

IN VIVO STUDY OF CALCIUM HYDROXIDE ENDODONTIC TREATMENT IN CHRONIC APICAL PERIODONTITIS

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ABSTRACT

The aim of this study was to evaluate the in vivo efficiency of endodontic treatment with calcium hydroxide in chronic apical periodontitis by determining the microbial load from the endodontic space in different stages of treatment. The microbiological determinations that have been made have led to the conclusion that calcium hydroxide possesses a redoubtable antimicrobial activity, but only with the condition of long-lasting contact with the root canals. Another important result is the essential role of the rigorous biomechanical treatment of the root canals, intracanal medication with calcium hydroxide is addresses mostly to microorganisms located in root canal ramifications.

Keywords: chronic apical periodontitis; endodontic microflora; calcium hydroxide;

Introduction

Our study was made on 10 cases (teeth) with chronic apical periodontitis, with pulp chamber closed. Biological samples was taken from endodontic space in order to isolate and identify microbial species and strains involved in the chronic periapical process(1). The main aim of this study was to evaluate in vivo antimicrobial activity and efficiency of calcium hydroxide endodontic dressing on endodontic microflora. Informed consent of patients has been taken before starting the present study.

Material and method

Microbiological determinations were carried out as follows: in the first treatment session, prior to the biomechanical endodontic treatment, after its completion, and in the second treatment session. In this session biological samples were taken from intraradicular space in order to determine the microbial population that resisted the antibacterial effect of calcium hydroxide endodontic antiseptic.

The method of endodontic microflora sampling was: insertion into the root canal of a sterile paper cone as deep as 1-2 mm of apex and maintained at this level 1-2

Table 1 Bacteria species initially identified, after biomechanical treatment and after 48-hours calcium hydroxide endodontic treatment

Species	Initial No.	%	No. after biomech. treatment	%	No. after Ca(OH) ₂ treatment	%
Clostridium	3	15,00	2	10,00	2	10,00
Peptostreptococ	3	15,00	1	5,00	1	5,00
Veilonella	1	5,00	-	-	-	-
Eubacterium	3	15,00	-	-	-	-
Fusobacterium	3	15,00	1	5,00	1	5,00
Prevotella	4	20,00	1	5,00	1	5,00
Bacteroides	1	5,00	-	-	-	-
Porphiromonas	2	10,00	1	5,00	-	-
Total	20	100	6	30	5	25

minutes. Bacteriologically positive samples were seeded on special solid environments enriched with growth factors and incubated under anaerobic conditions for 72-96 hours(2).

In the first treatment session, after the biomechanical treatment had been completed, the endodontic dressing in form of the calcium hydroxide paste (Calxyl, OCO Preparate) was placed. Then the endodontic acces cavity was closed with a glass ionomer cement provisory obturation, which ensure correct marginal adaptation, thus prevent endodontic microleakage and contamination(3).

The sampling for the evaluation of the antiseptic activity of calcium hydroxide was made differently for the two parts of the tested group of patients included in the study, as follows: for half the study lot (5 patients) after 48 hours, the average action time of the liquid antiseptics and antibiotics paste currently used in root canal disinfection. It is known that calcium hydroxide possesses an important bactericidal action as a result of it's high alkaline pH ~ 12.5, but its action is slow and on long term(4). The antimicrobial effect is significant after approximately seven days after intraradicular placement, reaching maximum efficiency after approximately 10-14 days(5,6). As such, we have made two endodontic samplings and evaluations of endodontic microflora: -for 5 teeth the sampling took place at 48 hours; -for the other half of the tested group(5 teeth) the sampling was done at 10 days.

The bacteriological diagnosis has been established on the basis of morphological, specific, and biochemical characteristics.

Results

Following the bacteriological diagnosis it was found that initially all the samples were positive for the anaerobic and aerobic germs, in acord to literature dates(7). Microbial strains belonging to the following types were isolated: Fusobacterium, Porphiromonas, Prevotella, Bacteroides, Peptostreptococcus, Veilonella, Actinomyces, Eubacterium, Clostridium. Following antibacterial treatment, the following results were obtained:

I. The results obtained at 48 hours indicate that from 20 initially microbial species indentified, biomechanical endodontic treatment succeeded in the removal of 14 species. The number of strains isolated after 48 hours of endodontic calcium hydroxide antiseptic treatment is 5, meaning 25% of the initial value. Percentage is expressed by an efficacy value of 16.67% over the 48-hour interval.

