

Effect of Calcium Hydroxide on Post- Endodontic Pain in Female Patients with Symptomatic Irreversible Pulpitis: A Randomized Clinical Trial

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Abstract

Introduction: Post-endodontic pain remains a significant challenge to the dental profession. It has been suggested that calcium hydroxide has pain-preventive properties through its anti-microbial and tissue-altering effects. The aim of this study is to evaluate the effect of intra-canal calcium hydroxide dressing on postoperative pain in female patients diagnosed with symptomatic irreversible pulpitis. **Material & Methods:** 51 female patients aged 18-40 years, diagnosed with symptomatic irreversible pulpitis were included. Subjects were randomly assigned to calcium hydroxide group, 26 subjects or dry cotton pellet group, 25 subjects. Subjects were given anesthesia, rubber dam isolation; access cavity, complete pulp extirpation, working length then canals were instrumented using hand K-files until size# 25. $\text{Ca}(\text{OH})_2$ was applied in (group 1) and dry cotton pellet was put in (group 2) then access cavities were restored. All subjects were given pain chart to fill after 24 and 48 hours. **Results:** The mean baseline pain level was severe (3.77 and 3.72) in group 1 and group 2 respectively. A significant reduction in pain level was observed as 1.81 & 1.38 in group 1 and 2.16 & 1.76 in group 2 after 24 and 48 hours. A superior pain relive (63.3%) was seen in $\text{Ca}(\text{OH})_2$ group compared to control group 52.7%. **Conclusion:** The emergency treatment of choice of symptomatic irreversible pulpitis is complete pulp extirpation. $\text{Ca}(\text{OH})_2$ reduced post-endodontic pain more than control group but not significantly. We recommend using $\text{Ca}(\text{OH})_2$ since it did not have any negative influence in post-endodontic pain. Small sample size is a major limitation in our study.

Keywords: Calcium Hydroxide; Post-operative pain; Irreversible Pulpitis

Introduction

The main reason people seek emergency dental treatment is pain from teeth diagnosed with symptomatic irreversible pulpitis, which is characterized by prolonged sensitivity to cold or heat and experienced more in posterior teeth.^[1] The emergency treatment of choice in such cases is to relive the pain by removing the inflamed pulp tissue and cleaning the canal system; then after that either to use intra-canal dressing material or to complete the root canal therapy and to prescribe the suitable analgesics at the end for such patients.^[2]

Post-treatment pain remains a significant challenge to the profession.^[3] Reports have suggested that up to 80% of people suffering from endodontic pain and continue to report pain after endodontic treatment, with pain level ranging from mild to severe.^[4] Patients with moderate to severe pain before treatment were five times more likely to experience moderate to severe pain post treatment.^[5]

Calcium hydroxide $\text{Ca}(\text{OH})_2$, an intra-canal dressing is considered as the most favorable anti-microbial agent.^[6] Furthermore, because of its anti-microbial and tissue altering effects, calcium hydroxide has been reported to have pain-preventive properties.^[7]

Walton et al.^[7] examined the effect of $\text{Ca}(\text{OH})_2$ intra-canal dressing on postoperative pain in various types of pulpal and periapical pathosis with and without symptoms and found that $\text{Ca}(\text{OH})_2$ was not superior to leaving the canal space empty without dressing. In a different study by Asgerly et al.^[8] they found that using calcium enriched mixture cement after pulpotomy significantly reduced pain intensity as early as

18 hours postoperatively while in single visit root canal treatment the pain intensity was reduced after 36 hours.

In the same study, they found that calcium enriched mixture maintain the same level of pain relive while in single visit endodontic patients experienced significant pain response to percussion one week postoperatively. This study aims to evaluate the effect of intra-canal calcium hydroxide dressing on post-operative pain in female patients diagnosed with symptomatic irreversible pulpitis.

Materials and Methods

After the IRB approval of the study design with ethical clearance number # (SRC/ETH/2018-19/021), the study was conducted at College of Dentistry King Khalid University. A written consent was taken from all the participants included in the study. A total of 51 female patients aged 18-40 years old who presented to the emergency dental clinics complaining of pain in molar teeth and diagnosed with symptomatic irreversible pulpitis were included in the study. Patients with medical conditions, pregnant or breast feeding, teeth with necrotic pulp were excluded from the study. Baseline records of analgesic use, patient age, tooth type & position, and pain level (using visual analog scale) were

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obtained. Subjects were randomly distributed into two groups. Group 1 was assigned for calcium hydroxide (26 subjects) while group 2 was assigned for dry cotton pellet (25 subjects).

All procedures were undertaken under local anesthesia and Rubber dam isolation. A Standard infection control protocol was observed. Access cavity was prepared followed by pulp extirpation. Working length was established using @RootZX (Morita, USA) apex locator and confirmed with radiographs. Canals were irrigated with 5.25% NaOCl and instrumented with hand K-files until size# 25 to ensure complete removal of pulpal tissue and allow enough space for intracanal medication. Finally, canals were dried with paper points and freshly mixed Calcium hydroxide powder @Pulpdent (Watertown, MA, USA) with normal saline was applied in group 1 and dry cotton pellet was put in the pulp chamber of group 2 then access cavities were restored using @Plastor (Ghimas, Italy) as a temporary restoration between appointments.

