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Study of Herbal vs Chemical Irrigant and Antibiotic against Enterococcus faecalis

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Abstract

Irrigation solutions are an important part of root canal therapy to completely disinfect the root canal area. Recently, there has been a lot of interest in using herbal extracts in the treatment of endodonties due to their benefits and low side effects. Therefore, we have designed a classification system for the classification of herbal and non-herbal Endodontic Irrigants since there is currently no standard classification.This structured classification will provide an overview on the variety of herbal Irrigants and the potential uses of each one. It will also make it easy to separate the studies and use herbal Endodontics according to the needs.The proposed classification system will prove to be very useful for students, researchers and clinicians. Herbal irrigants are becoming increasingly popular in endodontics for several reasons: ***High Antimicrobial Activity****,* ***Anti-inflammatory Properties****,* ***Biocompatibility****,* ***Ease of Availability and Cost-Effectiveness****,* ***Low Toxicity****.* ***Minimal or No Staining****,* ***Decreased Microbial Resistance****. These advantages make herbal irrigants an attractive option for root canal treatments, offering a natural and potentially safer alternative to traditional chemical irrigants.*

Key words: *Enterococcus faecalis, herbal and non-herbal. Antibiotic, sodium hypochlorite, cyclodextrin*

1.INTRODUCTION:

Enterococci are also called opportunistic pathogens that live in your digestive tract and vagina. There are at least 18 different species of these bacteria. Enterococcus faecalis (E. faecalis) is one of the most common species naturally occurring in the intestine. Although it is usually harmless in this environment, it can cause a serious infection if it spreads to other areas of the body. These bacteria also live in the mouth and vagina. They are very hardy, so they can survive hot, salty or acidic environments. But it can cause a more serious infection if it spreads to other parts of the body, E. faecalis usually lives harmlessly in the human intestine.In general, bacteria can enter blood, urine or wounds during an operation. From there, it can spread to different places, causing more serious infections, including sepsis, endocarditis, and meningitis. E. faecalis bacteria usually do not cause problems in healthy people. However, people with weak immune systems are more likely to become infected or sick. These infections are often spread in hospitals.In recent years, drug-resistant E. faecalis strains. Today, many antibiotics are ineffective against infections caused by these bacteria.This article explains the causes and symptoms of Enterococcus faecalis infections and the treatment of these infections.

Figure 1:E.Faecalis im moutm and dentries

To avoid infection, practice good hygiene, especially washing your hands with soap and water or using an alcohol-based disinfectant[1 &2]. You should also keep your wounds clean and avoid sharing personal items with others. If you have a medical device, such as a catheter or dialysis port, make sure it is properly inserted and stored. If you are in a hospital, ask your healthcare professionals to wash their hands before touching you or your device1. Enterococcus faecalis can be resistant to some antibiotics, so it is important to take your prescribed medicine as directed and not to stop without talking to your doctor3.There are different options for treating Enterococcus faecalis infections, depending on the type and severity of the infection and the antibiotic resistance of the bacteria. Some possible treatments include:

2.ANTIBIOTICS: This is the most common and effective treatment for bacterial infections. However, some strains of E. faecalis are resistant to certain antibiotics, such as penicillin, ampicillin and vancomycin[5]. Therefore, it is important to contact your doctor and take the prescribed medication as directed. Do not stop or change the dose without your doctor's approval.

Newer antibiotics that have shown activity against E. faecalis include:

2.1.Daptomycin: This is a cyclic lipopeptide that binds to the bacterial cell membrane and causes depolarization and cell death. Daptomycin is active against both vancomycin-susceptible and vancomycin-resistant E. faecalis, and it has been approved for the treatment of complicated skin and soft tissue infections and bacteremia caused by enterococci[1c].

