Calcium Hydroxide as an intra canal medicament in infected root canal

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Abstract:

This descriptive type of study on "Calcium hydroxide as an intra canal medicament in infected root canal" among the patients attending Department of Conservative dentistry and Endodontics, Faculty of Dentistry, BSMMU. The study was carried out from 1st January 2002 to 31st December 2003. Data were collected with a questionnaire and a checklist. The sample comprise 52 respondents. Among them 30 were male and 22 were female. Age variation was between 11 to 60 years. All respondents having alveolar abscess, out of them 35 were with acute alveolar abscess and rest were with chronic alveolar abscess. Most of the respondents' age were between 11-30 years. The maxillary central incisors and mandibular first molar were most common teeth having alveolar abscess. The most common aetiology of alveolar abscess were dental caries and trauma. As a result of this study it can be concluded that calcium hydroxide is an effective intra canal medicament in treatment of infected root canal.

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Introduction:

The use of calcium hydroxide in endodontics was introduced by Herman 1920[1]. Although well documented for this time, the clinical application during the following 25 years were well known[2]. Calcium hydroxide can be categorized as conventional antiseptic, but it does kill bacteria in root canal space. It has been routinely used by many endodontic by last 40 years. The value of calcium hydroxide in endodontic treatment of necrotic infected teeth is now well documented[3,4]. Calcium hydroxide normally used as a slurry of calcium hydroxide in a water base. At body temperature, less than 0.2% of calcium hydroxide is dissolved into Ca^+ and OH^- ions. Calcium hydroxide needs water to dissolve. Therefore it is most advantegeous to use water as the vehichle for the calcium hydroxide paste. In contact with air calcium hydroxide forms calcium carbonate. This is an extremely slow process, however, and of little clinical significance[4].

Calcium hydroxide is a white, odorless powder, which when mixed with water or glycerine produce alkaline medium as high as p^H 12.5. Calcium hydroxide should be stored in tightly closed and sealed bottles. Some spore forming bacteria also flourish in alkaline medium present in calcium hydroxide and contaminate it. Hence, preferably every time fresh and properly sealed calcium hydroxide should be used and rest should be discarded[5].

Calcium hydroxide has definite characteristic of producing calcium concentration resulting in less leakage at the capillary junction. It causes contraction of the pre-capillary sprinters, thus in resulting less plasma outflow. This could account for the clinical use of the material in controlling periapical exudation. Calcium hydroxide has been successfully used by some clinicians in treating teeth with periapical granuloma, abscess and cyst. Perhaps the locally destructive action of calcium hydroxide with the high p^H results in chemical cautery and is responsible for the breakdown of the epithelium. Many workers are of the opinion that if the concentration of the ions increased locally, the phosphatase enzyme in presence of calcium salt can accelerate bone formation. Khatavkar and Talim[6] carried out a study to evaluate the periapical healing following treatment with prednisolone calcium hydroxide. They concluded that calcium hydroxide is the one of the most suitable materials available at present for the treatment of several difficult pathological situations associated with pulpless teeth[7].

Calcium hydroxide is a slowly acting antiseptic. Direct contact experiments in vitro require a 24 hours contact period for complete kill of enterococci[8]. In clinical experimentation, one week of intra canal dressing has been shown to safely disinfect a root canal system[4]. In addition to killing the bacteria, calcium hydroxide has an extraordinary quality in its ability to hydrolyze the lipid moiety of bacterial lipopolysaccharides, thereby inactivating the biological activity of lipopolysaccharide[9,10]. This is a very desirable effect because dead cell wall material remains after killing of bacteria that causes the root canal infection. Calcium hydroxide not only kills the bacteria, but it also reduce the effect of the remaining cell wall material

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Disinfection of the root canal is very important phase of root canal treatment. Microorganisms present in the root canal can invade the periapical tissue and may not only give rise to pain, but also destroy the periodontium including alveolar bone[11].

The three main procedures to reduce the microorganisms from infected root canal. These are Biomechanical preparation, Irrigation of root canal, Intra canal medication. Several study have shown that intra canal medication reduces or eliminates microbial flora from the root canal. Bystrom and sundqvist[12] observed that when no inta canal medicament was used between appointments, in most of the cases pathogenic organism were increased in numbers. Therefore, the need of an intra canal medicament to destroy or reduce the number of microorganisms seems apparent.

