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USE OF ESSENTIAL OILS IN CLINICAL DENTISTRY: A REVIEW

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Abstract: Due to increasing resistance of micro-organisms which cause oral diseases, there is need to have better alternatives for prevention of the same. Since ancient times, essential oils (EOs) have been used for treatment of various oral ailments and have been helpful over the time. Efficacy and usefulness of essential oils have already been proved by several clinical trials. Extract of plants, essential oils can reduce the amount of pathogens in the mouth and help to act the antibiotics and other active components for treatment of periodontitis, mucositis and other oral diseases. This review demonstrates an overview of different essential oils, their clinical use and effects. The purpose of this review is also to analyse the published articles and data in respect of essential oils. Many studies have been done to prove the therapeutic properties of various essential oils, but few have been published on their effect on oral diseases. This review will give an overview on the essential oils, their therapeutic properties, and their uses. **Materials and Methods:** A literature search was performed in the internet for different review articles and studies on essential oils published up to February 2022. **Conclusion:** On the basis of the available information, it may be concluded that essential oils have the potential to be developed as preventive or therapeutic agents for various oral diseases, but further clinical trials are required to establish their actual effectiveness taking consideration of adverse side effects if any.

Keywords: Essential Oils, Oral Pathogen, Oral Diseases.

INTRODUCTION

World Oral Health Report states that, though there is improvement in oral health in several countries, the problems still persist among underprivileged groups in both developed and developing countries. [1] Periodontal diseases including dental caries are the most important among oral health problems globally. It is well known that periodontal diseases are caused by oral pathogens that colonize and proliferate in the periodontal pockets and gingival crevice of a vulnerable host [2]. The antiseptic and antibacterial agents which are currently used for treatment of oral health problems demonstrates several side effects such as diarrhoea, vomiting, thyroid dysfunction etc... The increasing bacterial resistance to the chemical drugs is a major concern now a days. To minimize the adverse effects and bacterial resistance, there is a need to conduct clinical research on traditional medicines obtained from various plant sources and explore to develop new therapeutic agents based on plant sources. Many clinical trials are being done to establish effectiveness of traditionally used medicines for treating infections. Essential oils is one of these natural medicines which created increased interest In the recent years [3, 4]. There are approximately 3000 known essential oils available till now. [5] Since ancient times, essential oils are being used for treatment of various medical and dental problems. Essential oils are one of the plant extracts that are secondary metabolites produced by various medicinal plants and possess antioxidant, antibacterial and antifungal properties. [6-8]. Essential oils are associated with killing a wide range of microorganisms by disrupting their cell walls and inhibiting their enzyme activity also with minimal side effects [9, 10].

MATERIALS AND METHODS

To identify relevant literature, an electronic search was performed internet database. After screening the titles, only articles related to different essential oils and their therapeutic use have been included in this review. Total 36 articles found relevant were selected for the present review.

REVIEW OF LITERATURE

Composition of essential oils

The secondary metabolites of plants, essential oils constituents of a complex mixture of terpenic hydrocarbons, especially monoterpenes and sesquiterpenes, and oxygenated derivatives such as aldehydes, ketones, epoxides, alcohols, and esters.[11] Essential oils differ in their compositions. Even the composition of essential oils extracted from the plants of same species differ in different geographic locations.[12] Composition also mostly depends on the maturity of the plant from which the EOs are being extracted. [12,13]

Action

Essential oils act depending on their chemical composition and the location of one or more functional groups on the molecules present in them.[14] Membrane damage is the main mechanism of action.[15] Solubility of essential oils in the



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phospholipid bilayer of cell membranes plays an important role in antimicrobial activity. Clove oil reduces the quantity of ergosterol which is found specifically in fungal cell membrane.[16] Terpenoids in essential oils have been found to interfere with the enzymatic reactions of energy metabolism.[17]

Basil Oil

Composition: Basil oil is prepared from the leaves of *Ocimum basilicum* in the process of hydro distillation. Its main composition is linalool, 1,8-cineol, eugenol, methyl cinnamate and α -cubebene.

Properties: Early researches have shown linalol, estragol, eugenol and methyl cinnamate as the major antimicrobial and antifungal components of basil extracts and essential oil. Some pointed to strong antifungal effect of oil which contained estragol as the main component on the growth of *Aspergillus niger*, *A. ochraceus*, and *Fusarium culmorum*, others found linalol and estragol to be more efficient against *R. nigricans*. Hence basil oil can be used as antifungal and antimicrobial treatment of oral cavity.