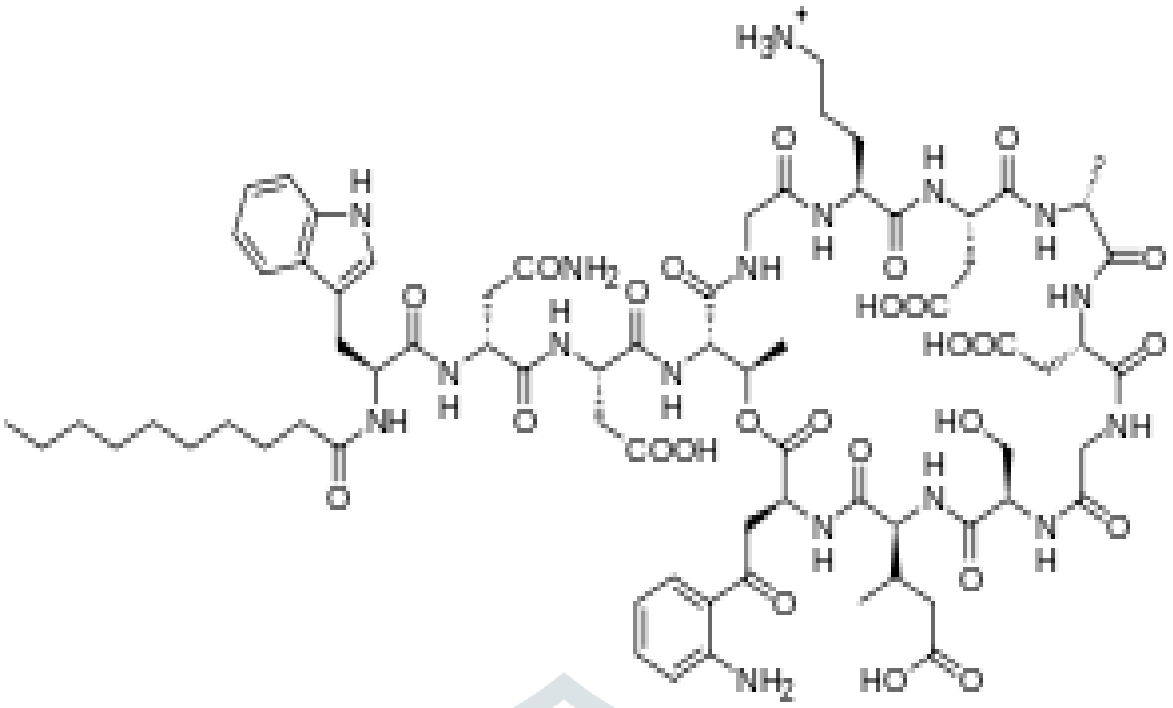

Figure 2:Deptomycin

2.2.Linezolid: This is an oxazolidinone that inhibits protein synthesis by binding to the 23S ribosomal RNA of the 50S subunit. Linezolid is active against both vancomycin-susceptible and vancomycin-resistant E. faecalis, and it has been approved for the treatment of complicated skin and soft tissue infections, pneumonia, and bacteremia caused by enterococci[1.2&3]

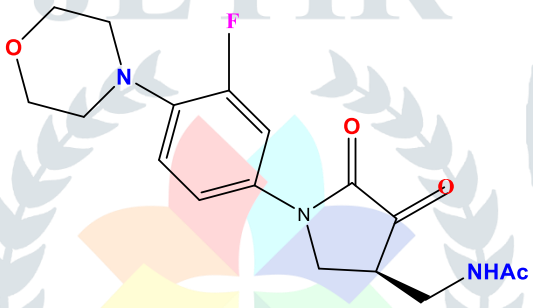

Figure 3:Linezolid

2.3.Tedizolid: This is a second-generation oxazolidinone that has a similar mechanism of action as linezolid, but with improved pharmacokinetics and potency. Tedizolid is active against both vancomycin-susceptible and vancomycin-resistant E. faecalis, and it has been approved for the treatment of acute bacterial skin and skin structure infections caused by enterococci[1].

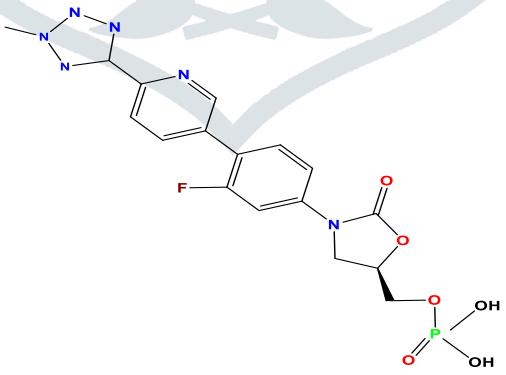

Figure 4:Tedizolid

2.4.Tigecycline: This is a glycylcycline that inhibits protein synthesis by binding to the 30S ribosomal subunit. Tigecycline is active against both vancomycin-susceptible and vancomycin-resistant E. faecalis, and it has been approved for the treatment of complicated skin and soft tissue infections and intra-abdominal infections caused by enterococci[1-4].