Calcium hydroxide is effective in the treatment of infected root canals. Its high p^H has strong antibacterial potential. In direct contact with calcium hydroxide , 99.99 percent of bacteria usually present in the infected root canal become bacteria free within 1 to 4 weeks after dressing with calcium hydroxide. Calcium hydroxide also has a capacity to dissolve the necrotic remnants, which act as potential substrates for bacterial growth[14].

On the other hand, caustic intra canal medicaments such as paraformaldehyde will not only fail to produce sterilization but may also percolate into the periradicular tissues and damage vital healthy tissues, thus delaying healing[15].

Materials and methods:

This prospective study was carried out among the selected patients in the Department of Conservative Dentistry and Endodontics, Faulty of Dentistry, BSMMU. The study was conducted for the period of two years from January 2002 to December 2003. The study population was comprised of patients having infected root canal, irrespective of age sex and tooth number. Initial sample size was 52 patients with infected root canal requiring endodontic treatment.

Inclusion criteria: Patients with infected root canal (acute or chronic alveolar abscess).

Exclusion criteria: Patients with irreversible pulpitis or other patient required endodontic treatment.

Keeping in mind, the study objectives, a draft data collection sheet was prepared in conclusion with the respected guide. It was an interview schedule and an observational checklist, which was a structured one to minimize time. All the variables were considered accordingly. The first portion of the interview scheduled in a form of relevant information and some variable and last portion was checklist to note the findings on examination.

Study procedure:

After proper selection of the cases on the basis of the above mentioned criteria, root canal treatment was performed in conventional technique. Disinfection of the operative field and proper sterilization of the instruments ensured. Isolation of the tooth was done with rubber dam, cotton roll and the use of the saliva ejector. All instruments anad material were sterile and in a aseptic manner. Hand gloves, facemask and eye protector were used in every case. Preparation of the access cavity was done by opening the pulp chamber and by removal of pulpal wall. Free access to all root canals along straight line were secured by gentle removal of all contents of the pulp chamber. Gentle irrigation was done with 5.25% Naocl solution to remove the necrosed dentine. Excavation of the necrosed tissue was done with sharp excavator or slow rotating round bur. Location of the canal orifice obtained with explorer and 5.25% sodium hypochlorite solution was applied to pulp chamber. All root canal instruments were fitted with instrument stop to prevent injury of periapical tissue by over instrumentation.

With the help of preoperative radiograph, approximate length of the root canal was obtained. Before bio-mechanical preparation of the canal, a diagnostic radiograph was taken for every case to calculate the exact root canal length. Bio-mechanical preparation of the root canal was done with accurate length, diameter and number reamer, K-file and H-file. Widening of the canal was done by gradual increasing uses of the files after flooding the canal to prepare it for obturation. Removal of the dentin and organic debris from the canal was done by irrigation alternately with sodium hypochlorite and normal saline. Drying of the root canal was done with absorbent paper points. As a root canal dressing slurry mix of calcium hydroxide paste was used in some cases more than one (two or three) dressing of calcium hydroxide was required. All cases were treated in multiple appointments. Root canal sealer zinc oxide eugenol was used in the canal with a hand reamer. Master cone gutta-percha point was selected and obtained in the canal according to the diameter of the canal. A spreader was used to create lateral space for condensation with multiple gutta-percha points to obtained hermetic sealing of the root canals. Immediate post operative follow-up was done after root canal obturation. A follow-up sheet was maintained for the record of response of the patient in every case.

Results:

After collection of the data were analyzed according to the variables for the purpose of the study . The results have been shown in tabular forms.

Table-I

Distribution of the patients by sex.(n=52)

Sex	Number	Percentage
Male	30	57.70
Female	22	42.30

Table-I shows that out of 52 respondents 30(57.70%) were male and 22(42.30%) were female.

Table-II

Distribution of the patients by type of infection.(n=52)

Type of alveolar abscess	Number	Percentage
Acute	35	67.30
Chronic	17	32.70

Table-II shows that out of 52 respondents 35(67.30%) had Acute and 17(32.70%) had chronic infection.

Table-III

Distribution of the patients by age group.(n=52)

Years	Number	Percentage
11-20 yrs	17	32.7
21-30 yrs	15	28.8
31-40 yrs	13	25.0
41-50 yrs	05	9.7
51-60 yrs	02	3.8

Table-III shows that out of 52 patients age range was 11 to 60 years. Among then 17(32.7%) patients were in age group of 11-20 years, 15(28.8%) patients were in age group of 21-30 years, 13(25%) patients were in age group of 31-40 years, 5(9.7%) patients were in the age group of 41-50 years and 2(3.8%) patients were in age group of 51-60 years.

