

SINGLE VISIT ROOT CANAL TREATMENT OF TEETH WITH CHRONIC PERIAPICAL PERIODONTITIS

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Abstract

The treatment of periodontitis aims to eliminate the etiological factor, i.e. microorganisms and their toxins; to influence the inflammatory process in the periapical tissues and to stimulate the healing process; to provide an airtight filling of the root canal to isolate the apical periodontium from contact with saliva in the oral cavity. The removal of the etiological factor is associated with mechanical and chemical treatment of the root canal. Since most endodontic problems are of microbial origin, their removal is considered the most important step in root canal therapy.

The number of visits for treatment of infected root canals is one of the most discussed topics in endodontics. Endodontic treatment through multiple visits is a traditionally accepted method. However, an alternative protocol involving one visit has been proposed.

The aim of this study was to determine the degree of clinical success in teeth diagnosed with chronic asymptomatic apical periodontitis treated by a single-visit method. Thirty one patients aged 16 to 69 years with a confirmed diagnosis of chronic asymptomatic apical periodontitis were included in the study. All proven cases are subject to treatment in a single stage. Based on the data obtained from this task, it is clear that adequate isolation and adherence to the simplified generally accepted irrigation protocol are sufficient to obtain good healing results.

Key words: one visit, periodontitis, microorganism

Introduction. The one-visit treatment of teeth with chronic asymptomatic apical periodontitis provides a good option in the already adopted treatment protocol which also includes the multi-visits treatment with application of additional medications such as calcium hydroxide and chlorhexidine [1]. The application of the single-visit method reduces the treatment time, the number of visits and the potential discomfort of the patients during repeated dental procedures. It also eliminates the risk of reinfection between the individual visits caused by microleakage through the temporary filling. Therefore, it would not be surprising that dentists would prefer the single-visit method for the treatment of teeth with chronic asymptomatic apical periodontitis.

Materials and methods. Selection of patients. A certain number of healthy male and female patients, aged 16 to 69, with no systemic diseases are required to perform the assigned tasks. Each person has one or more teeth on the upper, lower or both jaws, diagnosed with chronic apical periodontitis except for the third molar. The examined teeth are divided according to the jaw in which they are located and the group of teeth to which they are subject (anterior teeth, premolars and molars). Nineteen of the teeth are located in the upper jaw, the remaining 12 – in the lower jaw. Of all 31 teeth, only 7 are molars, 3 of which are on the upper jaw. Twelve of the teeth are from the frontal area, 7 of which are in the upper jaw and 12 are premolars, only 3 of them are in the lower jaw (Fig. 1). The diagnosis was made based on clinical and paraclinical studies. The teeth are asymptomatic and do not respond to thermal tests. The values reported from electroodontodiagnostics are above 100 μ A. Radiographic diagnostics is one of the main methods to verify the diagnosis of chronic apical periodontitis. Demineralisation and destruction of periodontal tissues, cementum and alveolar bone tissue are detected by periapical x-ray. CBCT can be used to confirm the diagnosis.

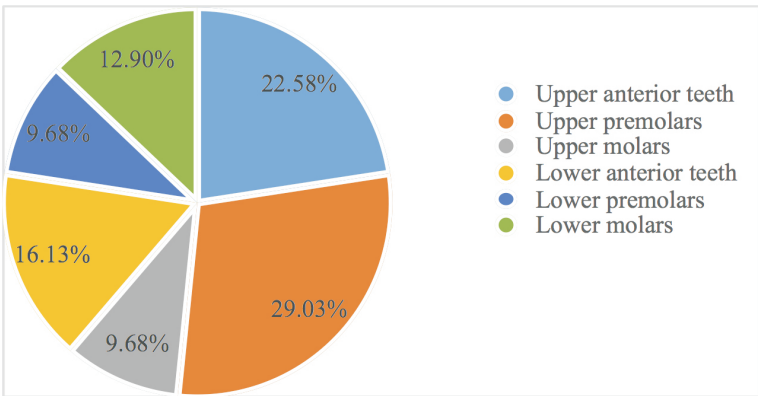


Fig. 1. Distribution of the examined teeth according to the jaw and position

Contraindications for the inclusion of the teeth in the study can be general and local. The systematic criteria for excluding patients from the study are pregnancy, patients who had used antibiotics in the past month, and diabetics. The lack of sufficient structures and the inability to restore the HDT (ferrule effect) for isolation using a rubber dam is one of the most important contraindications for the inclusion of certain teeth in this study.

There are several criteria for teeth with previous endodontic treatment to be included in the study. Firstly, one should be able to fully negotiate the root canals. Secondly, the canal filling should reach the middle third of the canal leaving the apical part not filled. Lastly, the presence of separated instruments in the examined canal is inadmissible.