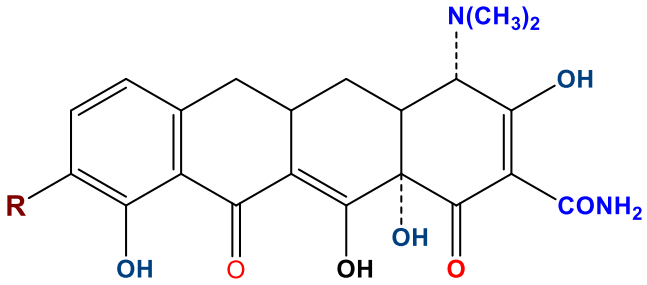

Figure 5:Tigecycline

2.5.Omadacycline: This is a tetracycline derivative that inhibits protein synthesis by binding to the 30S ribosomal subunit. Omadacycline is active against both vancomycin-susceptible and vancomycin-resistant E. faecalis, and it has been approved for the treatment of acute bacterial skin and skin structure infections and community-acquired bacterial pneumonia caused by enterococci[1-8]

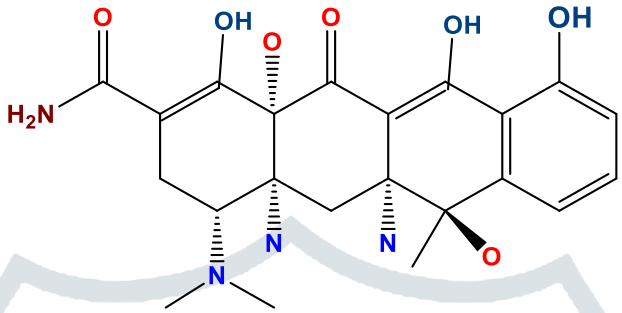

Figure 6:Omadacyline

3.HERBAL MEDICINES: Some herbal products have shown antimicrobial activity against E. faecalis such as turmeric, triphala, beeswax, neem and moringa[1- 5]. These herbs can be used as root canal rinses, mouthwashes or supplements to prevent or treat oral infections caused by E. faecalis. However, evidence of their effectiveness and safety is limited, and they may interact with other medications or cause side effects. Therefore, it is recommended to consult a doctor before using herbal products.

4.PROBIOTICS: These are beneficial bacteria that can help balance the intestinal flora and prevent the overgrowth of harmful bacteria such as E. faecalis. Probiotics can be found in foods such as yogurt, kefir, sauerkraut and kimchi or in supplements. Probiotics can help prevent or treat urinary tract infections, periodontitis, and other infections caused by E. faecalis[1-3] bacteria. But more research is needed to confirm their effectiveness and safety, and they may not be suitable for people with weakened immune systems or other medical conditions. Therefore, it is recommended to consult a doctor before using probiotics.

5.CHEMICAL AND HERBAL IRRIGANT:

A variety of herbal and Chemical /non-herbal irrigants can be used to eliminate Enterococcus faecalis bacteria from the root canal system. Some of the more common ones are:

5.1.CHEMICAL IRRIGANT

5.1.1.SODIUM HYPOCHLORITE: Sodium hypochlorite, commonly used as a disinfectant and bleaching agent. Its formula is NaOCl and it consists of sodium cation (Na+) and hypochlorite anion (OCl-). This is a non-vegetable wetting agent widely used for its antibacterial, tissue-dissolving and soiling properties . However, it has some disadvantages such as toxicity, irritation, unpleasant taste and possibility of tissue damage[1].

The mechanism of action of sodium hypochlorite is based on its ability to react with and destroy organic substances. It can also kill bacteria and other microorganisms by oxidizing their cellular components and inhibiting their enzymes. Sodium hypochlorite can also neutralize or hydrolyze essential amino acids and fatty acids.

