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# Flare-ups incidence and severity after using calcium hydroxide as an intra canal dressing

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## Abstract

**Introduction** Acute pain and swelling following endodontic treatment are challenges for patients and dentists. According to previous studies, the incidence of flare-ups increases after endodontic treatment of teeth with necrotic pulp. Calcium hydroxide is currently used as a multipotential medicament in root canal therapy. The aim of this study was to evaluate the incidence and severity of flare-ups after treatment of pulpless teeth using calcium hydroxide as an intracanal dressing.

**Materials and Methods** Sixty patients with single root necrotic teeth participated in this study. These patients were randomly divided into three groups of twenty. The patients in group A were treated in a single-visit approach, in group B with a two-visit approach without any intracanal dressing and in group C with a two-visit approach using calcium hydroxide as an intracanal dressing for one week. All of the patients were followed for 72 h after each treatment session. The information about the incidence and severity of pain and swelling was recorded in tables, using a modified visual analogue scale for pain severity measurement and a scale with four degree for measuring the severity of swelling. The data were analyzed by chi-square test and GENMODE procedure.

**Results** The incidence of pain showed to be the highest in group B and the lowest in group C. These differences were statistically significant. There was no significant difference in the severity of pain after the first visit between groups B and C; however, the severity of pain was significantly lower in group C after the second visit. The incidence of pain in group C was significantly lower than that in group A, but there was no significant difference in the severity of pain between these two groups. There was no significant difference in the incidence and severity of swelling among the three groups.

**Conclusion** It is concluded that calcium hydroxide as an intracanal dressing could be effective to decrease the postoperative pain and swelling. Therefore it is recommended to use calcium hydroxide as an interappointment dressing in necrotic teeth.

**Keyword:** Calcium hydroxide, Flare-ups, Intra canal dressing.

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## Introduction

Calcium hydroxide has been widely used in endodontics since Hermann introduced it in dentistry in 1920. Currently calcium hydroxide is used as an intracanal medicament for apexification, apexogenesis and following trauma for

preventing or resolving external root resorption. It has been noted that the general indication of calcium hydroxide intracanal medication is pulpal necrosis (1).

The development of periapical pathosis with

endodontic origin is associated with the presence of pathogenic microorganisms in the root canal system (2-3). Thus endodontic therapy in these teeth is primarily focused on maximal elimination of these bacteria. However, previous studies have shown that cleaning and shaping of root canal system with conventional chemo-mechanical methods can only eliminate half of bacterial population of root canal (2,4-5). The number of residual bacteria is usually low, but should the canal be left empty between appointments, the remaining bacteria can multiply to nearly the original levels (2,6-7). Furthermore, anatomical complications and dentinal tubules are regions not accessible to be cleaned and are sources for bacterial re-growth. These will negatively influence on the prognosis of root canal treatments. So, intracanal application of antimicrobial agents has been recommended (8). Antibacterial intracanal medication has been advocated to eliminate remaining bacteria after canal instrumentation and irrigation. Many medicaments have been used as intra canal dressings (9-10) and according to their chemical basis, generally fall into the following categories: phenolic derivatives (eugenol, camphorated paramonochlorophenol, camphoratedphenol, metacresyl acetate, beechwood creosote), aldehydes (formocresol), halides (iodine-potassium iodide), calcium hydroxide, antibiotics, and various combinations. Calcium hydroxide is considered as a favorable antimicrobial agent (4, 11-15) for intra canal dressing. Several well-controlled studies, both in-vitro and in-vivo, have shown intracanal reduction of microbial population, or at least inhibition of bacterial proliferation, in the short and long periods of time (1). But intra canal medication necessitates a multi-visit approach of root canal therapy. Furthermore some studies show that flare-ups are more frequent in teeth with infected necrotic pulp and apical Periodontitis (16-18). On the other hand, some studies reported an increased incidence and severity of post treatment pain (16, 19-20) after multi-visit endodontic treatment. These findings show that root canal medication may increase the incidence of flare-ups due to its multi-visit approach or irritator nature of medicaments itself (1).