Methodology. Thirty-one patients were studied and all of them signed consent forms. If necessary, build up was performed. Root canal treatment begins with isolation of the operative field with a rubber dam. An endodontic cavity is prepared using a diamond cylindrical bur, an Endo Z bur (Dentsply Maillefer) and a Gates Glidden bur. If present, the old canal filling is removed with retreatment files – Protaper Retreatment D1, D2 and D3 (Dentsply maillefer). The working length is determined by electrometric method using an apexlocator IPexII (NSK, Japan). An initial microbiological sample is taken at this stage of the treatment to prove the presence of pathogenic microorganisms in the root canals. The surface layer of dentin from the root canal is scraped with a sterile K-file. The material is taken with a sterile paper point that stays in contact for 10 seconds. It is transported to the laboratory in Amies liquid transport medium. The apical part of the root canal is processed manually to No. 20 K-file, and the subsequent expansion of the canal is achieved by rotary instrumentation using Protaper Next X1 and X2. The treatment of the root canals starts with irrigation with 2 ml 5.25% NaOCl for 30 to 60 seconds per canal. Distilled water is used to neutralize its effect. Next step is an irrigation with 2 ml 5.25% NaOCl using ultrasonic activation at a wavelength of 45 kHz (Ultra X, Eighteenth). A distance from the tip of the tool to the full working length must be provided within a minimum of 5 mm to avoid the release of irrigation solution outside the root canal into the periodontal space and the surrounding bone. This is followed by rinsing with distilled water and washing with 17% EDTA solution [2]. At the end of the preparation, all irrigation materials must be neutralized. Drying of the root canals using sterile paper points for Protaper Next follows. Following is the second microbiological test. The material is taken with a sterile paper point that stays for 10 seconds. It is transported to the laboratory in an Amies transport medium. The root canals are obturated with thermoplastic gutta-percha using a Soft-Core Heater (CMS Dental). Initially, a small amount of AH Plus Jet sealer was introduced (Dentsply Sirona, Germany). The heated shutter is then inserted slowly with a constant stroke without turning to the full working length. We wait for 1–2 minutes for the gutta-percha to harden.

Then the handle is removed. Control parallel sector radiography is prescribed.

One year after treatment and obturation of the root canals, the patients are scheduled for a second radiographic examination. It is performed in the same way as the first radiography. The measurement of the results is performed on the parallel intraoral radiographs in two stages. Periapical changes are reported in mm² on the first radiograph, immediately before endodontic treatment and on control graph, six months or one year after therapy. Using a computer program (PS CS5 EXTENDED), measurements are made in the vertical and horizontal directions. The vertical size is equal to the distance from the apex of the root apex to the highest point of the periapical lesion, and the horizontal one corresponds to a line perpendicular to the vertical, formed by connecting the two furthest points from the lesion. The obtained results are recorded in tables and are subject to statistical analysis with a specialized package IBM SPSS Statistics 20. Another sign of the healing process is the presence of newly-formed bone seams in the area of the periapical lesion. This is done using the Periapical Index (PAI) [3, 4] (Table 1). The structure of the newly formed bone may differ from the normal one.

T a b l e 1
Periapical index (PAI)

Periapical index PAI	1	2	3	4	5
Condition of periapical tissues	Normal periapical structures	Slight changes in bone structure	Changes in bone structure with loss of mineral substance	Periodontitis with clear radiological boundaries	Periodontitis with evidence of exacerbation

Laboratory methods to confirm pathogenic microorganisms in the root canals. Colombia blood agar or a chromogenic identification medium is used for the cultivation of the microorganisms. Cultivation was performed at 37°C. After 24 h, grayish colonies 1–2 mm in size were observed on the blood agar, showing an α hemolytic zone, weak β hemolysis or non-hemolytic at all. They form small lactose-positive colonies on the intestinal media.

Method for identification of streptococci and enterococci: In a drop of distilled water on a glass slide, dilute one inoculating loop of the test culture, then add a drop of 3% hydrogen peroxide. With a positive reaction, bubbles of varying intensity appear after about 1 min.

Esculin hydrolysis: Esculin hydrolysis (bile-esculin test) and growth in broth with 6.5% NaCl is used to identify the Enterococcus genus, which are able to hydrolyze esculin in the presence of bile. Enterococci and certain streptococci hydrolyze glucoside, esculin to esculetin and dextrose.

Test procedure: Stroke culture is carried out using a calibrated loop. The

tube is incubated at $35 \pm 2^\circ\text{C}$ in an aerobic atmosphere. The tubes are checked after 18–24 and 42–48 h for growth. If more than half of the beveled glass has blackened after 24 to 48 h, the test is considered positive.

