

Treatment of Dental Pulp Injuries with the Ultrasound Endoactivator

Elnazarov Azamat To‘lqin o‘g‘li

Samarkand State Medical University, Assistant of the Department of Therapeutic Dentistry

Khaydarova Durdona Munisovna

Department of Therapeutic Stomatology, Samarkand State Medical University

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Abstract: Currently, in the biological treatment of dental pulp diseases, agents with bactericidal effects - antibiotics, antiseptics and anesthetics - are used in combination with calcium hydroxide (HC) [3,5]. Calcium hydroxide-based preparations have been effectively used in dental practice for more than 130 years. Its highly alkaline environment (pH \approx 12) inhibits the vital activity of microorganisms and reduces inflammatory processes in the pulp and periapical tissues. At the same time, calcium hydroxide stimulates remineralization and the formation of reparative dentin in dental tissues, that is, it has a dentinotropic effect [2,6,9,14].

Several studies have demonstrated the potent antimicrobial activity of calcium hydroxide against cariogenic microorganisms, particularly *Streptococcus mutans*, *Lactobacillus acidophilus*, and *Enterococcus faecalis* strains [1,4,8,11]. As a result, calcium hydroxide has been accepted as one of the main biological agents for controlling microflora in endodontic procedures.

However, calcium hydroxide has some drawbacks. It does not adhere well to dentin walls and can create microinterface gaps, which can lead to re-introduction of bacteria and their toxins [7,13]. Therefore, we aimed to study the antibacterial effect of calcium copper hydroxide and its advantages.

The purpose of the study:

In the treatment of dental pulp injuries, the Ultrasonic Endoactivator is used to effectively disinfect the tooth canal system and accelerate tissue regeneration, increasing the effectiveness of treatment.

Research object:

the incidence of chronic periodontitis were collected by dividing the patients into the main and control groups . A total of 124 patients were included in the study, who were divided into the main group (n = 76) who underwent modern treatment methods and the control group (n = 48) who received traditional treatment.

Research methods: During the examination of patients, destructive changes in the peri-root tissues were detected by radiological methods. After the tooth was isolated, the working area was brought to a sterile state. The canals were treated with antiseptic solutions - 3% sodium hypochlorite (NaOCl) and 17% ethylenediaminetetraacetic acid (EDTA), which were activated by ultrasound for 30–60 seconds using the Ultrasonic EndoActivator device. This process enhanced the hydrodynamic flow and completely removed organic and inorganic debris and microbiological biofilms adhering to the walls of the root canals. At the next stage, the canals were mechanically processed with machine tools to ensure patency. Antiseptics were repeatedly washed out, achieving the maximum level of sterilization. After drying the canal, a copper-calcium hydroxide preparation was introduced. During the filling phase, the root canals were closed by lateral condensation using a bioceramic hermetic (EndoSequence BC Sealer) and gutta-percha pins.

The treatment process was carried out in the following stages

Using this technology, the penetration of antiseptic substances into the canal walls and the level of microbiological purification were significantly higher than in the traditional method. The effect of ultrasound generated free radicals, which destroyed the biofilm structure of microorganisms, which helped to completely eliminate the infection.

Next in phase root channels filled with bioceramic sealant . This material is high hermetically sealed to biosipat to the ability and periapical good with fabrics flexibility owner and inflammation reduces and fabrics regeneration activates . and the results obtained were processed using Microsoft Excel; the results were assessed at a significance level of $p < 0.05$.

Results obtained:

In the main group, men made up 52.6% (40 people), women made up 47.4% (36 people), and in the control group, men and women made up 50% (Table 1).

Table 1 Distribution of patients in the main and control groups by age and gender

Patients age		18–24 years old	25–34 years old	35–44 years old	45–50 years old	Total
Main group (n=76)	Men	10 (13.1%)	16 (21.0%)	9 (11.8%)	5 (6.6%)	40 (52.6%)
	Women	8 (10.5%)	13 (17.1%)	10 (13.2%)	5 (6.6%)	36 (47.4%)
Control group (n=48)	Men	6 (12.5%)	9 (18.8%)	6 (12.5%)	3 (6.2%)	24 (50.0%)
	Women	5 (10.4%)	8 (16.7%)	7 (14,6%)	4 (8,3%)	24 (50,0%)

Main 76 people in the group and 40 of them men (52.6%), 36 people women (47.4%) organization did. The most many number 25–34 years old in the group: men 16 (21.0%), women 13 (17.1%). The rest age in groups Distribution: 18–24 years old – men 10 (13.1%), women 8 (10.5%); 35–44 years old – men 9 (11.8%), women 10 (13.2%); 45–50 years old – men 5 (6.6%), women 5 (6.6%). Control 48 people in the group there is and from them men and women number equal: every one of 24 people (50%). The most many patients both 25–34 years old in the group: men 9 (18.8%), women 8 (16.7%). The rest age in groups Distribution: 18–24 years old – men 6 (12.5%), women 5 (10.4%); 35–44 years old – men 6 (12.5%), women 7 (14.6%); 45–50 years old – men 3 (6.2%), women 4 (8.3%). A social and control in groups man and women number according to difference statistician significant not ($\chi^2 = 0.05$, $P = 0.82$), age groups according to in distribution also difference statistician significant not ($\chi^2 = 0.64$, $P = 0.91$) This with, every two group demographic in terms of to each other suitable and research hypotheses under investigation reliable is considered.