Sodium hypochlorite is widely used in endodontics, which is the branch of dentistry that deals with the pulp and root treatment of teeth. Sodium hypochlorite is used as an irrigation to clean and disinfect the root canal and remove infected tissue and debris. It can also dissolve organic matter and dissolve plaque, which is a thin layer of debris that covers the dentinal walls of the root canal.

Sodium hypochlorite is also used in other areas such as water treatment, food processing, laundry and household cleaning. However, it has some disadvantages such as corrosive and toxic properties, instability and tendency to degrade, and the possibility of causing allergic reactions or tissue damage.

5.1.2.CHLORHEXIDINE: This is another non-herbal humectant with broad-spectrum antimicrobial activity, particularly against E. faecalis. It also has intrinsic activity, which means it can bind to dentin and provide long-lasting antibacterial activity. However, when mixed with sodium hypochlorite, it can cause tooth staining, allergic reactions and precipitation.

Chlorhexidine is a chemical compound with the molecular formula C22H30Cl2N10. It consists of two symmetrical 4-chlorophenyl rings and two biguanide groups linked by a central hexamethylene chain. The structure of chlorhexidine can be represented as follows:{ClC_6H_4NHC(NH)NH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-NHC(NH)NH-C_6H_4Cl}Chlorination, which is a cationization that is means it has a positive charge at physiological pH. It can form salts with various anions such as gluconate, acetate or hydrogen chloride. Chlorhexidine is widely used as an antiseptic and disinfectant in medicine and dentistry because it has a broad spectrum of activity against bacteria, fungi and some viruses.

5.1.3.OCTENIDINE: Another non- herbal irrigant that has been studied for root canal disinfection is octenidine, which is an antiseptic agent. Some studies have reported that octenidine (0.1%) has a higher antimicrobial efficacy than NaOCl (5%) against E. faecalis, and can also prevent the regrowth of bacterial biofilms. [5] However, octenidine is not widely available or approved for root canal irrigation in many countries, and its long-term safety and effectiveness are still unclear.
Therefore, the choice of non herbal irrigant and its concentration for the treatment of E. faecalis infections should be made by the dentist after considering the evidence, the availability, and the patient's condition. The irrigant should also be used with proper techniques and precautions to avoid complications and ensure successful outcomes[4] .

5.2.HERBAL IRRIGANT:

5.2.1.TURMERIC (Curcuma longa): It is a herbal humectant originating from the rhizome of Curcuma longa. It has anti-inflammatory, antioxidant and antimicrobial properties. It has been shown to have significant antibacterial activity against E. faecalis when used as a root canal irrigant[1-4a].


Figure 7:Turmeric (Curcuma longa)

Turmeric contains several bioactive compounds, with **curcuminoids** being the most notable. Following components that found in turmeric and their relevance as a teeth irrigant:

- **Curcumin**: The bright yellow chemical produced by turmeric, curcumin is a major curcuminoid. It is approved as a food additive by the World Health Organization, European Parliament, and United States Food and Drug Administration. Curcumin has antioxidant, anti-inflammatory, and antimicrobial properties.
- **Demethoxycurcumin** and **Bisdemethoxycurcumin**: These are other curcuminoids found in turmeric. They contribute to its health benefits.
- **Volatile Oil**: Turmeric contains essential oils, including compounds like **turmerone** and **zingiberene**.
- **Starch**, **Protein**, and **Dietary Fiber**: These provide additional nutritional value.
- **Vitamins**: Turmeric is rich in **vitamin A** and other vitamins.

As a teeth irrigant, turmeric's curcuminoids may offer antimicrobial effects. However, it's essential to note that **sodium hypochlorite (NaOCl)** remains the preferred choice due to its superior antibacterial efficacy. Further research is needed to explore ways to enhance the effectiveness of turmeric and other natural alternatives for root canal irrigation. [4b]
While turmeric has been used traditionally for various purposes, high-quality clinical evidence supporting its efficacy in treating diseases is still limited.

