



AN OVERVIEW OF THE ANTIMICROBIAL EFFECT OF NATURAL IRRIGANTS IN DISINFECTION OF ROOT CANAL SYSTEM

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ABSTRACT

The endodontic irrigants have an important role in eradicating microorganisms from the canal space to achieve a host manageable bioburden. The most important purpose for treating the root canal is to obtain an aseptic field and achieve the root canal system's three-dimensional obturation. The irrigating solutions used in endodontics can irritate the periradicular region due to their cytotoxicity and would not remove the microorganism which has penetrated deeper into the dentinal tubule. Phototherapy, a natural herbal alternative and biological medication, have been popularly used in endodontics due to its ease of availability, reduced cost, less toxicity, and improved shelf life. The present literature survey reviews the importance of using herbal medicaments and irrigants in the disinfection of the root canal system. In the current review article, we performed a Medline, PubMed, scopus search for all English-language articles published till July 2022. We used the keywords 'herbal irrigants' 'endodontic irrigant' 'biocompatibility', cytotoxicity.

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Introduction

Microorganisms have been shown to significantly influence the pathophysiology of pulp and periapical disorders. The major goal of endodontic therapy is the whole root canal system's disinfection, which necessitates the removal of bacteria and microbial components and avoiding reinfection during and after treatment [1]. Creating totally sterile conditions, on the other hand, is difficult. Even when done meticulously, mechanical preparation cannot cover substantial regions (>35%) of the canal walls, especially in the root's apical third. As a result, chemical irrigation is critical for root canal disinfection [2].

Irrigation is a technique that lubricates the root canals by soaking them with various kinds and concentrations of liquids and ensuring the disinfection of root canals by physically and chemically eliminating inorganic/organic waste, soft and hard tissue residues, bacteria, and infected pulp tissue [3].

The currently available irrigating agents are artificial compounds that may fail to produce their action. Researchers have been searching for treatments with natural and herbal products, and research pieces have indicated that natural substitutes for endodontic practice are completely encouraging, given the unfavorable and inadequate specifications of existing solutions, the continuous enhancement in the number of strains resistant to solutions, and the side effects of synthetic medicines [3].

The most important aspect of endodontic therapy is to prevent the development and progression of apical periodontitis by reducing the inflammatory makers and the infected tissues, thereby producing an aseptic field for better periapical healing [4, 5].

The antibacterial impact of herbal root canal irrigant to prevent intra-radicular biofilms is the topic of this review. As a result, further study may be needed to better our present understanding of the microbial ecology within root canals and how it affects oral and systemic health.

Materials and Methods

Articles published in the electronic databases of Open Grey, Web of Science, Science Direct, PubMed, and Scopus were searched. Two examiners worked independently to conduct the search. The electronic search technique was created by merging Medical Subject Heading (MeSH) phrases and text words from the most referenced descriptors in the previous publication on this topic. The phrases "herbal irrigant," "antimicrobial activity," "biocompatibility," and "antioxidant" were merged for each database.

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Neem (A. indica A Juss, margosa tree)

Neem (*A. indica* A Juss, margosa tree) is an ancient Indian plant with therapeutic benefits in all of its parts. Antioxidant, antifungal, anti-inflammatory, antibacterial, antiviral, and immune-stimulatory specifications are all present. Its antibacterial, biocompatibility and antioxidant qualities make it an excellent endodontic irrigant. Sweeteners can be added to change the bitter flavor. Neem extract is efficient against gram-positive and gram-negative bacteria, making it a viable option for root canal irrigation. Compared to NaOCl or *M. citrifolia*, we found that neem had a smaller inhibitory zone. Contradictory to our findings, Damre, Hegde *et al.*, and Gonmode *et al.* found that neem had the greatest inhibitory zone compared to NaOCl in their experiments [6].

M. citrifolia

Noni is the trade name for *M. citrifolia*. It is an antifungal, antiviral, antibacterial, antihelminthic, analgesic, and hypotensive herb that has been utilized in traditional medicine for centuries. As an antibacterial agent, *M. citrifolia* includes alizarin and L-asperuloside, which are more potent than 2 percent CHX. Endodontic irrigants containing 6% *M. citrifolia* are efficacious. In their investigation, Murry *et al.* determined that *M. citrifolia* had similar intracanal irrigating characteristics to NaOCl and EDTA [7].

A. vera (Aloe barbadensis)

Antibacterial characteristics are found in *A. vera*, a naturally occurring plant. Antifungal, antibacterial, antiviral, and anti-inflammatory activities are all present. It inhibits *Streptococcus pyogenes* and *E. faecalis* due to the anthrax quinine it contains. In contrast to our findings, Karkare *et al.* determined that *A. vera* had the greatest inhibition zone against *E. faecalis*, comparable to NaOCl. Ambareen *et al.* showed that NaOCl had the largest inhibition zone against *E. faecalis*, followed by ginger extract, garlic extract, and neem and the least inhibitory zone for *A. vera*, which was similar to our findings [8].