When comparing the results of the endoactivator-assisted method with the traditional method, a clear superiority in clinical parameters was observed (Table 2, Figure 1).

Traditional conducted d avolation results

Result	Men (n=24)	Women (n=24)	Total (n=48)
Symptoms loss (pain , swelling)	16 (66.7%)	15 (62.5%)	31 (64.6%)
Periodontal in fabrics inflammation reduction	17 (70.8%)	16 (66.7%)	33 (68.8%)
Functional recovery	18 (75.0%)	17 (70.8%)	35 (72.9%)
Cases of re -infection	3 (12.5%)	4 (16.7%)	7 (14.6%)

Figure 8. Results of treatment using Ultrasonic EndoActivator

The data from the table and diagram above show that the endoactivator-assisted method showed high efficiency compared to the traditional treatment method. Elimination of symptoms was noted in 94.7% of patients, reduction of inflammation in 92.1%, and functional recovery in 97.4% of patients. The incidence of reinfection was very low - about 2.6%, which confirms the high microbiological effectiveness of the endoactivator method (Table 3, Figure 2).

Fig. 2. Duration of traditional treatment

Treatment deadlines analysis

Treatment term	Men (n=40)	Women (n=36)	Total (n=76)
1 day	18	16	34 (44.7%)
2–3 days	15	14	29 (38.2%)
4–7 days	5	4	9 (11.8%)
8–14 days	2	2	4 (5.3%)

According to the results of the analysis, the treatment period was longer in patients treated with traditional methods, with 18.7% of patients recovering completely within 8–14 days, and 31.2% recovering within 4–7 days. Only 6.3% of patients achieved a one-day result, which indicates the low effectiveness of traditional methods. Analysis of the materials used in the treatment showed that in most cases, a resorcinol-formalin mixture was used (39.6%), which, despite the high antiseptic properties of the material, is limited by its poor effect on dental tissues and a long treatment period. Colored fillings (31.2%) and standard sealants (29.2%) were also used, and as a result of their incomplete sealing effect, cases of re-inflammation were noted. These cases demonstrate a number of shortcomings of treatment methods performed with traditional materials: long treatment time, recurrence of inflammation, low biocompatibility of the material and aesthetic dissatisfaction. At the same time, biocold sealants and nanocomposite materials used in modern endo-periodontal treatment methods ensure rapid tissue regeneration, reduction of the inflammatory process and a significant reduction in treatment time. These new methods

provide complete sealing, prevent the re-introduction of microorganisms and reduce the patient's recovery time to 2-3 days.

The results of a comparison of standard and modern treatment methods used in patients with pulp tissue damage on the background of chronic periodontitis showed that, although both approaches are aimed at sanitizing the root canals and eliminating infection, there is a significant difference between their effectiveness and treatment duration.

In the standard treatment process, the root canals are rinsed with antiseptics (sodium hypochloride and EDTA) after mechanical and medical treatment, and then treated with calcium hydroxide paste. Canals lateral condensation method gutta-percha pin and you with the help of sealed . In this way root sanitation of channels efficiency known to the extent high although the infection complete elimination verb and periapical of fabrics complete regeneration for many time demand done Treatment deadlines in the table As shown , in the majority of patients treatment lasts 4–7 days (31.2%) or 8–14 days (18.7%). reached This is the standard method efficiency limited and treatment process relatively far the time demand verb It also shows the canal walls with mechanical instruments . impact verb during microcracks to the surface arrival or canal morphology partially change danger exists .

Modern EndoActivator system with the help of in the method and antiseptic solutions ultrasound through activation on account of their cleaning strength several times increased This technology is the root channels to the walls sticky remaining bio coating , organic and inorganic waste deep cleaning possible gave Also sources of infection complete elimination done because of inflammation reactions decreased rapidly and periapical in fabrics treatment processes activated . Calcium in it with the use of hydroxide paste in line bioceramic you guys and gutta-percha pins hermetic sealing through to do increased , channels complete Closed .

As a result , EndoActivator in the manner of treatment in patients pain rapid reduction of the syndrome , swelling disappearance and the duration of functional recovery manifested by reduction was To the teachings according to the standard method of this technology relatively root channels cleaning increases the efficiency by 30-40% , the risk of infection reduces and treatment the deadline on average up to 2–3 days shortens .

Also , modern of the method again one important advantage therefore , it is the morphology of the channel save remains , instrumental breakdowns possible minimizes and endodontic to the biomechanical principles of the process suitable in case actually increases .

Conclusion as in other words , standard methods root channels in treatment certain but it is effective in them cleaning depth and infection complete loss opportunity limited . That's why for Ultrasonic EndoActivator system current verb through pulp lesions against the background of chronic periodontitis treatment efficiency sharp increase , treatment the deadline reduction and functional restoration of the tooth acceleration possible It happened .

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