5.2.2.TRIPHALA: It is a herbal irrigant that is a mixture of three fruits: Terminalia chebula, Terminalia bellerica and Emblica officinalis. It has anti-inflammatory, antioxidant and antimicrobial properties. It has been shown to have antibacterial activity similar to chlorhexidine against E. faecalis when used as a root canal rinse[2-5].

5.2.3.PROPOLIS: This is a plant watering substance, which is a resinous substance collected by bees from plants. It has anti-inflammatory, antioxidant and antimicrobial properties. It has been shown to have moderate antibacterial activity against E. faecalis when used as a root wash[3- 6].These are some herbal and non-herbal irrigants that can be used to treat E. faecalis. fecalised infections in the root canal system.

Turmeric, triphala and propolis are some herbal moisturizers that have shown antimicrobial activity against E. faecalis, but there is little evidence of their efficacy and safety, and they may interact with other drugs or cause side effects According to a systematic review of in vitro studies, none of the herbal agents can be used as primary irrigants. . disinfect canals because they are less effective than NaOCl.

5.2.4.MISWAK: derived from the **Salvadora persica** plant, is traditionally used as a natural tooth-cleaning chewing stick. It has been recognized for its therapeutic effects on oral health, including antibacterial, anti-fungal, anti-viral, anti-cariogenic, and anti-plaque properties[8&9]. In endodontics, a 10% water extraction of Salvadora persica has been found to be an effective antimicrobial agent when used as an irrigant in the treatment of teeth with necrotic pulps[1].
The use of herbal extracts as endodontic irrigants is gaining popularity due to their advantages and minimal side effects. A classification system for these herbal endodontic irrigants can help in understanding their diversity and potential uses. Miswak is one such herbal irrigant that has been studied for its efficacy and potential benefits in dental care[8&9]. Miswak extract was found to be significantly more effective in removing dental plaque when compared with Oral-B toothpaste.[8] Al-Lafi and Ababneh[9] reported that using chewing sticks twice a day on a regular basis may reduce the incidence of gingivitis and possibly dental caries. Apart from their


Figure 8:Miswak stic a natural teeth cleaner

antibacterial activity, they also inhibit formation and activity of dental plaque and can be used effectively as a natural toothbrush for teeth cleaning.

The **chemical composition** of the **miswak** (chewing stick made from the *Salvadora persica* tree) includes several natural constituents that benefit oral health. Let's explore these components:

- **Salvadorine**: This compound is responsible for the **antibacterial activity** of miswak. It helps control the formation and activity of dental plaque.
- **Benzylisothiocyanate**: Another key component contributing to the antibacterial effect of miswak.
- **Insoluble Fluoride**: Miswak contains a high concentration of insoluble fluoride, which can help strengthen tooth enamel.
- **Calcium**: Essential for overall dental health.
- **Salicylic Acid**: Known for its anti-inflammatory properties.
- **Antioxidants**: Although their specific function remains unclear, miswak contains some antioxidants.

These natural compounds make miswak an effective and inexpensive alternative for oral hygiene, especially as a natural toothbrush for teeth cleaning. It's commonly used in Muslim-inhabited areas and has been recommended by the World Health Organization (WHO).

5.2.5.GUAVA LEAVES: Guava (Psidium guajava) have been studied for their potential use as an herbal irrigant in endodontic therapy. Research indicates that guava leaf extract has significant antimicrobial efficacy against **E. faecalis**, The studies compare the effectiveness of guava leaf extract with other herbal extracts and traditional endodontic irrigants like 2.5% sodium hypochlorite. While sodium hypochlorite showed the best results, guava leaf extract also demonstrated a considerable inhibitory effect against the bacteria[10].

It's important to note that while these findings are promising, the use of guava leaves as an irrigant at initial stage or should be done under professional guidance, as the research is still ongoing and the standard endodontic irrigants are well-established for their efficacy and safety profiles.