Propolis

Propolis is a resinous hive product consisting of a mixture of constituents. For treating various illnesses and inflammatory conditions in both systemic and local applications, Propolis has been utilized. Naturally, it is a sticky material at room temperature but gets brittle and hard at low temperatures; it is composed of balsams and resin (50 - 70%), pollen (5 - 10%), wax (30 - 50%), essential oil, sand and other constituents, which are minerals, amino acids, vitamins A, B complex, E and the highly active biochemical substance known as bioflavonoid, aromatic and phenols compounds. Flavonoids are famous plant compounds with antifungal, antioxidant, antibacterial, anti-cariogenic, antiviral, and anti-inflammatory properties. As intracanal irrigants, Al-Madi and AlQathami examined the antibacterial effectiveness of sodium hypochlorite, Propolis, and saline. After accessing the canal, irrigation and instrumentation, the microbiological samples were obtained from the teeth. According to the findings of this investigation, Propolis possesses antibacterial activity comparable to sodium hypochlorite [9].

Meswak

Salvadora Persica is a medicinal plant whose roots, branches, and stems have been used as oral hygiene instruments for ages in various regions, including Saudi Arabia. Many research has shown that alcoholic extracts of *Salvadora Persica* with concentrations of 1%, 5%, 10%, 15%, and 20% exhibit antiplaque, antiperiopathic, anticaries, anti-inflammatory, and antimycotic properties. Compared to normal saline, a 15% alcoholic extract of *Salvadora Persica* demonstrated antibacterial activity comparable to sodium hypochlorite and chlorhexidine [10].

Triphala

It's a plant extract made from therapeutic plants that are antibacterial and high in citric acid. The irrigant has been indicated to be efficient in destroying *E. Faecalis* microorganisms and removing the smear layer in studies. The mixture of three medicinal plant compositions is responsible for this combined effect [11].

Green Tea

It is a traditional Japanese and Chinese beverage made from the *Camellia Sinensis* tea plant's young shoots. Green tea polyphenols are more frequently referred to as flavanols or catechins. Green tea polyphenols have been shown in many animals, humans, and in vitro studies to have strong antioxidant, anti-cariogenic, anti-inflammatory, thermogenic, probiotic, and antibacterial activities. Because of its antioxidant qualities, tea also contains natural fluoride, which may aid in the prevention of tooth decay [12].

Tree Tea Extract Tea Tree Oil (Melaleuca Alternifolia)

The young branches of the *Camellia Sinensis* tea plant are used to make this traditional Japanese and Chinese beverage. Polyphenols discovered in green tea are also recognized as catechins or flavanols. Green tea polyphenols have been indicated to have potent anti-cariogenic, antioxidant, probiotic, anti-inflammatory, thermogenic, and antibacterial properties in various animal, human, and in vitro investigations. It may be an effective antiplaque agent and can effectively reduce biofilm growth due to its antioxidant properties. Tea also includes naturally occurring fluoride, which may help to prevent tooth decay [13].

Arctium Lappa

The therapeutical characteristics *Arctium lappa* was introduced from Japan and acclimated in Brazil. It is frequently utilized in traditional medicine. It possesses antifungal and antibacterial properties, anxiolytic, diuretic, antioxidant properties, and HIV inhibitory and platelet anti-aggregating properties. In vitro testing of *Arctium lappa*'s antibacterial activity against microorganisms involved in endodontic infections revealed that *Arctium lappa* inhibited the studied endodontic pathogens significantly. *Arctium lappa*'s microbial inhibitory capacity was discovered in this study, which suggests that it might be used as an intracanal medicine [14].

Allium Sativum (Garlic)

Allicin, the principal active component, damages root canal bacteria's cell wall and cell membrane, making it a viable alternative to sodium hypochlorite as an irrigant [15].

Jeeryin Solution

This is an antibacterial, anti-inflammatory, and detoxifying Chinese herbal ingredient. It exhibited a comparable impact to sodium hypochlorite when administered at a 30% dosage for root canal irrigation [16].

Terminalia Chebula and Myristica Fragrans (Nutmeg)

The primary ingredient of *Myristica fragrans*, myristic acid, has antibacterial properties. The antibacterial activity of *Terminalia Chebula* is due to the tannin. Five plant extracts were tested as antimicrobial endodontic irrigants in a research done by Thila S.Vinothkumar *et al.* *Azadirachta Indica*, *Aloe Vera*, *Myristica fragrans*, *Curcuma Longa*, and *Terminalia Chebula* were the most effective extracts, in descending order [17].

Aroeira-da-praia and Quixabeira

The root canal cleansing capacity and antimicrobial activity of *Quixabeira* and *Aroeira-da-Praia* against *E.faecalis* were assessed in an in vitro investigation done by Edja Maria Melo de Brito Costa *et al.* *Aroeira-da-Praia* were shown to be antimicrobial at all densities examined. Still, *Quixabeira* was only influential at 50% and 100% densities [18].

Conclusion

Herbs have a lot of uses, one of which is root canal disinfection. To disinfect the canal, intracanal medicaments are commonly employed. They do, however, have several drawbacks. In certain cases, bacterial leftovers have enhanced the risk of reinfection. As a result of the potential side effects and safety concerns, employing herbs and plants as alternatives may be a more plausible option. Herbal replacements have very little, if any, adverse effects. It has been shown that Ayurveda has been widely used to use these plants from ancient times. These medicinal herbs contain anti-inflammatory, antibacterial, and antioxidant characteristics that effectively limit infections while causing little damage to tooth tissues. They help heal, but they also help to protect by boosting immunity.

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