COMPARATIVE EVALUATION OF THE ANTIBACTERIAL EFFECT OF CALCIUM HYDROXIDE PASTES USING FOUR DIFFERENT VEHICLES

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ABSTRACT: AIM: The present study evaluated the antibacterial effect of calcium hydroxide pastes using four different vehicles namely propylene glycol, glycerin, distilled water and camphorated phenol. **MATERIAL AND METHOD:** Calcium hydroxide pastes prepared with two commonly used vehicles namely distilled water and camphorated phenol. The antibacterial activity of these pastes were tested against five anaerobic organism that can commonly occur in the infected root canal. The pastes were also prepared using two chemicals such as propylene glycol and glycerin. **RESULTS AND CONCLUSION:** The result of this study show that calcium hydroxide paste made with propylene glycol gives enhanced antibacterial action and sustains it for longer period of time. Propylene glycol being biological acceptable vehicle, it can be recommended for routine use as a vehicle over glycerin.

KEY WORDS: Calcium hydroxide, Propylene Glycol, Glycerin, Camphorated monochloro phenol.

INTRODUCTION: Calcium hydroxide has been widely used in endodontics as an intracanal medicament. Cleaning and shaping is one of the most important step of successful endodontic therapy. The endodontist today, concentrates more upon instrumentation, irrigation through cleaning and shaping for the elimination of responsible microbial flore from the infected root canal [6,7,9]. Disinfection of the infected root canal is established by the comprehensive effect of instrumentation irrigation and intra canal medication contributes to maximum therapeutic success. Calcium hydroxide is generally mixed with vehicles namely distilled water, CMCP, glycerin and also propylene glycol to dissociated into calcium and hydroxyl ion thereby creating alkaline environment in its vicinity, not allowing the growth of micro-organisms [3,4] Dissociation of calcium hydroxide into non aqueous vehicles is not clearly understood and the biological consequences of endodontic application of calcium hydroxide mixed with a non aquous vehicles are not known. However there are very few study related to propylene Glycol that show as better vehicle exhibits no tissue irritating effect, alcoholic in nature and remains in paste from for longer time. Glycerin which has been used as intracanal lubricant and calcium hydroxide glycerin paste was found to have superior sealing property in the roots. The antibacterial activity of a paste with propylene glycol and glycerin against anaerobic organisms has not been clearly understood and reported till date. The purpose of this study is to comparatively evaluate of antibacterial effect of calcium hydroxide using four different vehicles against the five anaerobic organisms that can commonly seen in the infected root canals.

MATERIAL AND METHOD: Considering the microbial flora of infected root canal, five micro organisms were obtained. This study evaluates the antibacterial effect of calcium hydroxide against anaerobic organisms commonly found in infected root canal.

1) Prevotella intermedia 2) Prophyromonas gingivalis 3) Fusobacterium Nubleatum 4) Peptostroptococcus micros 5) Streptococcus milleri.

Calcium hydroxide paste was divided into four different group.

Group I : Calcium hydroxide with distilled water (CH-DW)
Group II : Calcium hydroxide with Propylene glycol (CH-PG)
Group III : Calcium hydroxide with glycerin (CH-GY)
Group IV : Calcium hydroxide with CMCP (CH-CMCP)

One gram of Calcium hydroxide powder mixed with one cc of appropriate liquid on a glass slab and paste were prepared with the help of sterile instrument under sterile condition.

The culture media used for the study were brain hart infusion and blood agar. Four wells of 5mm diameter were cut on each solid media using sterile metallic punch fitted with bulbed teat. A standard loop with on internal diameter of 4mm which could deliver 0.01ml of the suspension of culture of test organism, then spread across the plate using sterile cotton swab. The wells were then filled with the four different preparation of calcium hydroxide and culture plates were then incubated at 37^0C. The zone of inhibition was measured after 48, 96 and 166 hours and results observed.

RESULTS: All the different preparation of Calcium hydroxide showed positive zone of inhibition against the microorganism tests. Calcium hydroxide CMCP pastes showed significant higher zone of inhibition as compared to other groups. There was little difference between the antibacterial activity of calcium hydroxide Propylene glycol pastes and calcium hydroxide glycerin pastes. These pastes showed higher zones of inhibition than calcium hydroxide distilled water pastes. The inhibitory effect of calcium hydroxide Propylene glycol pastes and calcium hydroxide glycerin pastes enhanced with days of incubation with days of incubation that was not significant. The CH-CMCP pastes showed highest antibacterial activity against the micro-organisms as compared to other pastes. P. intermedia and P. gingivalis exhibited large zones of inhibition. Fusobacteria and streptococcus milleri showed small growth of inhibition. It was observed in the present study that among all the calcium hydroxide preparation. Only CH-PG pastes remain in the paste from for a longer period of time and exert significant antibacterial action. The average diameter of the zones of inhibition for experimental group and other group were similar.