Chemical composition of Guava leaves: are a remarkable natural resource with a wealth of health-promoting compounds. When used as a **teeth irrigant**, they offer several benefits due to their rich phytochemical composition. Let's explore some of the key components found in guava leaves:

- **Quercetin**: This potent antioxidant is abundant in guava leaves and contributes to their **spasmolytic activity**. It helps relax muscles and may have therapeutic effects on oral tissues.
- **Avicularin**: Another important phytochemical present in guava leaves, known for its potential health benefits.
- **Apigenin**: Exhibits anti-inflammatory properties and may contribute to oral health.
- **Guaijaverin**: Adds to the overall medicinal value of guava leaves.
- **Kaempferol**: A flavonoid associated with various health effects.
- **Hyperin**: Found in guava leaves and may have therapeutic properties.
- **Myricetin**: An antioxidant compound.
- **Gallic Acid**: Known for its antimicrobial and antioxidant properties.
- **Catechin** and **Epicatechin**: Both are flavonoids with health-promoting effects.
- **Chlorogenic Acid**: Present in guava leaves and exhibits antioxidant properties.
- **Epigallocatechin Gallate (EGCG)**: Famously associated with green tea, it also appears in guava leaves.

These compounds collectively contribute to guava leaves' potential as an **oral irrigant** with antimicrobial, anti-inflammatory, and antioxidant properties. So, the next time you consider oral hygiene, remember the natural goodness of guava leaves.

5.2.6.MANGO LEAVES: scientifically known as **Mangifera indica**, have been studied for their potential health benefits and therapeutic properties. The extracts from mango leaves contain **mangiferin**, a major C-glucosyl xanthone, which exhibits numerous pharmacological activities such as antioxidative, antibacterial, antiviral, anti-inflammatory, and immunomodulatory effects. These properties suggest that mango leaves could be explored as a herbal irrigant in endodontic treatments.

In an in vitro study, mango leaves extract was compared with conventional and other herbal irrigants for its effects on the microhardness and flexural strength of root canal dentin. The study concluded that herbal irrigants, including mango leaves extract, were less detrimental to root dentin microhardness compared to conventional irrigants. However, the flexural strength was equally reduced by both conventional and herbal irrigants.

Considering the phytochemical profile and beneficial effects of mango leaves, they can be used as a potential ingredient for the development of functional foods and pharmaceutical drugs. However, detailed clinical trials are still needed to establish the actual efficacy of mango leaves extracts[8].

Mango seed kernels contain a variety of bioactive compounds that contribute to their potential as a herbal irrigant. These include:

- **Phytosterols**: Plant-based compounds known for their cholesterol-lowering properties.
- **Carotenoids**: Pigments found in plants that have antioxidant properties.
- **Tocopherol**: A form of Vitamin E, which is an antioxidant that helps protect cells from damage.
- **Polyphenols**: Including **mangiferin**, **hesperidin**, **vanillin**, **penta-o-galloyl-glucoside**, **rutin**, **quercetin**, and **kaempferol**, which have various health benefits including anti-inflammatory and antimicrobial effects.
- Phenolic acids : Such as gallic acids, caffeic acid, ellagic acid and ferulic acid knoewn for their antioxidant and anti-inflammatory properties. These components are likely responcible for the antimicrobial activity observed in mango seed extracts making them a subject of interest for use as herbal irrigants in endodontic therapy. [8

5.2.7.Neem: (Azadirachta indica) is a **widely recognized traditional and medicinal plant** in India. Its use as an **endodontic irrigant** offers several advantages:

- **Biocompatibility**: Neem is well-tolerated by the body and does not cause adverse reactions.
- **Antimicrobial Properties**: Neem exhibits antimicrobial effects, making it effective against bacteria.
- **Antiadherent**: It helps prevent the adherence of microorganisms to surfaces.
- **Antioxidant**: Neem has antioxidant properties that can benefit oral health.


Figure 9:Azadirachta indica

In rural areas, neem twigs are commonly used as toothbrushes due to their medicinal properties. These twigs contain over **135 therapeutic compounds**[11-13] When considering root canal irrigation, neem can be a valuable natural alternative to conventional chemical agents.

Neem, contains several bioactive compounds that are found to have therapeutic properties. When used as an irrigant, the most important active constituent is **azadirachtin**. Neem, contains several bioactive compounds that are found to have therapeutic properties. When used as an irrigant, the most important active constituent is **azadirachtin**. Other significant compounds include **nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinate, gedunin, salannin,** and **quercetin**. These components contribute to neem's antibacterial activity, which is why it's being explored for use in various applications, including as an intracanal irrigating solution in dentistry. However, it's important to note that further preclinical and clinical trials are needed to evaluate the biocompatibility and safety of neem extracts for such use.

