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# MEDICATIONS FOR INTRACANAL DRESSING USED IN THE MULTIVISIT TREATMENT OF APICAL PERIODONTITIS

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## ABSTRACT

**INTRODUCTION:** Apical periodontitis is caused usually by bacterial infection in the root canal. *Enterococcus faecalis* is considered to be the main pathogen associated with periapical lesions. The main goal of endodontic treatment is to remove as many bacteria as possible from the root canal system and then create an environment in which other organisms cannot survive. Unfortunately, this cannot always be obtained with mechanical processing and proper irrigation of the root canal system only.

**AIM:** The purpose of this article is to present and compare the main materials used to treat the root canal.

**MATERIALS AND METHODS:** In this review of the literature related articles and publications will be reviewed and the results of researches on the topic will be summarized.

**Results:** The review of all the included related articles and publications shows that a significant number of intracanal medicaments can be used in order to treat existing inflammatory processes inside the root canals and reduce the number of pathogenic microorganisms. Some of them have a questionable effect on the health of the periapical tissues and therefore their use has been limited in modern endodontics.

**CONCLUSION:** According to the available literature-based evidence, the two-visit treatment of teeth diagnosed with asymptomatic apical periodontitis, which includes a placement of an intracanal medication, provides good results in the reduction of the inflammatory process in the periapical tissues and the amount of pathogenic microorganisms.

**Keywords:** *intracanal medication, calcium hydroxide, multivisit treatment, chlorhexidine, antimicrobial effect*

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## INTRODUCTION

The multivisit treatment is the main accepted method for the treatment of teeth diagnosed with chronic apical periodontitis. Various medications can be used between the visits in order to reduce pain and the number of the microorganisms, and benefit the healing of the periapical tissues (1-4).

Each of them has some advantages and disadvantages, which will be discussed in the review ar-

title in order to determine which is best suited to reduce root canal infection.

### AIM

The aim of this literature review is to determine which intracanal medicaments present the best ability to reduce the existing root canal infection and to promote bone healing, and at the same time avoid irritating the periapical tissues.

### MATERIALS AND METHODS

A series of related articles, publications, and results of different studies have been analyzed and summarized.

### RESULTS

#### *Calcium Hydroxide*

Calcium hydroxide presents with a lot of advantages and is therefore widely used in the field of endodontics (5). It shows high antimicrobial activity and ability to dissolve necrotic tissues, which is why it is widely used as an intracanal dressing. Calcium hydroxide placement inside the root canal leads to stimulation of the healing processes in the periapical tissues and limits the processes of internal resorption in the root canal (6,7). Side effects are rarely encountered (8).

The ability of calcium hydroxide to dissolve necrotic tissues has been reported by Hasselgren et al. (1988) (9). Its action is similar to that of sodium hypochlorite, but it is less effective. However, calcium hydroxide presents with a continuous therapeutic effect when placed inside the root canal system between the visits.

Anders Byström et al. (1985) investigate the bactericidal efficacy of calcium hydroxide on 35 teeth with chronic apical periodontitis. After treatment with an intracanal calcium hydroxide paste (Calasept), presence of bacteria is observed in one of the 35 treated root canals. The isolated bacteria are mostly gram-positive anaerobic ones (10).

Using the periapical index (PAI) in a study in 1999, Martin Trope et al. assess the healing process of teeth with apical periodontitis, which are treated either in one or in two visits and with or without intracanal dressing. They conclude that the best result is observed in the patients treated using calcium hydroxide application (11).

In another research R. Weiger et al. (2000) examine 67 patients with endodontically induced lesions. A total of 36 of them are treated in one visit and the remaining 31 - in multiple visits with an intracanal medication of calcium hydroxide for at least one week. The healing process is successful for over 90% of the patients. The team concludes that the treatment of a root canal in one visit is a viable alternative to the conventional method of two or more visits due to the fact that the former created similar environmental conditions for periapical recovery (12).

In 2000 George B. Shuping et al. examine the additional antibacterial effect of calcium hydroxide applied for 1 week on teeth with chronic apical periodontitis. They make a microbiological analysis on samples taken from the root canals of those teeth before, during, and after chemical and mechanical treatment and after application with calcium hydroxide. After irrigation, the microbial count is reduced in 61.9% of the canals of the 42 patients that participated in the study. The final stage shows even better results as applying calcium hydroxide for at least 1 week removes all bacteria from 92.5% of root canals (13).

