

REVIEW ARTICLE

Herbal Endodontic Irrigants

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ABSTRACT

With the advancement in the science of Endodontics like instruments, rotary machines, lasers and irrigation delivery system, the irrigation solution is also getting evolved, the researchers are looking for a substitute to synthetic drugs because of its side effects. Development is moving towards natural products which is safe and cost effective. This article reviews few herbal irrigants and its advantages for the root canal treatment

Keywords: Antimicrobial activity, *Enterococcus faecalis*, Herbal irrigation.

How to cite this article: Alharbi A, Aliuddin S, Alharbi TA, Alharbi S, Alanzi AO, Alharbi AA. Herbal Endodontic Irrigants. Int J Prev Clin Dent Res 2017;4(4):311-314.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

The success of root canal treatment depends on the removal of infected pulpal tissues, microorganisms, and its toxins¹ in order to achieve a sterile environment and a hermetic seal.² To clean the root canal, there are two procedures commonly referred to as “chemomechanical” preparation in which a chemical solution is used along with mechanical instrumentation in the root canal space.^{3,4} There are lots of bacteria present in the oral cavity but in an endodontic infection there are limited number of bacterial species present due to the low availability of oxygen and nutrients.⁵ Bone resorption is a very common phenomenon during an endodontic infection, the bacteria which is responsible for this is *Enterococcus faecalis*. It is a species that can survive easily and multiply.⁶ *Enterococcus faecalis* is most common and more resistant to endodontic treatment because it is capable of entering the dentinal tubules and adheres to collagen in the presence of serum, causing root canal failure.^{5,7,8} The chemical along

with mechanical preparation of the root canal definitely decreases the number of bacteria.

In order to achieve a long-term success in the root canal treatment, maximum disinfection is required.⁵ There are many chemical agents that help in disinfecting the root canal but the most commonly used chemicals are sodium hypochlorite in concentration ranging from 1 to 6% and chlorhexidine (CHX) 2%. Sodium hypochlorite is preferred over other chemicals from several decades due to its ability to dissolve tissue and its excellent antimicrobial activity.^{2,5,9} The disadvantage of sodium hypochlorite is unpleasant taste and smell, tissue toxicity, weakening of the tooth structure by reducing the structural integrity of the dentin,¹⁰ mutagenic potential when mixed with CHX forming carcinogenic product⁴ and inability to remove the smear layer. Removal of smear layer is important for the success of root canal treatment.¹¹ Chlorhexidine is used commonly due to its biocompatibility and wide-spectrum antimicrobial activity. However, it causes discoloration of teeth and tongue, burning sensation of the oral mucosa, and dryness of mouth^{2,5,12} An irrigant MTAD was introduced to overcome the above-mentioned problems. It contains tetracycline, citric acid, and a detergent. The advantages over conventional irrigant solution are: It does not alter the structural integrity of dentin, it removes the smear layer, and it is less cytotoxic. However, the ability to remove smear layer is not satisfactory.¹³ The other disadvantages with this irrigant are its shelf life (short) and not being economical, discoloration of the teeth (due to the presence of tetracycline), and it is also not safe in pregnancy.^{2,14} The problems with chemical agents and its safety concerns increased the attention toward medicinal plants from few decades.⁵ According to Badole et al,¹⁰ the other good alternatives to current irrigants are herbs and it needs to be explored more. A herb may exhibit one or more therapeutic properties like antibacterial, anti-inflammatory, astringent, anticarcinogenic, and antiplaque agent. The aim of this article is to review the various herbal alternatives available today for effective irrigation.

HERBAL IRRIGANTS

Allium sativum (Garlic)

Garlic was used in Asia and Europe for other advantages like giving strength to the body against cold and cough.¹⁵ The major component is Allicin which is like Penicillin.

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It has both bacteriostatic and bactericidal properties.¹⁶ It contains vitamins, amino acids, nutrients, and organo-sulfur compounds. The organosulfur compounds are anticarcinogenic. Allicin which is the main component¹⁵ damages the cell membrane of the bacteria.¹⁷ However, there are many mechanisms of action against bacteria like (i) influence on drug metabolizing enzyme, (ii) antioxidant activity, (iii) inhibition of tumor growth, (iv) initiation of apoptosis, and (v) stimulation of immune response.^{15,18} It is effective against Gram-positive species which are cariogenic like, *Streptococcus sorbinus*, *Actinomyces oris*, and *Streptococcus mutans* in various concentrations. In 2015, Birring et al¹⁹ concluded that garlic extract was most effective and showed similar antimicrobial efficacy as 5.25% sodium hypochlorite against *E. faecalis* biofilm in a concentration of 70%.

Propolis (Bee Glue)

The term Propolis means defender of the city in Greek. It is derived from honey bees' (*Apis mellifera*) hives. It has been used since the Greek and Egyptian civilization because of its healing qualities.²⁰ It is composed of resin (55%), essential oils, and waxes (30%) mixed with bee glue (bee salivary secretions), pollen (5%), amino acids, minerals, ethanol, vitamins, and highly active bioflavonoids (10%).²⁰ It possesses antimicrobial, anti-inflammatory, and antioxidant properties.¹⁶ The active components are flavonoids and cinnamic acid,²¹ caffeic acid phenethyl ester that act as anti-inflammatory agents.²² Few researcher concluded that in case of indirect pulp capping, the formation of secondary dentin is formed soon after the application of propolis, whereas in case of direct pulp capping, it did not show any area of pulpal degeneration like calcium hydroxide. Therefore, it is more histophilic.²⁰ A similar study by Sabir et al²³ showed that propolis with flavonoids in rats delays pulpal inflammation and stimulates reparative dentin. Ethanol extract of propolis helps in hard tissue bridge formation and bone regeneration.⁵ In 2014, a study showed that propolis is as effective as sodium hypochlorite against *E. faecalis* biofilm,²⁴ suggesting that propolis can be used as intracanal medicament and irrigant.²⁵ A study was conducted in 2009 to check the difficulties in propolis paste removal from the root canal, but the result showed no significant difference between the calcium hydroxide paste and propolis paste removal, concluding that the physical characteristics are the same.²⁶