Remember, though, that while neem has promising properties, it's essential to consult with a dental professional for personalized advice on its use in your specific case.

ESSENTIAL OILS: are natural substances extracted from plants that have various biological effects such as antibacterial, anti-inflammatory and antioxidant properties. Some essential oils have antimicrobial activity against Enterococcus faecalis, a type of bacteria that can cause infections in the root canal, blood, heart, brain and gums1 2.Some essential oils tested against E. faecalis include:

• **Oregano. :** Oregano essential oil (OEO) is rich in carvacrol and thymol, two compounds with strong antibacterial properties. OEO has been shown to inhibit the growth and biofilm formation of E. faecalis in vitro and in vivo3 4.

• **Thyme:** thyme essential oil (TEO) also contains carvacrol and timolol and other compounds with antibacterial properties. TEA has been shown to reduce the viability and biofilm formation of E. faecalis in vitro.

• **Lemongrass:** Lemongrass essential oil (LEO) has a high concentration of citral, a compound with antibacterial and anti-inflammatory effects. LEO has been shown to inhibit the growth and biofilm formation of E. faecalis in vitro.

• **Melaleuca:** Melaleuca essential oil (MEO), also known as tea tree oil, is rich in terpinen-4-ol, a compound with antibacterial and anti-inflammatory properties. MEO has been shown to inhibit the growth and biofilm formation of E. faecalis in vitro.

Clove(CEO) Fire oil is another name for clove essential oil, which is extracted from the dried flower buds of Syzygium aromaticum, a tropical tree belonging to the Myrtaceae family. Clove essential oil has a spicy, warm, and aromatic scent, and it is rich in antioxidants and volatile compounds such as eugenol, β-caryophyllene, and α-humulene. Clove essential oil has various medicinal, pharmacological and therapeutic properties for centuries, such as antibacterial, antifungal, anti-inflammatory, analgesic, and antitumor. It can be used for dental care, skin care, aromatherapy, and as a natural insect repellent. Clove oil is sometimes used as a herbal irrigant for root canal treatment, as it can help reduce pain and inflammation, and eliminate bacteria such as E. faecalis

***Figure 10**: Clove essential oil*

However, clove oil is not effective against non-herbal irrigant, octenidine, which is a synthetic antiseptic agent that is also used as a root canal irrigant. Octenidine has a broad spectrum of activity against bacteria, fungi, and viruses, and it can penetrate biofilms and dentinal tubules. Octenidine is more potent and less toxic than chlorhexidine, which is another commonly used antiseptic irrigant.

Therefore, clove oil cannot be used as a substitute for octenidine in root canal treatment. Clove oil may have some benefits as an adjunctive irrigant, but it should not be used alone or in combination with octenidine, as it may interfere with its efficacy or cause adverse reactions.

CONCLUSION:

The conclusion drawn from the article suggests that herbal irrigants could serve as a viable alternative to chemical irrigants due to their lower toxicity and cost-effectiveness. Additionally, the potential of herbal irrigants warrants further exploration through future research. It's essential for the scientific community to continue investigating and validating the efficacy and safety of herbal options in medical contexts. By doing so, we can enhance our understanding and potentially expand the range of available treatments.

REFERENCES:

[1]a. M. M. Huycke, D. F. Sahm, and M. S. Gilmore, Emerging Infection dieade, Multiple-Drug Resistant Enterococci: The Nature of the Problem and an Agenda for the Future, Volume 4, Number 2—June 1998. ;**b.**Livornese LL, Dias S, Samel C, Romanowski B, Taylor S, May P, Hospital-acquired infection with vancomycin-resistant *Enterococcus faecium* transmitted by electronic thermometers. Ann Intern Med. 1992;117:112–6.PubMedExternal LinkGoogle ScholarExternal Link **;c**. S. D. Taylor and Michael Palmer; The action mechanism of daptomycin ,*Bioorganic & Medicinal Chemistr***y**; Volume 24, (24),pp 6253-6268, 15 December 2016.

