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ORIGINAL RESEARCH

COMPARATIVE ANALYSIS OF HERBAL ROOT CANAL IRRIGANT'S ANTIBACTERIAL EFFECTIVENESS

Richa Goel[1], Neelam Makwana[2], Kalpesh Vaishnav[3], Mohamed Tharwat Salama[4], Nitin Purohit[5], Pavithra Rangarajan[6], Silpiranjan Mishra[7]

[1].PhDScholar, Professor & Head, Department of Public Health Dentistry, Karnavati School of Dentistry, Karnavati University, Gandhinagar-Pin code- 382007, Gujarat, India.
[2].Professor & Head, Karnavati Scientific Research Centre, Karnavati School of Dentistry, Karnavati University, Gandhinagar, Pin code- 382007, Gujarat, India.
[3].Professor & Head, Department of Prosthodontics, Karnavati School of Dentistry, Karnavati University, Gandhinagar- Pin code- 382007, Gujarat, India.
[4].Lecturer Pediatric Dentistry, Orthodontics and Pediatric Dentistry Department, College of Dentistry, Qassim University, KSA.PhD Scholar, Pedodontics and Preventive Dentistry Department, Sharad Pawar Dental College and Hospital, Datta Meghe Institute of Higher Education and Research, Maharashtra, India.
[5]MDS, OMFS, Consultant Oral and Maxillofacial Surgeon, Department of Dentistry, District Hospital, Rudraprayag, Uttarakhand, India.
[6].Reader, Department of Periodontics, Ragas Dental college and Hospital, Uthandi, Chennai-600119, Tamilnadu, India.
[7].Associate Professor, Department of Oral Medicine and Radiology, Kalinga Institute of Dental Sciences, KIIT Deemed to be University, Bhubaneswar, Odisha, India.
Corresponding author Dr. Nitin Purohit. MDS, OMFS, Consultant Oral and Maxillofacial Surgeon, Department of Dentistry, District Hospital, Rudraprayag, Uttarakhand, India. E-mail: drnitinomfs007@gmail.com
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ABSTRACT

Background: The total removal of microorganisms from the root canal is essential for effective root canal procedure. The objective of this research was to assess the antibacterial properties of sodium hypochlorite (NaOCl) in combination with herbal root canal irrigants (Tulsi, neem extract, and triphala).
Methods: Mueller-Hinton agar plates were injected with the bacterial E. faecalis(ATCC) culture, which had been cultured overnight in brain heart infusion (BHI) broth. The agar well diffusion method was used to measure antibacterial inhibition. After adding each of the four research irrigants to its corresponding well on an agar plate, the plates were incubated for 24 hrs at 37°C. Each well's surrounding bacterial inhibitory zone was observed. The findings were examined statistically.
Result: Neem and triphala extracts exhibited the greater inhibitory zone against E. faecalis in NaOCl, whereas tulsi extract showed the least.
Conclusion: Neem extract, triphala, and tulsi, three herbal remedies that were tested, shown an inhibitory zone against E. faecalis. Therefore, these irrigants can be applied as irrigating solutions for root canals.

***Keywords*:**Antimicrobial, herbal, irrigants, root canal

INTRODUCTION

In order to produce the perfect environment for tissue repair, the goal of root canal therapy is to eradicate bacteria from the root canal.[1] In unsuccessful root canals, Enterococcus faecalis is typically isolated. It is independent of other bacteria's survival and can infiltrate dentinal tubules. An anaerobic gram-positive bacterium, it is the cause of 80–90% of enterococcal infections. [2,3] Because all germs cannot be eliminated by

mechanical cleaning, adequate irrigation with intracanal medication is recommended.[2] In situations when instrumentation is not available, root canal irrigation aids in the elimination of germs. [4]

Sodium hypochlorite (NaOCl) and 2% chlorhexidine (CHX) are two examples of chemical root canal irrigants that have been utilised successfully.[2, 5] Strong antibacterial CHX works well against *E. faecalis,* the bacteria that causes endodontic failure. At low concentrations, it is bacteriostatic; at high concentrations, it is bacteriocidal.[2,6] The most popular root canal irrigating solution is NaOCl, the gold standard antibacterial agent with tissue-dissolving qualities.

The best root canal irrigants should taste and smell well, be nontoxic, and be biocompatible.[6,7] Despite their effectiveness in root canal irrigation, chemical irrigants have a number of drawbacks. An allergic reaction, tissue toxicity, instrument staining, periapical tissue irritation, the inability to remove the smear layer, and an unpleasant taste and smell are all caused by NaOCl.[6,8] When CHX and sodium hypochlorite are combined, parachloroanaline, a carcinogen, is created. The drawbacks of CHX include tissue toxicity and an unpleasant taste and odour. [6] Cytotoxicity and drug resistance are disadvantages of chemical irrigants.[9]

The search for substitute herbal medications has been encouraged by the increase of antibiotic-resistant strains and the adverse effects of chemical irrigants. A variety of botanical extracts, including aloe vera, tulsi, and neem.[2, 6, 8] Because of their advantageous qualities, herbal products and their derivatives are becoming more and more popular as root canal irrigants. [10]

The Indian Neem or Margosa tree is AzadirachtaIndica. It is antibacterial against Candida albicans and *E. faecalis*. Because of its significant antibacterial and antioxidant qualities, it may be used as a root canal irrigation agent. [5]

Terminalia bellerica, Terminalia chebula, and Emblicaofficinalis are three medicinal plants whose dried and powdered fruits make up the well-known ayurvedic herbal combination known as triphala. Many substances, including tannin, quinones, flavonoids, flavanols, gallic acid, and vitamin C, are found in triphala. Tannins can deactivate enzymes and microbial adhesins. [5]

The purpose of this study was to assess the antibacterial properties of sodium hypochlorite (NaOCl) in combination with herbal root canal irrigants (Tulsi, Triphala, and neem extract).