Gu Yong Han et al. (2001) examine 68 teeth infected with *Enterococcus faecalis*. Authors use two types of calcium hydroxide pastes to eliminate the bacteria in the dentine tubules. The first one is water-based and the other one—based on silicone oil. After a microbiological examination they conclude that only the water-based paste is effective in eliminating bacteria in the dentinal tubules (14).

José F. Siqueira et al. (2008) investigate the long-term (1-4 years) outcome of endodontic treatment of teeth with apical periodontitis. Only 7 of all 100 teeth that are included in the study need 4 years to heal completely. The low failure percentage observed in that particular research increases the importance of calcium hydroxide usage as temporary dressing in teeth with apical periodontitis (15).

Siqueira JF et al. (1996) investigate the efficacy of calcium hydroxide medications on the reduction of facultative and obligate anaerobes in dentinal tubules. For this study, the team purposefully infects root canals with *Actinomyces israelii*, *Fusobacterium nucleatum*, and *Enterococcus faecalis*. Calcium hydroxide medications mixed with saline solution or

paramonochlorophenol are applied to the infected samples for a period of 1 hour, 1 day, and 1 week. The results show that parachlorophenol with camphor increases the antibacterial effects of calcium hydroxide, removing even *Enterococcus faecalis* after exposure for 1 day. On the contrary, calcium hydroxide with saline is ineffective against *E. faecalis* and *F. nucleatum* even after one week of exposure (16).

#### **Antibiotics, Steroids and Nonsteroidal Anti-Inflammatory Medications**

Endodontic infections are primarily of anaerobic origin, including a combination of gram-positive, gram-negative, and facultative anaerobes. For this reason, antibiotics for local or intracanal application can be used during the endodontic treatment.

Naveen Raj Sivakumar et al. (2014) use steroids to manage post-periodontal inflammation. During endodontic treatment steroids can be administered systemically, which often leads to undesired side effects, or topically, which is a more effective and commonly used route of administration. The team shows that antibiotics, used in conjunction with corticosteroids, have anti-inflammatory, antibacterial, and anti-resorption properties. All these effects help reduce the periapical inflammatory response and the resorption (17).

Various studies show that MTAD (a mixture of tetracycline isomer, acid, and detergent) is an effective antibacterial irrigant for removing the smeared layer on the walls of the root canal. In their study, Wu Zhang et al. (2003) investigate the cytotoxicity of MTAD compared to other commonly used irrigants and medications. They conclude that MTAD is less cytotoxic than eugenol, 3% hydrogen peroxide, calcium hydroxide paste, and 5.25% NaOCl. It has been found to be more toxic than sodium hypochlorite at concentrations of 2.63%, 1.31%, and 0.66% (18).

Maged M. Negm et al. (1994) investigate post-operative dental pain after endodontic treatment including intracanal administration of two nonsteroidal anti-inflammatory medications - diclofenac and ketoprofen. After subjective assessment of the patient's pain throughout different intervals, the data show that both diclofenac and ketoprofen significantly reduce the pain before and immediately after root canal treatment (19).

#### **Calcium Hydroxide with Antibiotics**

Molander A et al. (2003) study the antibacterial potential of tetracycline and erythromycin mixed with calcium hydroxide (CH) against enterococci. In 28 of the 55 examined teeth a tetracycline dressing is used in combination with calcium hydroxide for one month. Reducing *Enterococcus faecalis* is effective in 22 (79%) teeth, but in part of the teeth other microorganisms are observed. For the remaining 27 teeth the dressing contains erythromycin and calcium hydroxide, which reduce the enterococci in 96% of these teeth. Antimicrobial treatment in combination with erythromycin or tetracycline has a significantly high effect on enterococci, but the overall antimicrobial effect is considered to be relatively weak (20).

#### **Calcium Hydroxide with Iodoform**

Stephen J. Cwikla et al. investigate the antibacterial efficacy against *Enterococcus faecalis* of three variants of calcium hydroxide (CH)—pure calcium hydroxide, calcium hydroxide mixed with iodine-potassium iodide (CH + IKI), and calcium hydroxide mixed with iodoform, which proves to be the most effective one to reduce the microbial number (21).