Table-IV

Distribution of the patients by tooth number.(n=52)

Tooth	Maxillary		Mandibular	
	No.	(%)	No.	(%)
Central Incisor	14	(26.90)	04	(7.70)
Lateral Incisor	05	(9.60)	01	(1.92)
Canine	02	(3.85)	01	(1.92)
First Premolar	02	(3.85)	02	(3.85)
Second Premolar	01	(1.92)	01	(1.92)
First Molar	04	(7.70)	12	(23.10)
Second Molar	01	(1.92)	02	(3.85)
Third Molar	0	(0)	0	(0)
Deciduous	0	(0)	0	(0)

Table-IV shows that 14(26.90%) teeth were maxillary central incisors, 12(23.10%) were mandibular first molar, 01(1.92%) was second premolar, 2(3.85%) were maxillary canine. Third molar and deciduous tooth were not in the study.

Table-V

Distribution of the patients by Aetiology.(n=52)

Aetiology	Number	Percentage
Carious exposure	29	55.75
Trauma	13	25.00
Others	10	19.25

Table-V shows that 29(55.75%) of aetiology was dental caries and 13(25%) was trauma.

Discussion:

Residual microorganisms left in the root canal system following cleaning and shaping or microbial contamination of a root canal system between appointments have been a concern. If root canal treatment is not completed in a single appointment, antimicrobial agent are recommended for intra canal antisepsis to prevent the growth of microorganism between appointments. The access opening in the tooth must also be sealed with an effective inter appointment filling to prevent the microbial contamination by microleakage from the oral cavity. Despite the controversy over culturing root canals, most clinicians agree that healing is more likely in absence of bacteria[3]. A recent study used modern microbiologic techniques ,with tooth root-filled at a single a appointment and evaluated for clinical success. Initially all 55 single rooted teeth were infected. After instrumentation and irrigation with 0.5% sodium hypochlorite, bacteria still could be cultivated from 22 of the 55 root canals[2]. Periapical healing was followed for up to 5 years. Complete healing occurred in 94% of those teeth that had negative culture but only 68% of those with positive culture at the time of root canal obturation. These finding suggest the importance of elimination bacteria from the root canal system before obturation. In the past, numerous antimicrobial agents have been used that were antigenic and cytotoxic and provided relatively short term antisepsis.

These include traditional phenolic and fixative agents such as camphorated monochlorophenol, formocresol, eugenol, metacresylacetate and halides (iodine-potassium iodide). A reliance on mechanical instrumentation and aversion to the use of cytotoxic chemicals had lead to a lac of use of an intra canal dressing by many clinicians, a practice that allows remaining bacteria to multiply between appointments.

The current inta canal dressing of choise is calcium hydroxide. Although not categorized as an antiseptic, studies have shown calcium hydroxide to be an effective antimicrobial agent[1]. Other studies have shown it is to be an effective inter appointment dressing over several weeks. When mixed into a paste with water, calcium hydroxide's solubility is less than0.2%, with a p^H of about 12.5. some of its antimicrobial activities may be related to the absorption of the carbon dioxide that starves capnophilic bacteria in root canal. The Saunders group in Dundee was disappointed, however, in the lack of antimicrobial activity of calcium hydroxide against the anaerobes[4].

On the other hand calcium hydroxide has been shown to hydrolyze the lopid moiety of bacterial lipopolysaccharides, making them incapable of producing such biological effects as toxicity, pyrogenicity, macrophase activation and complement activation. Lipopolysaccharides have been shown to be present in the dentinal tubules of infected root canals[5].

Obliterating the canal space with calcium hydroxide during treatment may minimize the ingress of tissue fluid used as nutrient by microorganism. Removal of the smear layer facilitates the diffusion of calcium hydroxide into dentinal tubules[6]. But smear layer or not, a Brazilian group was disappointed in the inability of calcium hydroxide to destroy in the infected dentinal tubules, whereas four root canal sealers appeared to be quite effective against tubular bacteria, AH26 being the best. Moreover, zinc oxide-eugenol sealer was found to be more effective in inhibiting the growth of *Streptococcus anginosus* than that of calcium hydroxide containing sealer. *Actinomyces israelii,* a species of bacteria isolated from periapical tissues, has been reported to not respond to conventional endodontic therapy[7].

Conclusion:

As a result of this study, it can be concluded that calcium hydroxide is an effective inta canal medicament in case of infected root canal specially for exudation control and management of inter appointment pain. However, additional information is needed to more accurately predict the outcome of this treatment. A study in which multifactorial analysis could be performed would be extreme valuable.

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