[2].Handwerger S, Raucher B, Altarac D, Monka J, Marchione S, Singh KV, Nosocomial outbreak due to *Enterococcus faecium* highly resistant to vancomycin, penicillin, and gentamicin. Clin Infect Dis. 1993;16:750–5.PubMedExternal LinkGoogle ScholarExternal Link

[3]**a**.Edmond MB, Ober JF, Weinbaum DL, Pfaller MA, Hwang T, Sanford MD, Vancomycin-resistant *Enterococcus faecium* bacteremia: risk factors for infection. Clin Infect Dis. 1995;20:1126–33.PubMedExternal LinkGoogle ScholarExternal Link. **b**.Goldmann D, Larson E. Hand-washing and nosocomial infections. N Engl J Med. 1992;327:120–2.PubMedExternal LinkGoogle ScholarExternal Link

[4]**a.**Noskin GA, Stosor V, Cooper I, Peterson LR. Recovery of vancomycin-resistant enterococci on fingertips and environmental surfaces. Infect Control Hosp Epidemiol. 1995;16:577–81. DOIExternal LinkPubMedExternal LinkGoogle ScholarExternal Link ; **b.** Mahmoud A Tawfik , Alaa El Din A Mohamed , Alaa N Abbas, Noha S Shafik , evaluation of turmeric and thyme as root canal irrigants on primary teeth, Orthodontic & Pediatric Dentistry Issue (Orthodontics and Pediatric Dentistry) Al-Azhar Journal of Dental Science Vol. 25- No. 4- 539:546- October 2022.

[5].Centers for Disease Control and Prevention. Recommendations for preventing the spread of vancomycin resistance: recommendations of the Hospital Infection Control Practices Advisory Committee (HICPAC). MMWR Morb Mortal Wkly Rep. 1995;44(No. RR-12):1–13.PubMedExternal LinkGoogle ScholarExternal Link

[6].Morris JG Jr, Shay DK, Hebden JN, McCarter RJ Jr, Perdue BE, Jarvis W, Enterococci resistant to multiple antimicrobial agents, including vancomycin. Ann Intern Med. 1995;123:250–9.PubMedExternal LinkGoogle ScholarExternal Link

[8]**a**.P. Choudhary T. Bidyalakshmi Devi· S. Tushir, and R. C. Kasana, Mango Seed Kernel: A Bountiful Source of Nutritional and Bioactive Compounds, *Food and Bioprocess Technology* (2023) 16:289–312 https://doi.org/10.1007/s11947-022-02889-y;**b.**M. kumar, Mango (*Mangifera indica* L.) Leaves: Nutritional Composition, Phytochemical Profile, and Health-Promoting Bioactivities, Encyclopedia*Antioxidants* 2021, *10*(2), 299; https://doi.org/10.3390/antiox10020299
;**c.** Hattab FN. Meswak: the natural toothbrush. *J Clin Dent.* 1997;8:125–129.

[9]. Al-Lafi T, Ababneh H. The effect of the extract of the miswak (chewing sticks) used in Jordan and the Middle East on oral bacteria. *Int Dent J.* 1995;45:218–222.

[10].W. Ruksiriwanich, Guava (*Psidium guajava* L.) Leaf Extract as Bioactive Substances for Anti-Androgen and Antioxidant Activities, Plants (Basel). 2022 Dec; 11(24): 3514.

neem
[11].H. Mookhtiar etal. Herbal Irrigants: A literataure Review Herbal Irrigants; A new Era in Endodontics: Literature Review, *International Journal Dental and Medical Sciences Research (IJDMSR)*, ISSN: 2393-073X Volume 3, Issue 3 (March- 2019), PP 15-22

[12].A.V. Susila etal,Can natural irrigants replace sodium hypochlorite? A systematic review,Clinical oral investigation, Volume 27,pp.1849-2023

[13]. J.F Siqeir, I.N. Rocas, A.Favieri and K. C. Lima, Chemomechanical Reduction of the Bacterial Population in the Root Canal after Instrumentation and Irrigation with 1%, 2.5%, and 5.25% Sodium Hypochlorite, Journal of endontic,Volume26issue 6 pp331-334 2000