



Comparison of Antimicrobial Efficacy of Turmeric from three Different Regions of India as Intracanal Medicaments-An *In Vitro* Study

Mansi Baviskar¹, Shilpa S Naik², Rachna Anand³, Chinmaya Chaudhary^{4*} and Aayushi Mehta⁴

¹Professor, Department of Pediatric and Preventive Dentistry, D.Y. Patil Deemed to be University School of Dentistry

²Professor and Head of Department, Department of Pediatric and Preventive Dentistry, D.Y. Patil Deemed to be University School of Dentistry

³Senior Lecturer, Department of Pediatric and Preventive Dentistry, D.Y. Patil Deemed to be University School of Dentistry

⁴Post-Graduate Student, Department of Pediatric and Preventive Dentistry, D.Y. Patil Deemed to be University School of Dentistry

*Corresponding Author: Chinmaya Chaudhary, Post-Graduate Student, Department of Pediatric and Preventive Dentistry, D.Y. Patil Deemed to be University School of Dentistry.

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Abstract

Background and Aim: In endodontic procedures, the intracanal medicament is an integral part to achieve an antibacterial effect in the infected root canal. Calcium hydroxide is currently taken as the 'golden standard' in intracanal medicament. There is a renewed interest in ayurvedic herbal products in recent years – turmeric is known to have antibacterial, antiseptic properties and several studies have been conducted with contradictory results. This led us to wonder if the properties of the same ingredients differed from region to region.

Aim: To compare in-vitro, the antibacterial efficacy of turmeric from three different regions of India as an intracanal medicament with Calcium hydroxide as intracanal medicaments.

Material and Method: This is a pilot in-vitro study in which 5 ATCC strains were used (*E. faecalis*, *Streptococcus mitis*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Candida albicans*). The antibacterial efficacy of turmeric from three different regions was tested with calcium hydroxide as a control using the agar diffusion method. The zone of inhibition around all the wells will be measured on the 1st, 3rd, 5th, and 7th days.

Results: Calcium hydroxide showed the best zone of inhibition compared to turmeric from three different regions of India. Among the turmeric from three different regions, turmeric from Meghalaya showed better antimicrobial efficacy as compared to turmeric from Maharashtra and Tamil Nadu.

Conclusion: Calcium hydroxide remains the material of choice as intracanal medication.

Keywords: Calcium Hydroxide; Turmeric; Zone of Inhibition

Introduction

Pulp and periapical infections are caused by the microorganisms that are present in the root canals. The aim of root canal therapy is to eliminate these microorganisms and to provide an environment for tissue healing [1]. It has been observed that only mechanical instrumentation does not remove the microorganisms completely, but the use of intracanal medicaments and irrigants helps to eliminate the bacteria during and after cleaning and shaping [2].

Calcium hydroxide [Ca (OH)₂] (CH), a white odorless powder was first introduced in the field of endodontics by Herman in 1920 as a direct pulp-capping agent [3]. Calcium hydroxide is extensively used for indirect pulp capping, direct pulp capping, pulpotomy, and pulpectomy. Calcium hydroxide is also known to cause an increased root resorption rate. Estrela., et al. found that Ca (OH)₂ in infected dentinal tubules had no antimicrobial effect on *S. faecalis*, *S. aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, or on the bacterial mixture used throughout the experiment [4]. Therefore search for an alternative intracanal medication is still elusive which helps to improve the eradication of bacteria before obturation.

Ayurvedic medicine was the world’s oldest medical system, which originated in India over thousands of years. “*Ayurveda*” combines the Sanskrit word “*Ayur*” (life) and “*Veda*” (Science of knowledge). In this study, we have tried to infuse time-tested views of Ayurveda with modern technology.

We found several articles showing contrary results where in some studies turmeric showed good antibacterial efficacy while in some it did not. There are 70 species of turmeric of which 40 are cultivated in India. Studies done by Kamran Ashraf, *et al.* (2012) [5] and HK Sharma, *et al.* (2016) [6] found that turmeric cultivated in different regions of India showed different curcumin. Hence the study was designed to check if the antibacterial efficacy of turmeric was related to the location and the curcumin content found in different regions of India.

Materials and Method

This study is an experimental in-vitro pilot study carried out in the Infexn Laboratories located in the Thane district of Maharashtra, India. The Faculty Research Committee of D. Y. Patil University School of Dentistry (Approval number - IREB/2022/PEDO/16) gave ethical clearance for the study.

Five ATCC strains were used for this study

- Enterococcus faecalis (ATCC 29212)
- Streptococcus mitis (ATCC 49456)
- Staphylococcus Aureus (ATCC 29213)
- Klebsiella pneumoniae (ATCC 700603)
- Candida albicans (ATCC10231)

Turmeric was obtained from three different regions of India (Table 1).

Sr.no	Turmeric	Curcumin content
1	Wai, Maharashtra (Sample A)	4.16%
2	Lime-treated turmeric, from Wai, Maharashtra (Sample B)	4.16%
3	Salem, Tamil Nadu (Sample C)	3-4%
4	Lakadong turmeric, Meghalaya (Sample D)	7-12%

Table 1: Turmeric from different regions and their curcumin content.

All 5 strains were inoculated on separate Mueller Hinton agar plates except streptococcus mitis which was inoculated on the chocolate agar. A total of 5 Wells with diameters 6-8mm were punched on each agar plate with the help of a sterile cork [7]. Turmeric powder was weighed and dispensed on a sterile glass slab. It was then mixed with distilled water to a similar consistency as that of calcium hydroxide. Turmeric from three different regions of In-

dia (Sample A, B, C, D) was pipetted into the agar wells [8]. Calcium hydroxide was used as a control. The plates were then incubated at 37° C.