Conglutination and latex agglutination reaction – reagent and kit Crystal BD (Becton Dickinson). The BBL Crystal system uses modified conventional, fluorogenic and chromogenic substrates to identify gram-positive bacteria. It is designed to identify frequently isolated anaerobic gram-positive bacteria.

Results. Results based on clinical research. This task included 31 patients who were diagnosed with CPP through clinical and paraclinical methods. The effect of the applied one-visit treatment has been taken into account by collecting data from clinical and paraclinical studies, as well as from the information given to us by patients. Thirteen (41.9%) of these patients were male and the remaining 18 (58.1%) were female.

All patients were divided into four subgroups according to their age. There are no registered patients in the first age subgroup 16–18. In the second subgroup 19–35 years of age there were 6 men and 10 women. The third subgroup included patients aged 36–60. There were 7 men and 8 women in this group. The fourth subgroup included patients over 60 years of age. There were no registered patients in this group.

Based on the data collected from the patients, it was found out that 9 male patients (69.23%) experienced symptoms, which included pain and discomfort but resolved within 48 hours after filling the root canal. Four of these patients (30.76%) were in the 19–35 age group. The other five (38.46%) were in the 36–60 age subgroup. Three patients (23.07%) reported persistent pain one week after treatment as well as percussion pain. Two of them (15.38%) were into the 36–60 age subgroup. Only one female patient (5.56%) aged 36–60 reported pain after root canal filling, which resolved within 48 hours of treatment. All patients returned a week after the treatment.

Results based on microbiological research. From the analysis of the clinical laboratory results of thirty-one patients, we have concluded that in 19 of the samples (61.3%) taken before root canal treatment only one MO was isolated, namely, *Enterococcus faecalis* (Fig. 2). Quantitative testing in most samples has revealed a large number of the tested microorganisms $> 10^5$. In two of the samples, MO have been observed in the amount between 10^4 and 10^5 . In two of the cases (6.5%), a mixed infection has been found, which included *Enterococcus faecalis*, *E. coli* and *Staphylococcus* CNS (coagulase-negative staphylococcus). In both cases there are molars on the lower jaw. *Candida albicans* infection has been observed in 4 (12.9%) of the samples. These are teeth from the upper and lower jaw, falling into the group of anterior teeth and premolars. In one of the samples from the upper anterior tooth (3.2%) *Pseudomonas aeruginosa* was isolated in large quantities 10^5 . In 5 (16.1%) of the microbiological samples no infection has been observed in the root canal system. In 25 of the studied patients

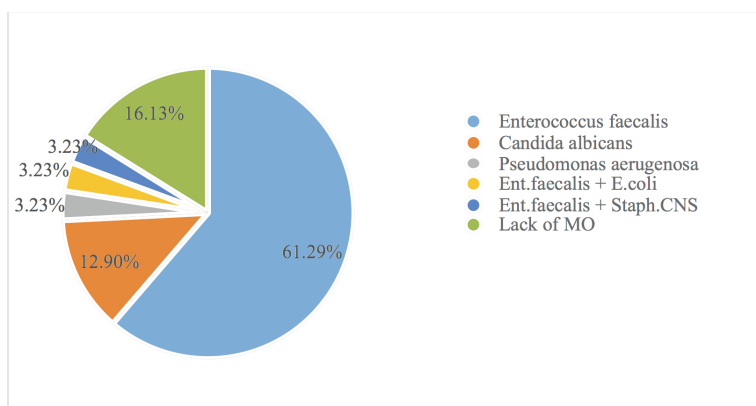


Fig. 2. Isolated microorganisms before medication treatment in teeth treated using a single-visit method

(96.1%), complete removal of microorganisms has been observed after mechanical and chemical treatment. Only in one patient (3.85%), the persistence of some of the microorganisms has been detected in the follow-up microbiological examination (Fig. 3). The initial sample revealed a polymicrobial infection caused by *Enterococcus faecalis* and *Staphylococcus* CNS (coagulase-negative staphylococcus). The follow-up microbiological examination revealed the presence of only *Staphylococcus* CNS (coagulase-negative staphylococcus).

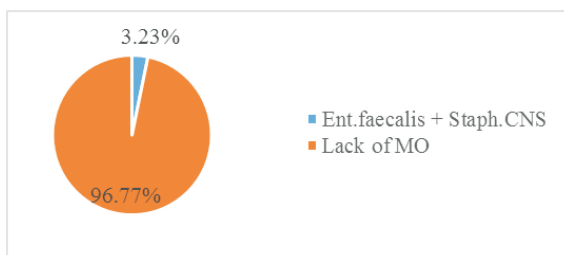


Fig. 3. Isolated microorganisms after medication treatment in teeth treated using a single-visit method

Results based on paraclinical research. Thirty out of all thirty-one people examined returned for a follow-up radiography. Using the PAI-index (Fig. 4), we have found out the following:

From the results obtained for the average size of the lesion on the PAI scale before and in the sixth postoperative month after completion of treatment, it has been established that its size decreased by an average of approximately two times. The analysis of the experimental data was performed with a specialized statistical analysis package SPSS.