Aloe Vera

The name aloe vera means "true shiny bitter substance," which is derived from Arabic and Greek.²⁷ The Greeks used to call aloe vera the "universal solution" and the

Egyptians regarded it "the plant of immortality."¹⁵ It consist of 0.0013% protein and 99.5% water.²⁸ It has 75 active ingredients²⁹ including vitamins, minerals, enzymes, sugars, amino acids, and organic and inorganic compounds.²⁷ The main chemical ingredients are aloins and barbadoins.¹⁰ Aloe vera has got anti-inflammatory, antibacterial, antifungal, antiviral, antioxidant, antiseptic,²⁷ and pain relief properties.⁴ One study showed a significant reduction of gingivitis and plaque accumulation after using it in a form of mouth rinse.³⁰ Aloe vera inhibited the growth of *S. mutans*, *Streptococcus sanguis*, *Actinomyces viscosus*, and *Candida albicans* in an *in vitro* study.³¹ Athiban et al³² conducted a study in which they concluded that aloe vera gel is effective for disinfecting gutta percha cones against *E. faecalis*, *Escherichia coli*, and *Staphylococcus aureus*. It also shows bactericidal activity against cariogenic and periodontopathic bacteria.²⁷

Salvadora persica (Miswak)

It is a chewing stick known by different names in different cultures³³ like Qesam in Hebrew, Arak or miswak in Arabic, Qisa in Aramic, and Koyoji in Japanese.³⁴ It is widely distributed in Asia and Africa.³⁵ The main components are alkaloids like trimethylamine and salvadorine. Chlorides and fluorides are also present in high ratio. It also contains silica, sulfur, vitamin C, tannins, flavonoids, and sterols.³⁶ There are many studies that have demonstrated its antimicrobial activities. In 1994, Almas et al³⁷ concluded that *E. faecalis* is sensitive to *Salvadora persica*, and suggested that miswak might prevent the bacteria from attaching on the tooth surface. A study in 2004 showed a significant reduction in *S. mutans* count. The presence of fluoride which interacts with bacterial glycolytic enzymes could be a possible mechanism of action.³³ Al-Salman et al³⁸ suggested that 10% of water extract of miswak is an effective antimicrobial when utilized as a root canal irrigant with necrotic pulp. Due to its good antimicrobial activity³⁹ and low level of cytotoxicity, it can replace sodium hypochlorite and CHX for a root canal irrigant. It can be used even in primary teeth as irrigant and is safer than sodium hypochlorite.⁴⁰

Curcuma longa (Turmeric)

Curcuma longa is an Indian spice and traditional medicine which is being used for wound healing, rheumatic disorders,¹⁵ anticancer agent,¹⁶ gastrointestinal symptoms, and rhinitis. It belongs to Zingiberaceae family. It possesses a wide range of pharmacological properties like anti-inflammatory, antioxidant, antimicrobial,⁴¹ antimalarial,¹⁵ and hepatocellular.¹⁰ The main active component of turmeric is diferuloylmethane; however,

tumerone and zingiberone¹⁰ are some volatile oils present in it. It is insoluble in water but readily soluble in organic solvents. The possible mechanism of action of curcumin suggests the inhibition of assembly of a protein-filamenting temperature-sensitive mutant Z (FtsZ) and it also increases the guanosine triphosphatase activity of FtsZ which is lethal for the bacteria.⁴² According to Rai et al⁴² it also inhibits bacterial cell division by direct interaction with FtsZ42. *Curcuma* inhibits fungal growth among various natural irrigants according to Sinha et al.⁴³ Mandroli and Bhat⁴⁴ conducted an *in vitro* study to check the antibacterial activity of curcumin. They stated that turmeric potentiates the antimicrobial action of cefixime, vancomycin, and tetracycline; therefore, it can be used in combination with other medicament. There were questions about its antimicrobial action against *E. faecalis*.⁴⁴ In 2015 a study showed that turmeric is a weak agent against *E. faecalis*,⁴⁵ but another study conducted by Kumar⁴⁶ showed promising results against *E. faecalis*. A paper by Sahni and Chandak² even suggested it to be an alternative to sodium hypochlorite due to its antibacterial activity and it could be used in root canal failure cases.

CONCLUSION

Herbal medicines are the future in dentistry due to its low cost, less or no side effects, and easy availability. Many of the researchers suggest its use as a substitute for the synthetic/chemical agents like sodium hypochlorite, but these herbal products need preclinical and clinical review, their interaction with other materials, and its side effects. However, there is still a huge scope to explore the nature and its product to utilize it in our practice. In countries where majority of the population are not able to afford expensive treatments, these herbal products can be beneficial due to its advantages discussed earlier. The other advantages of these herbal irrigants are its less toxicity in case of extrusion (open apex) and staining of teeth as in case of CHX synthetic irrigants. More herbal products are encouraged to build up a new horizon in dentistry.

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