Since studies (4,16-18) showed that microorganisms play the main role in periapical inflammation; root canal dressing with an antimicrobial agent may be useful in controlling the post treatment discomforts. Also, it has been suggested that calcium hydroxide has pain-preventive properties because of its anti microbial or tissue-altering effects (1). Law et al (21) reviewed the literature evaluating the antibacterial effectiveness of intracanal medicaments used in the management of apical periodontitis. They found that calcium hydroxide remains to be the best medicament available to reduce residual microbial flora.

The aim of this study was to assess the effect of calcium hydroxide dressing in the incidence and severity of pain and swelling after root canal therapy in pulpally necrotized teeth.

### Methods and Materials

Sixty-nine patients (thirty-nine female and thirty male) participated in this prospective randomized clinical trial study. Informed consent was also obtained from all subjects who participated in this research. Among them; two were excluded, since they did not pursue the treatment, three due to overfilling and four due to positive cavity test. All patients were selected from those who were referred to Endodontics Department of Mashhad Dental School. The selection criterion was necrotized pulp which was emphasized through thermal and electrical pulp test and radiographic examination. There was no contraindication for a customary root canal therapy (i.e. no medication for any systemic conditions) in selected patients.

Randomly, these patients were divided into three groups of twenty (A, B and C). In this study a general practitioner, displayed all experimental steps in order to decrease variability. After isolation caries were removed from the teeth using low speed instruments before access cavity preparation. The patients were excluded if there was any sign of vital pulp. Working length was determined using K-file which engaged in apical root canal wall at the 0.5-1mm from the radiographic apices. Cleaning and shaping were done using K-files (Maillifer, Dentsply) and normal saline solution. The following treatment was done in experimental groups.

**Group A: Single visit**

In this group, after cleaning and shaping, the master cone was selected according to the master apical file (MAF). The canal was filled using lateral condensation method. Small dry cotton pellets were placed in the pulp chamber and then sealed by at least 3mm temporary filling (Coltosol, Favodent, Germany).

**Group B: two visits without interappointment dressing**

In this group, after cleaning and shaping; the root canal space was left empty. Sterilized cotton pellets were placed over the orifice and the access cavities were sealed by at least 3 mm of temporary filling material. After seven days; the MAF was increased one size to mimic procedure done for group C. Then the proper master apical cone was selected and the root canal was obturated.

**Group C: Two visit with interappointment dressing**

In this group, after cleaning and shaping procedure; the root canal space was filled with a diluted mixture of calcium hydroxide powder and aquapura water; using a K-file which was one size smaller than MAF. A sterilized piece of cotton was placed over the orifice and the access cavity was sealed by at least three mm of temporary filling material. In the second visit, seven days later, the remaining calcium

hydroxide was removed from the canal using a file one size larger than the MAF. Then the canal was filled using lateral condensation method.

**Data gathering**

Severity of pain was measured using a modified version of a 10-degree form of Visual Analogue Scale (VAS). Severity of swelling was measured using a four degree scale developed by the authors (Table 1).

After each appointment patients in all groups were given the forms and asked to report severity of pain and swelling every 6 hours during the first 72 hours after treatment.

All patients were recalled after 72 hours for examination and to return the forms. Data gathered from patients were coded as described in Table 2.

**Statistical Analysis**

Statistical method for longitudinal data (GENMODE Procedure) was used to compare the severity of pain and swelling between the three groups. Chi-square test was used for comparing the incidence of pain and swelling between three groups.

**Results****Pain**

Frequency of pain occurrence is shown in Table 3 Patients in group C reported the minimum (15%) while patients in group B reported the

**Table 1:** The four-degree scale designed to evaluate swelling severity

Code	Degree	Description
0	No swelling	There is no intraoral or extraoral swelling.
1	Mild	The swelling is not visible but palpable.
2	Moderate	The swelling is seen intraorally but not extraorally
3	Severe	The swelling is seen extraorally.