Zone of inhibition

Organism Observation	**Period**	**Zone of inhibition (mms)**			
		Group I	**Group II**	**Group III**	**Group IV**
P. Intermedia	Day 2	2.0	1.8	1.5	1.4
	Day 4	2.0	2.1	1.2	1.3
	Day 7	1.9	1.9	1.2	1.6
P.Gingivalis	Day 2	2.9	1.7	3.7	2.4

	Day 4	2.6	1.6	4.0	2.4
	Day 7	3.1	1.7	4.1	2.3
F. Nucleatum	Day 2	1.2	1.5	0.9	2.8
	Day 4	1.2	1.8	1.3	3.0
	Day 7	1.2	1.7	0.7	2.7
P.Micros	Day 2	0.4	1.0	1.4	3.0
	Day 4	0.5	1.4	1.1	2.6
	Day 7	0.5	1.7	1.3	2.9
S. Milleri	Day 2	2.1	2.0	1,3	2.4
	Day 4	2.3	1.7	1.2	2.5
	Day 7	1.8	1.6	1.4	2.7

Group I Calcium hydroxide + Distilled water
Group II Calcium hydroxide + Propylene Glycol
Group III Calcium hydroxide + Glycerin
Group IV Calcium hydroxide + Camphorated mono chloro phenol

DISCUSSION: Infected root canal exhibit a mixed microbial flora with anaerobic organism that is one of the major causes of pulpal infection. In modern endodantic, disinfection of root canal is established by combined effect of instrumentation & irrigation that has been further reduced the role of intracanal medicament just to limit the microbial growth in between the visit. Calcium hydroxide is more commonly used intracanal medicament that nearly fulfills the ideal requirement and when mixed with vehicles to from a paste, placed in contact with root canal space and periapical tissues to exert its antibacterial effect. The ditch place diffusion through agar method was used to chick the antibacterial property of an against. Four wells of 5mm diameter were cut on each solid agar media under sterile condition. The wells were then filed with different prep ration of calcium hydroxide and agar plates were then incubated at 37^0C and the zone of inhibition observed. [13] Distilled water does not possesses appreciable antibacterial property. The result showed that CH-DW pastes produced zone of inhibition that was significantly smaller, than other groups. The results of the study is similar to the studies done in the past. [2] Propylene glycol and glycerin possess significant antibacterial property and their pastes with calcium hydroxide showed antibacterial effect against organisms tested. The result showed that they produced large zone of inhibition as compared to CH-DW pastes.

They dissociates calcium hydroxide into calcium and hydroxyl ions due to the absorbtion of water by the hygroscopic nature of propylene glycol and glycerin gradually which can be contributed to the gradual ionic release.[12] Hence the calcium hydroxide propylene glycol paste and calcium hydroxide glycerin pastes remain in the paste from for longer period of time.

As compared to propylene glycol, glycerin is found to be more toxic and tissue irritant topically. It require further investigation related to biocompatibility before recommendation it as a vehicle for calcium hydroxide.

It was observed in the present study that among all the calcium hydroxide paste, CH-CMCP pasts exhibited relatively high inhibition zone. The results are similar with the finding of past studies.[8] calcium hydroxide combined with CMCP result in the formation of insoluble weak salt which may interfere with hydroxyl dissociation and reduce the long term activity.[1] CMCP is volatile liquid and rapidly lost from the paste.[15] It is irritant to the periapical tissue. It was also observed in the study that only CH-PG and CH-GY pastes had better handling properties, long

term activity as compared to the other pastes. They also have better flow and good sealing properties in the root canal space.[11] The CH-DW pastes and CH-CMCP pastes has a tendency to set fast and poor handling properties.

Considering the result of the study and review of literature, it can be said that the routine use of propylene glycol in place of CMCP can be recommended as vehicle. For calcium hydroxide in view of efficacy, better handling characteristic and non irritating properly to the periapical tissue, Glycerin can be use as alternative vehicle to propylene glycol.

CONCLUSION: The results of this study are suggestive of:

1) CH-CMCP paste gave the best results (maximum zone of inhibition) but its clinical use is objectionable due to its tissue irritating property and poor handling characteristics.
2) The routine use of propylene glycol in place of CMCP can be recommended as vehicle for calcium hydroxide in view of its efficacy better handling and non tissue irritating properties.
3) The use of glycerin as an alternative vehicle for calcium hydroxide.
4) Zone of inhibition is not a true indicative of the antibacterial activity. However, the result of the study were used to compare the antibacterial effect of calcium hydroxide using four different vehicles. Further investigation is required in vivo to test the antibacterial activity of the different calcium hydroxide pastes described in our study.

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