MATERIALS AND METHOD

***Azadirachtaindica* (neem) extract preparation:** Fresh, A. indica leaves were gathered and cleaned from the garden. 800 millilitres of distilled water were placed in a beaker with 100 grammes of neem leaves tied in a muslin cloth. To get a 25% concentration of aqueous neem extract, this beaker was heated over a low flame until the extract reduced to 400 ml. Following cooling, the extract was filtered through filter paper and put away for later use.

Preparation oftulsi extract: Tulsi seeds were pulverised into a fine powder after being exposed to shade drying. Then, using Soxhlet with 90% ethanol as the solvent, 45 g of powder were extracted.

Triphala (Alantra, Alantra Healthcare Private Limited, India) and sodium hypochlorite (OMAL, Orient Micro Abrasive Ltd, India) that are commercially available were utilised in the study. Mueller-Hinton agar plates were infected with the bacterial culture of *E. faecalis* (ATCC 29212), which had been cultured overnight in brain heart infusion (BHI) broth. The agar well diffusion method was used to calculate antibacterial inhibition. After adding each of the four research irrigants to its corresponding well on an agar plate, the plates were incubated for 24 hours at 37°C. Each well's surrounding bacterial inhibitory zone was recorded. The ANOVA test was used to statistically analyse the results at $P<0.05$.

RESULT

Table 1 indicated that sodium hypochlorite had highest inhibitory zone against*E feacalis* followed by neem extract, triphala and least with tulsi extract.

Table 1. various root canal irrigant's Inhibitory zone against *EnterococusFeacalis*

Group	Mean	SD	SE
Neem extract	26.4	1.153	0.243
Tulsi extract	20.5	1.123	0.186
Triphala	25.8	1.148	0.240
Sodium hypochlorite	30.7	1.162	0.341

DISCUSSION

According to the current study, sodium hypochlorite has the largest inhibitory zone, subsequently triphala, neem, and tulsi extracts. Because *E. faecalis* is so common in secondary endodontic infections, it was selected for this study.

Babaji et al. used sodium hypochlorite (NaOCl) to measure the antibacterial properties of herbal root canal irrigants, such as Aloe vera, Azadirachtaindica extract, and Morrindacitrifolia. They came to the conclusion that the herbal remedies they examined exhibited an inhibitory zone against E. faecalis and could be applied as irrigating solutions for root canal therapy. [1]DurgaBhavani et al. found that herbal medicines that showed an inhibitory zone against *E. faecalis* included triphala, propolis, and aloe vera. [11] Ganesh et al. found that when administered as irrigants, the herbal group (Morindacitrifolia juice, coconut milk, and triphala) significantly reduced E. *Faecalis.*[9] In contrast to saline and noni, Afshan et al. found that neem leaf exhibited a higher level of inhibition against E. Faecalis. [12] When compared to 2% CHX, Rathee et al. herbal medicines (neem, tulsi) have demonstrated strong antibacterial efficacy in primary endodontic infections. [13]

According to Mali et al., myrobolan, nutmeg, and tulsi can all be utilised as effective irrigants for primary teeth. [10] As a root canal irrigant, Sarath Kumar et al. discovered that herbal extracts (garlic, lemon, and guava leaf extract) are more effective against *E. faecalis* than 5% sodium hypochlorite. [14]

Herbal mewdicaments such as, turmeric, triphala have anti inflammatory, antioxidant, anti-fibrotic properties.[15] Vathsala et al concluded that, Triphala, Neem, green tea and Turmeric are effective agains *E Faicalis* and uses full as root canal irrigants. [16]

Vinothkumar et al. used real-time quantitative polymerase chain reaction (qPCR) to perform an in vitro investigation. In line with the current investigation, this study found that A. indica was more effective than sodium hypochlorite against Candida albicans and *E. faecalis.* [7]

According to the studies mentioned above, herbal irrigants may be utilised as conjunctive agents or as alternatives for root canal disinfection.

Limitation of the study: The current research has a smaller sample size and it was in vitro research. The requirement for fresh processing and taste modification for acceptability is a major drawback of plant extracts.

Herbal irrigants have been shown to have antibacterial and therapeutic properties against oral germs, and they are readily available and reasonably priced. To assess the effectiveness of herbal irrigants against any potential root canal microorganism, more research is needed.

CONCLUSION

Neem, triphala, and tulsi, three herbal remedies that were tested, confirmed inhibitory zones against *E. faecalis.* These can therefore be applied as irrigating solutions for root canals. To test these herbal remedies and adjust their content for patient acceptability, more in vivo study is needed.

DECLARATIONS

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable.

Competing interests

Theauthorsdeclarenoconflict of interest.

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