**Table 2:** Data Coding

Code	Description	
	Pain	Swelling
0	0 (No pain)	0 (No swelling)
1	1-3 (Mild)	1 (Mild)
2	4-6 (Moderate)	2 (Moderate)
3	7-9 (Severe)	3 (Severe)

**Table 3: Incidence of pain**

Group	Total	Symptomatic (Pain)		Mild		Moderate to severe	
		1 <sup>st</sup> visit	2 <sup>nd</sup> visit	1 <sup>st</sup> visit	2 <sup>nd</sup> visit	1 <sup>st</sup> visit	2 <sup>nd</sup> visit
A	20	8(40%)	-	2(10%)	-	6(30%)	-
B	20	10(50%)	9(45%)	6(30%)	5(25%)	4(20%)	4(20%)
C	20	5(25%)	1(5%)	3(15%)	1(5%)	2(10%)	0(0%)

**Table 4: Incidence of Swelling**

Group	Total	Symptomatic (Swelling)		Mild		Moderate to severe	
		1 <sup>st</sup> visit	2 <sup>nd</sup> visit	1 <sup>st</sup> visit	2 <sup>nd</sup> visit	1 <sup>st</sup> visit	2 <sup>nd</sup> visit
A	20	7(35%)	-	5(25%)	-	2(10%)	-
B	20	6(30%)	2(10%)	6(30%)	2(10%)	0	0
C	20	2(10%)	0	1(5%)	0	1(5%)	0

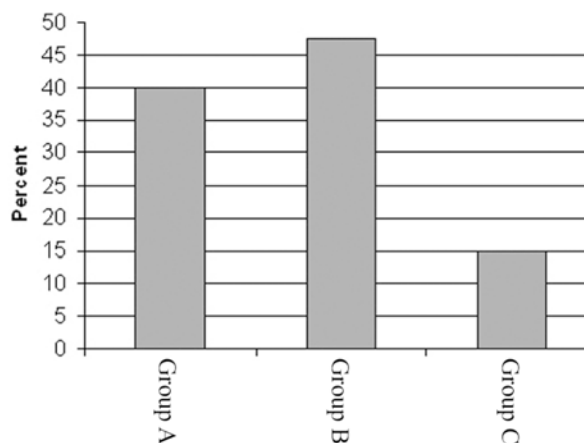
maximum (47.5%) frequency of pain sensation (Figure 1). The difference was statistically significant ( $P < 0.05$ ). No difference in severity of pain was found between group B and C after the first visit. However, a significant difference was found between these two groups after the second visit ( $P < 0.05$ ).

As shown in Table 3, number of patients reported pain sensation in group C is significantly less than group A ( $P < 0.05$ ). However, GENMODE procedure shows that treatment type (single visit or two-visit with interappointment calcium hydroxide dressing) does not affect the severity of pain.

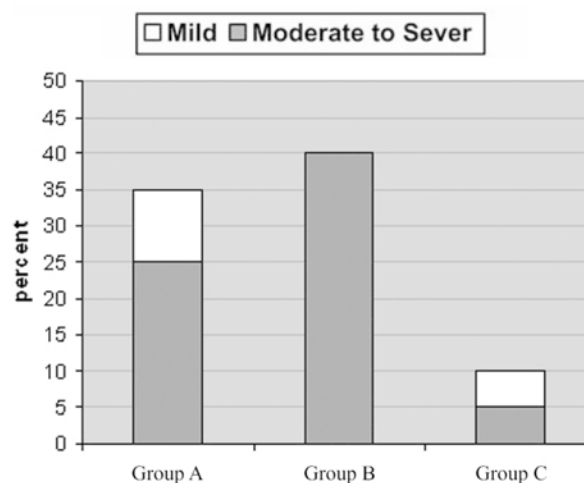
Chi-square test shows that the incidence of pain after first and second visit is significantly less in group C in comparison with groups B ( $P < 0.05$ ). Furthermore, GENMODE procedure shows that in these two types of root canal treatment (two-visit with or without interappointment calcium hydroxide dressing) does not have effect on the severity of pain after first visit but significantly does after second visit. ( $P < 0.08$ ).