Sandalwood Oil

Composition: Sandalwood oil, also known as East Indian sandalwood oil (EISO), is an essential oil distilled from the *Santalum album* tree and has demonstrated biological activity as an anti-inflammatory, anti-microbial, and anti-proliferative agent.

Properties: The sandalwood oil is extremely beneficial in inhibiting the growth of cavity-causing bacteria in the mouth. It portrays strong anti-bacterial, antifungal and antiviral properties that are not only used for removing bacteria and germs from the mouth cavity but also effectively treats wounds and improves healing mechanisms. It helps in treating bleeding gums and minor wounds, also helps in cleansing the mouth, enhancing salivation and strengthening the gums.

Coconut oil

Composition: Coconut oil extracted from fresh coconuts either by cold press or hot distillation. It's main composition is medium chain triglyceride (MCT) which is easily metabolise in the body. Coconut oil also contains lauric acid and capric acid, the medium chain fatty acid (MCFA).

Properties: Coconut oil demonstrates good antibacterial and anti-inflammatory properties against a bacteria related to inflammation. Studies have done on coconut oil pulling and its effect on plaque-induced gingivitis. The Lauric acid has anti-inflammatory and antimicrobial effects. Study shows a decrease in plaque after day seven.

Castor oil

Composition: Castor oil is made by extracting oil from the seeds of the *Ricinus communis* plant. The castor beans or seeds contain a toxic enzyme called ricin. However, in the process of preparing castor oil by heating, it deactivates the ricin, makes the oil to be used safely. Castor oil contains ricinoleic acid, a fatty acid that comprises about 90% of the oil.

Properties: Castor oil is antibacterial and anti-fungal. Many studies have shown that castor oil helps to reduce harmful bacteria and fungi in dentures and may help improve symptoms related to a condition called denture stomatitis, which can cause inflammation in the mouth.

Lavender oil

Composition: Lavender oil, obtained from the flowers of *Lavandula angustifolia* (Family: Lamiaceae) by steam distillation. It's main composition are linalyl acetate (3,7-dimethyl-1,6-octadien-3-yl acetate), linalool (3,7-dimethylocta-1,6-dien-3-ol), lavandulol (1,8-cineole), lavandulyl acetate, and camphor. The linalool overpowers and reflects that of the whole oil, indicating that linalool is the active component of lavender oil.

Properties: Lavender oil exhibit good antimicrobial activities against most of the bacteria, filamentous fungi, and yeasts. It also acts as anti-pseudomonal [18]. It is bactericidal as it acts against antibiotic resistant bacteria. Lavender oil is reported to reduce stress, anxiety, and improve mood when inhaled or orally administered. *Lavandula luisieri* show an inhibitory effect on yeast, dermatophyte, and *Aspergillus* strains. *Lavandula viridis* is having fungicidal effect on *Cryptococcus neoformans* and *Candida* species.

Eucalyptus oil

Composition: The main component of eucalyptus oil is 1,8-cineole followed by cryptone, α -pinene, p-cymene, α -terpineol, trans-pinocarveol, phellandral, cuminal, globulol, limonene, aromadendrene, spathulenol, and terpinene-4-ol.



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Properties: Essential oil of the leaves of Eucalyptus globulus has antimicrobial effect against Gram-negative bacteria (*Escherichia coli*) as well as Gram-positive bacteria (*Staphylococcus aureus*). The study of Serafino et al. shows that eucalyptus oil can stimulate the innate cell-mediated immune response suggesting its use as adjuvant in immunosuppression, in infectious disease

Peppermint oil

Composition: Peppermint (*Mentha piperita*) oil is one of the most popular and widely used essential oil and menthol is the major compound, followed by menthyl acetate and menthofuran.

Properties: Peppermint oil is antibacterial and shows an inhibitory effect on the proliferation of staphylococci. It's also antifungal and exhibit fungicidal activities against both the standard and clinical strains of *Candida* species and against the azole-resistant and azole-susceptible strains.

Tea Tree Oil

Composition: The composition of tea tree oil includes terpinen-4-ol, γ -terpinene, p-cymene, α -terpinene, 1,8-cineole, α -terpineol, and α -pinene.