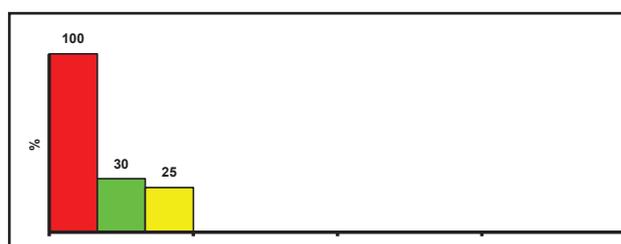


Figure 1 Bacterial load in endodontic space: initial value, after biomechanical treatment and after 48-hours calcium hydroxide endodontic treatment

II. The results obtained for the other half of the group of patients treated with calcium hydroxide and assay of biological results at 10 days are:

- the number of initially isolated microbial species: 15.

Table 2 Bacteria species initially identified, after biomechanical treatment and after 10 days calcium hydroxide endodontic treatment

Species	Initial No.	%	No. after biomech. treatment	%	No. after Ca(OH) ₂ treatment	%
Clostridium	2	13,33	1	6,67	1	6,67
Peptostreptococcus	3	20,00	1	6,67	-	-
Eubacterium	2	13,33	-	-	-	-
Fusobacterium	4	26,67	2	13,33	-	-
Prevotella	1	6,67	-	-	-	-
Actinomyces	3	20,00	1	6,67	-	-
Total	15	100	5	33,34	1	6,67

- the mechanical treatment of the canal, together with endodontic lavage with sodium hypochlorite, reduced the number of species identified at 5.
- after a 10-day interval we detected only 1 microbial species which survived inside endodontic space, representing 13.34%. Within 10 days calcium hydroxide paste reduced microbial load from 33.31% (resulting from biomechanical treatment) to 6.66%. Practically, the antimicrobial efficacy of calcium hydroxide at 10 days is 80%.

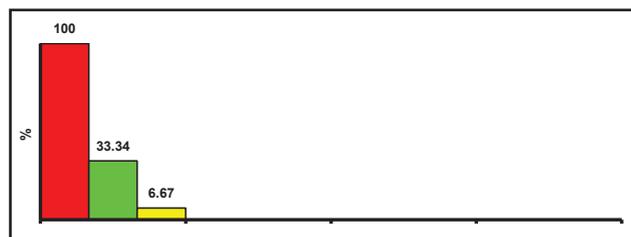


Figure 2 Bacterial load in endodontic space: initial value, after biomechanical treatment and after 10 days calcium hydroxide endodontic treatment

Discussions

The result of this microbiological in vivo study of calcium hydroxide antimicrobial activity revealed two seemingly conflicting aspects of the bactericidal effect on endodontic flora: calcium hydroxide has a very high efficiency when placed inside the root canals for a longer period of time (10 days) and, respectively, extremely low in effectiveness on endodontic germs after 48 hours (25% of isolated microbial species persisted). This is only in apparent contradiction with literature data, because in fact the antimicrobial effect of calcium hydroxide appears and increases over time, as the contact time with endodontic

microorganisms increases(8,9). The maximum efficacy of calcium hydroxide occurs when it remains in the root canal for at least 7 days.

Another aspect to be highlighted is that the results of this study confirm the essential role of rigorous biomechanical treatment of root canals in the elimination of endodontic infection. Virtually most of the microorganisms are removed by root canal preparation. Most of the bacteria that persist in the endodontic space after a properly executed biomechanical treatment are located in the ramifications of the root system and are inaccessible to their direct mechanical removal(10). The endodontic antiseptic treatment in chronic apical periodontitis addresses precisely these microorganisms.

Calcium hydroxide has, apart from the antibacterial effect in cell membranes due to pH 12.5, also the ability to denaturation proteins inside endodontic space, making them less toxic to the host organism. However, it takes a period of time varying from week to month to act on residual germs inside dentinal tubules from the root canal walls(11).

Likewise, calcium hydroxide is the only endodontic treatment that possesses the ability to initiate and stimulate the remineralization of periapical areas affected by chronic apical periodontitis. Indisputably, from this point of view, calcium hydroxide is the most valuable endodontic medication.

Conclusions

Regarding bactericidal effect of calcium hydroxide used as interappointment dressing endodontic we can conclude that it possesses a low endodontic disinfection capacity within 48 hours of placement, but within 10 days, its efficiency increases spectacularly. It has therefore

been shown that calcium hydroxide possesses a redoubtable antimicrobial activity, but only with the condition of long-lasting contact with the root canals.

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For this article all the authors have equal contributions.

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