Table 1: Comparison of pain scores from baseline to 24 hour and 48 hour follow up using Repeated Measures ANOVA.

Group	Follow up	N	Mean	SD	Wilks' Lambda	F	df	p-value
Dry	Baseline	25	3.72	0.458	0.842	61.387	2.000	0.000*
	24 Hour	25	2.16	0.688				
	48 Hour	25	1.76	0.926				
Ca(OH) ₂	Baseline	26	3.77	0.430	0.087	125.829	2.000	0.000*
	24 Hour	26	1.81	0.749				
	48 Hour	26	1.38	0.637				

*Statistically significant at 5% level of significance

Table 2: Reduction in pain scores during follow up visits.

Group	Follow up	Pain Score		p-value
		Mean Difference	Percentage reduction	
Dry	Baseline to 24 Hour	1.560	41.9	0.000*
	24 Hour to 48 Hour	0.400	10.8	0.022*
	Baseline to 48 Hour	1.960	52.7	0.000*
Ca(OH) ₂	Baseline to 24 Hour	1.962	52.0	0.000*
	24 Hour to 48 Hour	0.423	11.2	0.003*
	Baseline to 48 Hour	2.385	63.3	0.000*

*Significant at 5% level of Significance. LSD test

Patient's Pain Level Survey				Study ID:.....	
1	Before Tx	None 0	Mild 1-3	Moderate 4-6	Sever 7-10
	Pain Killers	Yes	Name:..... #/day:.....		
2	After 24 H	None 0	Mild 1-3	Moderate 4-6	Sever 7-10
	Pain Killers	Yes	Name:..... #/day:.....		
3	After 48 H	None 0	Mild 1-3	Moderate 4-6	Sever 7-10
	Pain Killers	Yes	Name:..... #/day:.....		

Figure 1: Patient take home pain chart.

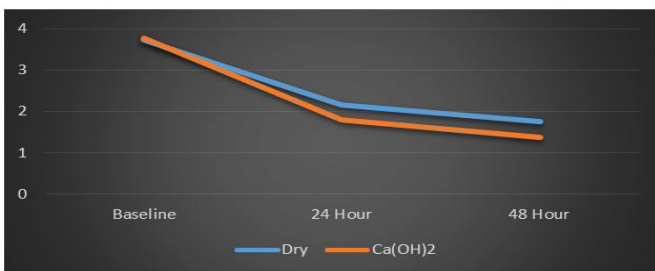


Figure 2: Comparison of mean pain scores between Ca(OH)₂ and dry.

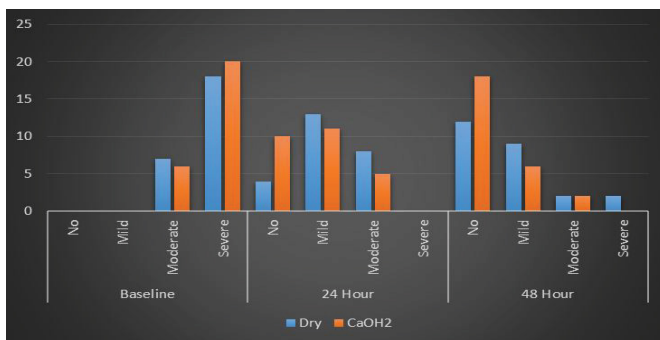


Figure 3: Frequency of subjects with respective pain scores from baseline to follow up.



Figure 4: Comparison of analgesic use frequency among groups.

All subjects were given a pain record chart [Figure 1] to fill at home after 24 and 48 hours of the initial treatment and also were reminded with a phone call. Subjects were recalled after one week to complete the root canal treatment and final coronal filling.

Data were then collected for statistical analysis. Statistical analyses were performed with SPSS Version 13 (SPSS, Chicago, IL, USA). In addition to reporting the two- sided confidence interval (CI), data were analyzed to determine whether the pain relieving effects of Ca(OH)₂ were similar to those of dry cotton pellet. In the two study groups, means of pain intensity level at baseline were compared with Student's t test, and the pain level trend after 24 and 48 hours was analyzed by repeated measures analysis of variance (ANOVA). The data of analgesic use were subjected to two-way ANOVA with treatment and analgesic use as factors. First type statistical error was considered as (P < 0.05).

Results

The mean baseline pain level was severe in both groups as 3.77 in Ca(OH)₂ group and 3.72 in dry cotton group respectively. A significant reduction in the pain level was observed in both groups after 24 and 48 hours. In group 1 pain was reduced to 1.81 & 1.38 after 24 h and 48 h while in group 2 pain level was 2.16 & 1.76 as shown in Table 1. Figure 2 compared the main pain reduction in both groups at 24 h and 48 h which was not significant.

