finding the remains of fillings. Further archaeological research revealed a lot of evidence of dental activity in different years. The first written records of dental care have been found in many of the most developed parts of the world. In one of the largest cities of the Sumerian civilization, hieroglyphic writings were found describing medicines, methods used in treatment, including dental treatment (about 3500-3000 BC). The Ebers papyrus was found on the territory of ancient Egypt, dating back to 3000 - 2000 BC. e., in which a separate chapter was devoted to dental treatment (splinting techniques, various drugs). One of the ancient Chinese treatises on medicine (2500 BC) contains many recipes and techniques for making dentures. One of the most extensive medical literary monuments - "Ayurveda" (1800-1700 BC), found in ancient India, contains information about the methods of treating diseases of the maxillofacial region, as well as numerous prescriptions for medicines. In the writings of Hippocrates (5th century BC), a lot of information was found regarding the surgical treatment of dental diseases, dislocations, and fractures [6, 7].

In 1700, dentistry began to develop rapidly in France under the influence of Pierre Fauchard, the personal dentist of Louis XV. Methods for the manufacture of artificial crowns, the use of amalgam as a filling material were applied. In 1836, for the first time, arsenic-based compounds were used to necrotize the dental pulp. Most cases of dental diseases ended with their extirpation, which is indirectly evidenced by the name of the specialists who performed this procedure - "dentist". This information is confirmed by archaeological finds of that time [8, 9]. There were conservative methods of treatment, according to which rinses, mouth baths, applications of various decoctions and tinctures were used. So in the materials dating back to the 12th century, information was found that one of the Kiev healers - Agapius used a decoction of black henbane, a tincture of iris. The peculiarity of the state system did not allow the development of this direction as rapidly as in many other industrial countries. Dentistry developed more rapidly during the reign of Peter the Great [10]. The accumulation of information in the field of natural sciences, as well as the development of scientific and technological progress, formed the basis for the development of endodontics. Numerous historical evidence of endodontic treatment, as well as the results of scientific research, created the conditions for the development of endodontics as a science. In 1920, studies of X-rays led to the widespread use of the method of targeted radiography [12]. This made it possible to detect foci of bone resorption in the region of the roots of the teeth. Studies of the contents of the channels led to the identification of microorganisms. This contributed to the strengthening of the opinion that it is necessary to extirpate the affected teeth. Subsequent discoveries within 30-35 years became the heyday of modern endodontics. Microbiologists have studied the composition of infected root canals, physiologists and pathophysiologists have studied in detail the reaction of tooth tissues and the periapical region to various dental interventions. Radiography made it possible to determine the necessary boundaries of the work, and clinicians offered many options for aseptic treatment of root canals [10, 12]. For a long time, cauterization of the pulp with a hot wire or exposure to various aggressive liquids such as acids was considered the usual method of treatment. Many other methods of devitalization using arsenic paste were distributed later. In the 19th century, the first endodontic instru-

ments, similar to small hooks, were used to remove damaged and infected pulp from the root canal of the tooth, and the introduction of local anesthesia in the 20th century made this procedure painless. Until that time, the main and only goal of dental treatment was the elimination of pain. However, changes in the dentition due to tooth loss have led to an increase in the value of tooth-preserving operations. New discoveries made it possible to perform them at a high level [14,15].

This is facilitated by the current trend in the development of the discipline, aimed at increasing complexity and increasing requirements for the quality of work. Analyzing the literature on the frequency of occurrence of endodontic treatment in humans, the following data were obtained. On average, in developed countries, about 72 - 83% of the total population has a history of at least one tooth subjected to endodontic treatment [3,11]. In domestic dentistry, this figure is higher - 91-93% [12,14]. In order to obtain a stable positive result of treatment, it is necessary to achieve the fulfillment of a number of conditions that can be divided into three groups: First, the manual skills of the dentist:

1. Compliance with the rules of asepsis and antisepsis.
2. Follow treatment protocols.
3. Competent instrumental processing of the root canal.
4. Sufficient irrigation, etc.

Secondly, the quality of dental materials:

1. Mechanical properties.
2. Chemical properties.
3. Biological properties.
4. Features and working conditions.

Thirdly, the reactivity of the patient's body:

1. Somatic pathologies.
2. The state of the immune system.
3. Sensitization of the organism.
4. Regenerative abilities of the body.
5. Hormonal background.
6. Age, gender.
7. Patient's diet.
8. Taking medications and dietary supplements [5,10,9,11].

In 5-6% of patients, complications occur due to root perforation, excessive removal of material beyond the root apex, and the development of apical root periodontitis. These data are due to treatment errors, deviations from the protocols, as well as the imperfection of the materials used [12,13,14,16].

To optimize treatment, a classification was created that allows you to navigate the possible complications, as well as understand the ways to overcome and prevent them. All errors and complications made during treatment at any stage lead to serious consequences in the corresponding anatomical and topographical regions of the maxillofacial region. They are divided into those that appeared immediately after or during treatment - the nearest ones, and the remote ones - those that appeared some time after the end of treatment. Complications are represented by infection of the root canal with microflora contained in the oral cavity. This is due to the penetration of microorganisms from the oral cavity into the root canal [4,5,7,8,9]. Root canal contamination is possible due to the following reasons:

1. with poor-quality isolation of the working field in case of ingress of oral fluid during treatment;
2. with incomplete removal of necrotic masses from the tooth cavity;
3. with poor-quality isolation of root canals between visits;
4. other reasons [16,17].

Also, complications are often represented by errors in the formation of access to the mouth of the root canal. Insufficient removal of the overhanging edges of the tooth, inadequate opening of the orifices leads to the need for excessive load

for endodontic instruments. This can provoke many other complications, such as [11,12]:

1. Perforation of the bottom and walls of the tooth cavity. This complication occurs in 3-12% of all complications, usually in curved canals.

2. Obturation of the lumen of the root canal with dentinal sawdust, which is manifested by the inability to penetrate the tools deeper than the place where the dentinal plug accumulates. In addition, excessive compression can lead to expulsion of the dentin plug, endolubricants, and other substances beyond the root apex, which provokes inflammation and the development of further destructive processes [8,9 , 11].

3. Creating an apical expansion when the root canal is curved, or "Zipping". This complication results from the use of inflexible tools. If the shape of the channel is preserved by the file during rotational movements, an excessive funnel-shaped expansion is formed. Often there is a simultaneous blocking of the canal with dentinal sawdust.

4. Excessive lateral expansion of the canal along the internal curvature, or "Stripping". Underestimating the curvature of the canal, the use of machine-made, inflexible files leads to excessive removal of wall tissue, which weakens the root of the tooth.

5. Destruction of the physiological or anatomical narrowing of the canal. The reason for the development of complications is errors at the stages of determining the length of the root canal, as well as work without limiting rings on the instruments.

6. Instrument breakage in the root canal, or instrument fragmentation. The complication is caused by a violation of the technique of working with endodontic instruments.

7. Heterogeneous low-quality filling of the root canal system. The disadvantages of obturation are due to the wrong choice of material or errors in the process. Also, the physical and chemical properties of materials limit the quality of root canal obturation.

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