#### **Chlorhexidine**

Chlorhexidine has high antimicrobial effect against both gram-positive and gram-negative bacteria (22, 27). Another major advantage of chlorhexidine is that it is biocompatible and has low toxicity (23). Even though calcium hydroxide has been a major root canal medication, it has almost no effect on *E. faecalis*, in contrast to chlorhexidine preparations (25). Therefore, CHX can be recommended as an alternative to calcium hydroxide (26).

In their study, Bettina Basrani and team conclude that different concentrations of chlorhexidine are more effective against *E. faecalis* compared to only using calcium hydroxide. These results are determined in a conducted inoculation test in which the different concentrations of CHX are more efficient than calcium hydroxide (25).

Dametto FR et al. (2005) study antimicrobial efficacy on 80 teeth infected with *Enterococcus faecalis*, using 2% chlorhexidine gel, 2% chlorhexidine liquid and 5.25% sodium hypochlorite. Microbial samples are taken from each tooth before the mechanical preparation of the root canal, immediately after

treatment and 7 days after instrumentation. They conclude that chlorhexidine gluconate (gel and liquid) is significantly more effective than sodium hypochlorite when treating *Enterococcus faecalis* (28).

After review of the studies related to the application of CHX, we conclude that it is highly effective against *E. faecalis* and other microorganisms in root canals (26) and its effect can last up to two weeks (29). Compared with other root canal medications, CHX is more sparing for the periapical tissue (24,25). However, chlorhexidine has its disadvantage—it is most effective in tissues with a neutral pH value.

#### Calcium Hydroxide with Chlorhexidine

In their study, Dakshita Joy Vaghela and colleagues find that both *E. faecalis* and *C. albicans* could be successfully treated using chlorhexidine gel with 2% concentration. The best combination of medications for eliminating *E. faecalis* is calcium hydroxide with propylene glycol with 2% chlorhexidine. As for *C. albicans*, the most efficient combination is calcium hydroxide with iodoform with 2% chlorhexidine (30).

Brenda Paula Figueiredo de Almeida Gomes et al. examine the antimicrobial activity of various medications against endodontic microorganisms. The team compares the application of calcium hydroxide (Ca(OH)<sub>2</sub>), 2% chlorhexidine gel, a combination of the two agents as well as calcium hydroxide paste with distilled water. The best effect against endodontic pathogens is observed when using 2% chlorhexidine gel in combination with calcium hydroxide. This combination needs between 30 seconds to 6 hours to eliminate all microorganisms (31).

In their study, B. P. F. A. Gomes and colleagues study the effect of the various medications over the growth of *E. faecalis*. They divide the experiment into four categories depending on the time the medication stay in the root canal—1, 2, 7, and 15 days. The team concludes that the application of chlorhexidine presents good results, showing reduction of *E. faecalis* even after the first day. Similar results are maintained till the end of the second week. In the first days the applied combination of chlorhexidine and Ca(OH)<sub>2</sub> presents perfect antibacterial activity, which decreases after the end of the first week. In contrast with the mentioned medications, calcium

hydroxide is shown to allow microbial growth in every category of the study (29).

Unlike the previous study, investigating the antibacterial efficacy of intracanal treatment with calcium hydroxide, 2% chlorhexidine gel and a combination of both, Aldo Manzur et al. (2006) find that all three medications affect equally the reduction of microorganisms in the root canals (32).

Vince A Penesis et al. (2008) conduct a study with the purpose of comparing radiographically the healing process after single-visit and multivisit treatment, using the periapical index (PAI). In the multivisit approach, they apply temporary dressing of calcium hydroxide and chlorhexidine paste. Both methods show equally favorable periapical recovery in the twelfth month after treatment (33).

#### Camphorated Parachlorophenol

Chlorophenols are effective antiseptics and good disinfectants for root canals. They have higher antibacterial, antiseptic and disinfectant potential than other disinfectants or phenols (34) and have shown high efficacy against *E. faecalis*. The antibacterial effect is based on its ability to destroy the bacterial membrane by binding to its proteins and lipids (35). The limited application of chlorophenols is due to the fact that they are cytotoxic and cause an inflammatory reaction in the periapical tissues (36).

## CONCLUSION

According to the available literature-based evidence, the two-visit treatment of teeth diagnosed with asymptomatic apical periodontitis, including placement of an intracanal medication, provides good results in the reduction of the inflammatory process in the periapical tissues and the amount of pathogenic microorganisms.

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