During follow up visits, the mean difference in pain score was 1.96 & 1.56 comparing baseline with 24 h in Ca(OH)₂ and Dry cotton respectively and was 2.39 & 1.96 comparing baselines with 48 h in both groups as shown in Table 2. The frequency of subjects among pain levels was shown in Figure 3 where most of the subjects were in severe pain level at the baseline records while after 24 h subjects were mainly in mild to moderate pain level and mostly free of pain after 48 h.

A significant reduction of analgesic use was observed in follow up visits in all groups with no significant difference among groups as shown in Figure 4. Although Ca(OH)₂ showed better results in pain score reduction after 24 h and 48 h compared to dry cotton, that was not statistically significant. Overall, there were no flare-ups during follow up visits and the clinical procedure itself was the most important factor in pain score reduction.

Discussion

A number of treatment options are available for painful tooth with established irreversible pulpitis, including pulpotomy, pulpectomy or RCT while in fact using painkillers alone or tooth extraction are the extreme options. Although RCT is the treatment of choice, for some reasons, extraction may be a more attractive treatment option. In some instances patients use self-prescribed analgesics to delay tooth extraction.^[8,9] We hypothesized that pulpectomy treatment using Ca(OH)₂ dressing might be able to play an important role in such cases. This study showed a significant reduction in pain level within the first 24H after providing pulpectomy treatment in molar teeth with symptomatic irreversible pulpitis. These results agree with the consensus that pulpectomy or pulpotomy is probably the most important factor in reducing post-treatment pain, regardless of other variables.^[10,11]

Population-based research consistently demonstrates greater pain prevalence among women relative to men. The literature also suggests clear difference between men and women in pain response and analysis which is more common in women. It suggests that multiple biological and psychosocial processes are common contributing factors to these differences.^[12] Therefore only female patients were accepted to participate in our study to control the gender variable effects on response to pain, sensitivity and risk of pain. Many studies talked about early life exposure to pain and stress effect on pain process in relation to gender and age considering men and older patients are more tolerant to pain.^[12,13] Therefore, age was limited in our study to young adult patients only (18-40 years) to eliminate age related confounding factors.

Pain perception is highly subjective and modulated by many factors thus; it could be influenced by factors other than the experimental procedures with difficult pain assessment and more opportunities for error. Pain scales are based on the theory that pain intensity is continuous, without jumps or intervals.^[14] VAS simplifies pain rating by allowing patients to quantify the extent of their pain by rating it from 0 to 10 in four grades. Preoperative (baseline) pain is related to inflammatory reactions initiated by bacterial invasion, and lasts from several minutes to several days.^[15] the baseline pain level means were severe at 3.77 in group 1 and 3.72 in group 2. These pain scores suggest that these patients with irreversible pulpitis might have opted for tooth extraction. To achieve meaningful comparisons between treatment effectiveness in providing pain relief, the baseline recordings in both groups should be similar. This condition was met in this trial, no significant difference being present in the baseline means of pain level.

The antimicrobial action of Ca(OH)₂ is related to hydroxyl ions release in aqueous solutions.^[16] It is highly oxidant free radicals with extreme reactivity with biomolecules.^[17] The antimicrobial effect of hydroxyl ions is through damaging cytoplasmic membrane, damaging the DNA, or protein denaturation.^[18] As long as high pH is maintained by free hydroxyl ions, Ca(OH)₂ will exert its antimicrobial effect.^[18] Multiple *in vivo* studies^[19-21] reported excellent antimicrobial effect on different endodontic microorganisms with fewer number of bacteria after root canal dressing with Ca(OH)₂ compared to other treatment modalities. Shuping et al.^[22] showed that about 93% of canals are bacteria free after one week dressing with Ca(OH)₂.

This study showed that the mean postoperative pain level scores significantly decreased in both groups following treatment; however, no significant differences between Ca(OH)₂ and dry cotton group was seen. Analgesics use was significantly reduced in both groups at 24 h and 48 h after treatment. Patients in both groups were completely asymptomatic after 1 week. The main study limitation was the small sample size. This was due to too specific inclusion criteria which made it difficult to collect subjects in short time limits. Also, most of the

patients did not attend their follow up visits which might be due to absence of pain after the first visit and lack of motivation to complete dental treatment.

Conclusion

Since calcium hydroxide is an excellent antimicrobial agent and with pain preventive properties, the study aimed to evaluate its effect in reducing post-endodontic pain in symptomatic female subjects. Despite the small sample of this study, Ca(OH)₂ reduced post-endodontic pain more than control group however it was not significant. Therefore we recommend using Ca(OH)₂ during emergency endodontic treatment to help reducing pain and prevent bacterial infection and rendering further bacterial invasion. Finally, the emergency treatment of choice of symptomatic irreversible pulpitis is complete pulp extirpation.

Conflict of Interest

The authors disclose that they have no conflicts of interest

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