Properties: Tea tree oil is antibacterial and is found to possess an inhibitory effect on various bacterial colonies and dental biofilm. It shows strong antibacterial action against oral pathogens also. It's also possessed antifungal effect, antimycotic activity, terpinen-4-ol being its most effective component. Studies have also shown that TTO prevents the adhesion of *S. mutans* and *P. gingivalis* to plaque.

Lemon oil

Composition: Mostly, lemon oil contains exclusively terpenes and oxygenated terpenes. Lemon EO is suggested to be used as an effective remedy against candidiasis caused by *C. albicans*.

Properties: Lemon oil shows antifungal potential against three *Candida* species (*C. albicans*, *Candida tropicalis*, and *Candida glabrata*) and is suggested to be used as an effective remedy against candidiasis caused by *C. albicans*.

Clove oil

Composition: Clove oil extracted from clove buds and constitutes the eugenol acetate, thymol, phenylpropanoids eugenyl acetate, carvacrol, cinnamaldehyde, β -caryophyllene, and 2-heptanone. Medicinal properties of Eugenol are well-known as is widely used in dentistry.

Properties: Clove oil exhibited a very strong radical scavenging activity when tested against tert-butylated hydroxytoluene. It possesses antifungal character as its main content eugenol reduces the quantity of ergosterol, the specific component of fungal cell membrane. Clove oil is found to possess inhibitory effect on multi-resistant *Staphylococcus* and proves to be antibacterial.

Cinnamon oil

Composition: Cinnamon oil obtained from the bark, leaf, and root barks of *Cinnamomum zeylanicum* and major compositions are trans-cinnamaldehyde, eugenol, and linalool. Cinnamaldehyde is the major constituent of cinnamon oil and is the most active component too.

Properties: Cinnamon oil possess antimicrobial effect and has inhibitory effect on the growth of various bacteria including Gram-positive, Gram-negative, and also on fungi. Furthermore, the study of Cabello et al. performed in animals shows that oral administration of cinnamaldehyde (CA) exerts significant anti-melanoma activity. Besides this Cinnamon oil is antiparasitic, antioxidant, and possess free radical scavenging properties.

Combination of essential oils

Combining different essential oils and antibiotics can reduce antibiotic resistance in multidrug-resistant bacteria. Peppermint, cinnamon, and lavender essential oil are found to be antibiotic resistance-modifying agents. Hence can be used in combination with antibiotics.

The potential use of essential oils in dentistry has been tabulated as below in Table-1.

Essential oils and their potential use in dentistry	
Name of EO	Potential use in dentistry
Basil Oil	Antimicrobial and antifungal activity Use in oral hygiene products
Coconut Oil	Use in oil pulling, anti-inflammatory use



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Lavender Oil	Anxiolytic, Reduces pain of needle insertion, Anti-carcinogenic agent
Peppermint Oil	Antimicrobial activity Use in oral hygiene products
Cinnamon Oil	In treating oral candidiasis
Eucalyptus Oil	Antimicrobial activity Use in oral hygiene products
Sandalwood Oil	Use in preservative, cleansing, against bleeding gum
Lemon Oil	In treating candidiasis
Clove Oil	Shows antimicrobial activity against several oral pathogens
Tea Tree Oil	Oral candidiasis, Suitable for use in prophylactic oral hygiene products
Combination of EOs	Antibiotic resistance-modifying agent