**Swelling**

Number of patients with swelling is shown for each group in Table 4. Incidence of swelling in group C is significantly less than group A ( $P < 0.05$ ). (Figure 2) Comparison of groups A and B shows that the frequency of swelling after first visit is more in group B; not statistically significant. There is no report of swelling after the second visit in group C.



**Figure 1: Incidence of pain in three groups**



**Figure 2: Incidence of swelling in three groups**

GENMODE produce shows that in comparison with group A, treatment method has decreased the severity of swelling in group C. However, comparison of groups B and C shows that intra canal medication with calcium hydroxide decreases the frequency of swelling but does not affect its severity.

### Discussion

Studies about post endodontic treatments complications increase our ability to predict and prevent these sequelae to make endodontic treatments more comfortable.

Researchers believe that discomforts after root canal treatments in teeth with non-vital pulps are more common (16-18). First of all, it seems that such discomforts are due to the high level of infection and irritant agents in pulpal and periapical region of the teeth. Several studies have found a direct relationship between the infection of root canal and the level of pain and discomfort after endodontic treatments (19-20, 22-23). Cleaning and shaping of root canal system not only extrude the irritants to the periapical region, but also cause immunologic response (24). Therefore, several risk factors increase the incidence and severity of post treatment problems.

Introduction of new techniques and technologies into endodontics may guide clinicians to conduct single-visit treatments. Although, some believe that multi-visit treatments may increase the frequency of pain sensation (19), but in the present study, comparison of the results in three different groups shows that application of calcium hydroxide as an intra canal medication may influence the flare-ups incidence and severity in one or two visit root canal treatments. Studies (4, 25) showed that chemo-mechanical cleaning and shaping of root canal systems eliminates only half of the infection and debris which can affect the prognosis of endodontic treatments. This implies the necessity of intra canal medication for treatment of infected root canals and those periapical lesions, which are resistant to treatment. Application of calcium hydroxide in endodontics is being recommended because of its antibacterial property. However it may also influence the inflammatory response of periapical tissue after root canal therapy. This study was designed to answer the question of whether or not intra canal medication with

calcium hydroxide would affect the pain and swelling experience after root canal treatment.

Bacteria have been identified as the main excitant of periapical inflammation (3). Many authors have proposed some probable mechanisms for antibacterial activity of calcium hydroxide. Generally this property is related to hydroxyl ions, which are produced from ionization of calcium hydroxide in aqueous solution (4, 15). Most of the microorganisms cannot tolerate this increased pH up to 12.5. Estrela et al (11) focused on the effect of hydroxyl ions on bacterial cell membrane. They believe that since calcium hydroxide affects the cell wall enzymes, it has high ability to inhibit microbial growth. Although some studies have shown that calcium hydroxide is not an absolute antimicrobial agent and some species would stay alive in the presence of this medicament (26). Bystrom & Sundqvist (2) have noted that endodontic infections are combined and the synergism effect of several species would cause endodontic diseases. Therefore; it's not necessary to eliminate all of the microorganisms to treat the infection. Furthermore, some studies have shown that calcium hydroxide alone may dissolve necrotic tissues or may increase the effect of other solvents (14).

This suggests that calcium hydroxide would be an effective agent for cleaning and disinfecting the infected root canals.

As previously mentioned, calcium hydroxide increases the pH of tissue environment up to 12.5. On the other hand, tissue destruction during inflammation occurs in acidic pH, so it follows that application of calcium hydroxide will inhibit tissue destruction and controls inflammation in periapical region (8).