Statistical analysis

The zone of inhibition of all 5 wells on each agar plate was manually measured using a metered scale in millimeters on the 1st, 2nd, 3rd, 5th and 7th day.

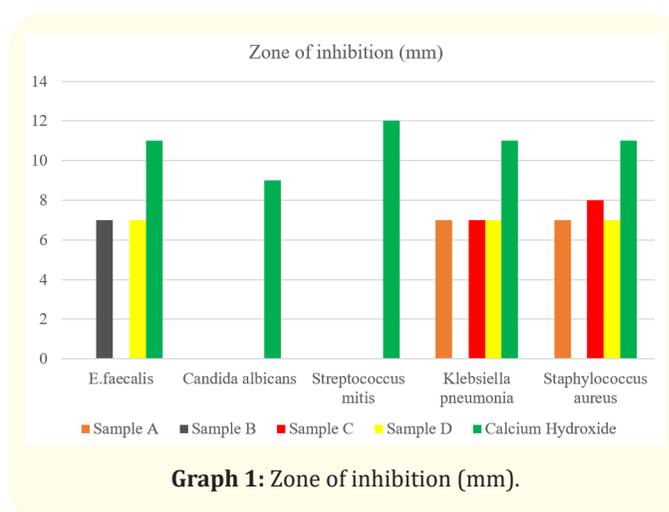
Results

Calcium hydroxide showed the best zone of inhibition against all the strains consistently on all days. Sample A and sample C showed mild antibacterial efficacy against Klebsheilla pneumoniae (Sample A-7mm, Sample C-7mm) and staphylococcus aureus (Sample A-7mm, Sample C-8mm). Sample B (7mm) showed mild efficacy only against *E. faecalis* while Sample D showed mild efficacy against Klebsheilla pneumoniae (7mm), staphylococcus aureus (7mm), and Faecalis(7mm). table 2.

Sr. no	Strain	Calcium Hydroxide	Sample A	Sample B	Sample C	Sample D
1.	Enterococcus faecalis	11mm	0mm	7mm	0mm	7mm
2.	Streptococcus mitis	12mm	0mm	0mm	0mm	0mm
3.	Staphylococcus Aureus	11mm	7mm	0mm	8mm	7mm
4.	Klebsiella pneumoniae	11mm	7mm	0mm	7mm	7mm
5.	Candida albicans	9mm	0mm	0mm	0mm	0mm

Table 2: Zone of inhibition (mm).

A graph was plotted after every reading taken on each day, no change was seen in the size of the halo on the 1st, 3rd, 5th and 7th day (Graph 1). This shows that there is no increase in the antibacterial activity after 3 days, sustained activity was observed up to 7 days.



Graph 1: Zone of inhibition (mm).

Discussion

Endodontic failure by the residual bacteria can be controlled by placing an intracanal medicament within the prepared canal. Calcium Hydroxide is the most used intracanal medicament and requires a period of 7 days for efficient disinfection [9,10]. Mechanism of action of calcium Hydroxide involves the release of hydroxyl ions (OH⁻) in an aqueous environment which damages the bacterial cytoplasmic membrane and their DNA and initiates protein denaturation [3].

Turmeric (*Curcuma longa*) is a flavourful yellow-orange spice [11]. **Curcumin**, the principal curcuminoid found in turmeric, is considered its most active constituent including other various volatile oils including turmerone, atlantone, and zingiberone. Curcumin, the main active constituent of *C. longa* has a broad range of activities including antioxidant, anti-inflammatory, anti-cariogenic, hypo-cholesterolemic, wound healing, antispasmodic, anticoagulant, antitumor, and hepatoprotective activities [12].

Curcuma longa showed better antimicrobial efficacy as compared to Calcium hydroxide as an intracanal medicament in a study carried out by Shruti Saha, *et al.* (2015) [13]. In a study done by Vasant R Digole, *et al.* (2020) [14] antimicrobial efficacy of curcumin showed the highest antibacterial efficacy followed by calcium hydroxide and aloe vera as an intracanal medicament. Rakesh Kumar Yadav, *et al.* (2018) [15]. compared the antimicrobial efficacy of calcium hydroxide, chlorhexidine gel, and curcumin against *E. faecalis* in their study and found that *C. longa* extract showed mild activity against *E. faecalis*. A study by MN Hegde, *et al.* (2012) [16] found that the aqueous extract of curcumin longa showed good results against *Staphylococcus aureus* and *Candida albicans* and mild activity against *Enterococcus faecalis*. In our study turmeric showed no antibacterial efficacy against *Candida albicans*. A study done by Yang, *et al.* (2021) [17] also found that turmeric exhibited poor antibacterial properties with a higher rate of bacterial growth. This was similar to the results obtained in our study.

Conclusion

Calcium hydroxide showed the best antibacterial efficacy and remains the material of choice as intracanal medication but not without its share of disadvantages like increased internal root resorption. Hence the search for ideal material is still elusive.

The experiment shows that species of turmeric have different levels of antibacterial properties against different bacteria.

Turmeric showed mild antibacterial efficacy against *E. faecalis*, *klebsiella pneumoniae*, and *Staphylococcus aureus* from which turmeric from Meghalaya (Lakadong) showed better antibacterial efficacy as compared to turmeric from Maharashtra and Tamil Nadu.

More in-depth studies on properties and combinations can be carried out.

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