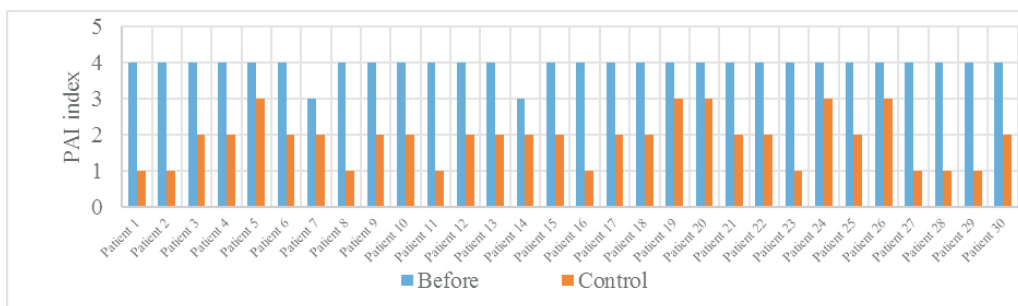


Fig. 4. PAI – before and control

Hypotheses for reduction of PAI values in teeth treated using one-visit method: Dependent samples were used in this statistical analysis. The statistical analysis shows the average difference between the two samples as well as the significance of the test (Sig.). The statistical method uses a two-tailed test to test the null hypothesis. We modified the two-tailed test into one-tailed test and got the following values:

- p -value = 0.0000 – This shows strong evidence against the null hypothesis, as there is less than a 5% probability that it is true. Therefore, we can reject the null hypothesis and accept the alternative. We have registered a statistically significant difference between the results before and after treatment.

There is a statistically significant difference between the results before and after treatment based on the periapical lesion, measured by PAI, in teeth treated with the single-visit method.

Discussion. After analyzing the healing process and reviewing the para-clinical and clinical examinations after filling the root canals and the information obtained from patients, we have concluded that the applied one-visit treatment has proved 95% successful. The cases were considered successful if the tooth showed no clinical symptoms. Judging by postoperative sensitivity, unsatisfactory results from the one-visit treatment have been observed only in patients with persistent pain (9.68%). In the short term we can conclude that the one-visit treatment has given good results.

Our study has proven that the adequate isolation of the operative field, the correct mechanical and chemical treatment, including only EDTA, sodium hypochlorite 5.25% and saline (distilled water), were sufficient to control the infection and reduce microorganisms (*Ent. faecalis*, *C. albicans*, *E.coli*, *P. aeruginosa*) in the root canal system [5, 6]. From a microbiological perspective, we have arrived at the conclusion that the treatment of root canals in one visit created favourable environmental conditions for periapical recovery, which has been confirmed by other authors as well [7, 8]. One of the main advantages of the single-visit treatment is the prevention of reinfection of the root canals between visits, which might occur during the multi-visits treatment.

Our results have not been confirmed by the results obtained from another study [9], which used the same irrigation protocol, but observed residual infection in 87.5% of the teeth included in the study.

By applying paraclinical and statistical methods, we determined that there is a statistically significant difference in the data obtained before treatment and the follow-up X-ray [10, 11]. The results may be due to the fact that all the requirements for a satisfactory endodontic treatment were strictly applied during the procedures. This includes the proper isolation of the operative field, the sufficient amount and time of exposure to the used medications for irrigation and removal of the root canal contents, the three-dimensional obturation of the root canals and hermetic definitive restoration [12].

With the advancement of medicine, the emergence of new technologies for good isolation of the operative field, the possibility of using magnifying techniques and the wide choice of materials, make one-visit treatment of teeth with chronic apical periodontitis possible and affordable. Applying a one-step method would reduce treatment time, number of visits and patient discomfort from repeated dental procedures, as well as the risk of reinfection in the presence of microleakage from temporary obturation between visits. Obturation of root canals, immediately after mechanical and medical treatment, restricts the flow of oxygen to residual microorganisms in the root canal system. All medications and irrigants administered may elicit an immune response in the patient. In single-visit endodontic treatment, exposure to these medications is shorter. It is for this reason that patients treated with the single-visit method report milder and shorter-term postoperative pain.

Conclusion. Based on the data obtained from this task, it has become clear that adequate isolation and adherence to the simplified, generally accepted irrigation protocol can prove to be sufficient for good recovery results. This thesis has been confirmed by other authors [13, 14], who presented good recovery results during the follow-up period after one-visit treatment of teeth with chronic apical periodontitis.

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