Furthermore, Weiger et al (3) stated that calcium hydroxide would decrease or eliminate the amount of MMP-8 (Collagenase-2), which presents in pulpal and periapical inflammation and also showed that calcium ions would improve tissue circulation and control exudation. These findings show that calcium hydroxide intracanal dressing at least does not increase inflammatory reactions in periapical origin.

However, there is some controversy about the concentration and the thickness of calcium hydroxide paste used for antimicrobial purposes. Some studies have shown that thinner pastes have higher antimicrobial activity. Behnen et al

(4) found that in a period of 24 hours; 0.1 gr/ml and 1gr/ml solution of calcium hydroxide in distilled water decrease the microbial population (*E. faecalis*.) by 73 to 86 percent and 13 to 26 percent respectively.

Several studies have compared antimicrobial activity of calcium hydroxide in different solvents. Findings show that calcium hydroxide in aqueous solvent has higher antimicrobial activity compared to alcoholic or oily solvents (13, 27), therefore, we have used distilled water as solvent for calcium hydroxide in this study.

According to Sjogren et al (5) we allowed calcium hydroxide paste to remain for seven days in root canal. They compared antimicrobial properties of calcium hydroxide in two periods of ten minutes and seven days. It is found that after seven days there would not be any bacterial infection immediately after removing calcium hydroxide and also after one to five weeks. Furthermore according to endodontic literature, there is an acceptance about application of calcium hydroxide for seven days to disinfect root canals. However, Hosoya et al (28) suggest that the time required for optimum intracanal activity when using calcium hydroxide mixtures is at least 2 weeks.

Comparison of the two-visit treatment with calcium hydroxide intra canal dressing with single-visit treatment shows that though incidence and severity of pain sensation is less in group C but the difference is not significant. It is worthy to mention that this is in agreement with the finding of Walton's study (1). In the present study, we found that patients treated in two visits with calcium hydroxide intra canal dressing, experienced lower incidence and severity of pain comparing to those treated in single visit.

Comparing two groups (patients treated in two visits with and without calcium hydroxide dressing) shows that treatment method has significant effect on post treatment pain. The only difference in treatment method between these two groups was intra appointment dressing; this indicates that calcium hydroxide has the ability to inhibit inflammation. Also, pain incidence decreased after both first and second appointment with calcium hydroxide intra canal dressing. This difference was significant for the second appointment.

Comparison of the similar time points after first and second appointments in the first 72 hours

shows that in 99% of cases, patients who experienced pain after the first visit, reported some degree of pain after second visit. This is an important key to manage patients with inter appointment pain.

The only severe pain reported in group C is related to sixteen years old boy who had three of his teeth endodontically treated; the first was his right maxillary lateral incisor which was treated in a single visit. He reported no pain after treatment. The second was his right maxillary central incisor, which was treated in two visits without calcium hydroxide dressing. This time the patient reported mild to moderate pain after the first visit. Subsequently the other maxillary lateral incisor was treated in two appointments with calcium hydroxide dressing. This time the patient has reported moderate to severe pain after first but no pain after second visit. This may have occurred because a number of teeth were treated. The amount of irritant agents in periapical region increases after root canal therapy of adjacent teeth and the immunologic response will be more severe.

According to our findings, the number of patients with post treatment swelling is much less in two visit groups with calcium hydroxide treatment than the two other groups. It shows that calcium hydroxide can control exudation well.

In addition, we found that two-appointment endodontic treatment with dressing not only does not increase but also significantly decreases the incidence and severity of swelling.

### Conclusion

According to our findings we can conclude:

1. Calcium hydroxide can decrease painful immunologic responses to endodontic treatments.
2. Calcium hydroxide can well control and decrease exudation.
3. To improve prognosis of root canal treatment in teeth with necrotic pulps, two visit endodontic treatments with calcium hydroxide intracanal dressing can be performed without likelihood of the increasing flare-up incidence.

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