Therapeutic uses of essential oils in dentistry

1. Anxiety reduction -Aroma of lavender essential oils is capable of altering emotional states and reducing mild anxiety. It has been reported to be useful in reducing anxiety in dental patients when used in waiting area [20,22] Use of aromatherapy with natural essential oil of orange has been shown to reduce salivary cortisol and pulse rate due to child anxiety state [26].
2. Oral hygiene application-Essential oil rinses are found to be equally effective in inhibiting plaque. A study carried out by Pizzo et al. on plaque inhibitory effect of amine fluoride/stannous fluoride and essential oils showed no significant difference in efficacy of both [25]. As chlorhexidine causes staining of teeth on long term use, essential oils can be used as an alternative to chlorhexidine rinse.
3. Antimicrobial application- Many essential oils exhibit good antimicrobial activities against most of the bacteria, fungi, and yeasts. In the study of Benabdelkader et al., minimum inhibitory concentrations were found to be ranging from 0.16 to 11.90 mg/ml when lavender essential oil is used.[12]
4. Dental implants application - Many essential oils have been shown to possess anti-biofilm activity. They can be used with dental implants. Treatment of dental implant material surfaces with essential oils has shown to inhibit biofilm production [28].
5. In Wound dressing - According to the study done by Budzyńska et al., better therapeutic effects can be achieved from the wound dressings containing essential oils. Activity was found to be more when stored at 4°C for 7 days [27]. Therefore, they can be used to achieve better healing after oral surgical procedures.
6. Use as preservative - Essentials oils showed higher inhibitory activity against tested microorganism strain as extracts and methyl paraben. The study by Herman et al. suggests use of essential oils as substitute of methyl paraben in cosmetic emulsions. Similarly, it can be used to replace methyl paraben, which is used as preservative in various dental products, especially in patients allergic to it [29].
7. Radical scavenging – Essential oils clove shows strong radical scavenging activity when tested against tert-butylated hydroxytoluene [30]. Cinnamon essential oil also possess free radical scavenging properties besides antiparasitic, antioxidant actions [31].

The different application of essential oil in dentistry is tabulated below in Table2.

APPLICATION OF ESSENTIAL OILS	
Dental Application	Essential Oils
Periodontal abscess	Clove
Aphthous ulcer	Basil, Orange
Bruxism	Lavender, Sandalwood
Candida	Clove, Peppermint, Eucalyptus, Lavender
Caries prevention	Cinnamon, Peppermint, Eucalyptus
Gingiva	Lavender, Sandalwood
Halitosis	Peppermint, Lavender
Herpes simplex	Peppermint, Lavender, Eucalyptus, Clove
Teething	Lavender, Sandalwood
Toothache	Clove

Non-support of essential oils

There are studies which have also raised questions about the efficacy of essential oils. A study in which essential oil mouth rinse was compared with 0.2% chlorhexidine rinse for their efficacy. It was showed that essential oil mouth rinse is are effective only



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for very short duration and concluded that use of chlorhexidine is preferable over essential oil.[32] When a study was done to measure the efficacy of essential oils used as a coolant, it was concluded that there was no benefit over use of water in ultrasonic root debridement for the treatment of periodontitis.

Adverse effects of essential oils

Though it is a wide believe that natural medicines have least side effect but those are not always free of side effects. Many adverse effects have been reported with essential oils also. As per the study of Millet et al., commercial preparations of essences of sage, hyssop, thuja, and cedar have been reported to cause neurotoxicity and human intoxication.[33] According to a review by Posadzki et al., mild to severe adverse effects can be caused by essential oils like lavender, peppermint, tea tree oil, and ylang-ylang when used in aromatherapy. The most common adverse effect was dermatitis. [34] Thus further clinical trials and research to be done to have the details of side effect of use of essential oils.

LIMITATIONS

Only a few essential oils have been included in this review. Only English language articles were referred. There may be publication bias as the review is done on the basis of published literatures referred. The search of articles was performed only in electronic media.

CONCLUSIONS

Essential oils are one of the oldest forms of medicine known to humankind, until recently practising their therapeutic uses. It's still unknown to a majority of people and health practitioners. As of now, many studies have exhibited the therapeutic effectiveness of essential oils, but very few have practised in clinical dentistry. Essential oils can enhance a healthy oral cavity.

The essential oils contain the same regenerating, anti-oxidating, and immune-strengthening characteristics of the plants from which they are extracted. Essential oils are powerful antioxidants which help to eliminate free radicals and prevent mutations, and oxidation in the cells. Essential oils have antimicrobial, antifungal and antibacterial properties.

Essential oils have potential to be used as preventive or therapeutic agents for many oral diseases.[36] There are also several other potential uses of EOs have been identified [35] and claims of therapeutic efficacy have been validated by either in vitro testing or in vivo clinical trials. But still there is need for conducting further studies and researches to prove the efficacy of these essential oils before adding them in general dental clinical practice. As dental practitioners acquire more knowledge and a better understanding of essential oils, they may adopt a holistic approach to oral care by including essential oils in their treatment procedure. Essential oils can be a more natural way of maintaining oral hygiene.

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