

The Antimicrobial Activity of *Salvadora Persica* Solution as Root Canal Irrigant

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Abstract:

The choice of certain irrigant in the chemo-mechanical preparation of endodontic treatment is very important to ensure complete bacterial elimination and proper eradication of organic tissue remnants. The main role of any used irrigant in this process is to obtain the maximum antimicrobial effect and the maximum peripheral tissue dissolving effects. The most common irrigating solution used is sodium hypochlorite because of its high ability for dissolving necrotic pulps and organic remnants, and for its effective antimicrobial action on aerobic and anaerobic bacteria. But on the other hand, it has many negative effects as corrosion of endodontic tools and lacking the differentiation between vital and necrotic tissues which will adversely affect on apical or periapical tissues. So, *Salvadora Persica* recently has been used widely worldwide according to “Back to Nature” trend, in order to prevent the negative effects of the other chemicals. Miswak chewing sticks have been used as popular oral hygiene tool due to its availability and low cost. It has shown effective antibacterial and antifungal action.

The active ingredients to which the Miswak has obtained its antimicrobial effect, are the following components: the high content of NaCl & KCl, Salvadourea & Salvadorine, saponins, tannins, vitamin C, silica, resin, cyanogenic glycoside and benzyl-isothiocyanate, and the latter one is the most effective component. In this research we will show the benefits of using *S. Persica* in endodontic treatment and comparing it with other irrigants. Alcoholic extract of *S. Persica* is used as root canal irrigant in the endodontic treatment in its different solutions as 1%, 5%, 10%, 15% and 20%. Many studies have been performed to study this extract and found that 15% *S. Persica* extract solution has the most effective antimicrobial effect against aerobic and anaerobic bacteria. 10% water or aqueous extract of *S. Persica* has also showed effective antimicrobial effect. The recent organizations in the world recommend using natural solutions to prevent the side effects of chemical agents.

Keywords: Antimicrobial, Activity, *Salvadora Persica* , Solution, Root Canal.

Introduction:

In general, irrigant solutions have an important role in preparing the root canals, helps in the root canals cleaning, lubricating files, flushing out debris, bleaching effect, act as tissue antibiotic, and dissolution of tissues without having any destruction of the periapical tissues. The aim of using an irrigant in the process of endodontic treatment is to achieve complete removal of the necrotic root pulps being infected with either aerobic or anaerobic bacteria. The correct choice of the suitable irrigating solution used in the treatment lead to proper root canal filling, proper periapical tissues repairing, instant removal of bacteria with least side effects on teeth and tissues. [1]

There are many irrigants used also in endodontic treatment in addition to *Salvadora Persica* extract, as 5.25% sodium hypochlorite, 0.2% chlorhexidine, and normal saline, and they all an antimicrobial effect except normal saline which has no significant effect on bacteria. Biomechanical preparation and intra-canal medicaments are also used in removing the necrotic pulps of root. Recent researches are discussing the comparative effects of sodium hypochlorite, chlorhexidine gluconate and *S. Persica*, to show the most suitable irrigant.

They found that sodium hypochlorite is an effective solution in the process of chemo-mechanical preparation of root canals, due to its strong antimicrobial activity and great ability in tissue dissolution. But one of its disadvantages is the inflammatory reactions caused to vital tissues when treating with it. Also, it makes staining of the instruments, burning of surrounding tissues chlorhexidine gluconate is found to have a broad spectrum antimicrobial activity on root canals treatment due to its ability to bind to oral tissues for long time and for non-toxic characteristics. But one of its disadvantages is non-dissolution of tissues. In contrast, S. Persica is found to have many more benefits in its antimicrobial activity, non-toxic and dissolving tissues without any disadvantages on oral tissues. [1][3]

In general, endodontic treatment or root canal therapy aims to change the microorganism living environment to help in healing of the periapical tissues. So, the irrigating solutions used in this therapy not only having an antibiotic effect but they have a significant role in cleaning the root chamber. The great success of endodontic treatment is depending on the aseptic conditions used during therapy, and on the accepted clinical principles. The success of root canal therapy is depending on several factors as mechanical preparation, irrigation, microbial control and complete obturation of root canals. The role of irrigants is to have the maximum antimicrobial action against wide range of microorganisms, with having the minimum toxicity on oral tissues and feasible cost to the dentist, which is achieved in S. Persica. Miswak is a word which is traditionally known for the wooden stick used for cleaning teeth, and it's derived from a plant called "Arak" or S. Persica as a scientific name of which (see figure 1). [2][3]



Figure (1): Miswak chewing sticks. [3]

There are many studies performed to explain and discuss the antimicrobial activity of several types of Arak sticks. The researchers found that either the alcoholic or the water extracts of Arak have an inhibitory action on growth of many bacteria, as *Strept. pyogenes*, *Staph. aureus*, *E. coli*, and *Pseudomonas aeruginosa*. The active ingredient of Miswak/Siwak is benzyl thiocyanate which has an inhibitory action on *Strept. mutans* growth and decreases the formation of dental caries. Also, when isolating the active ingredient, the scientists found that the limonoid act as a broad spectrum antibiotic against several types of Gram positive (G+) and Gram negative (G-) bacteria. When testing the inhibition ability of 10% aqueous extract of *S. persica* against bacterial growth, they found that its active ingredient has interfered with extra-polysaccharides and glycosidase enzymes produced by bacteria. Also, the inhibitory effect of *S. Persica* is alike or similar to the effect of chlorhexidine, but without any side effects on vital tissues. What makes the using of *S. Persica* solutions is the compatible irrigant in treatment of necrotic pulps of teeth. [2]

Statement of the problem

Evaluating the antimicrobial effect (in vivo and in vitro) of both water and alcoholic extracts of *Salvadora Persica* (known as Miswak/Siwak), when used as root canal irrigating solution.

Objectives

The research aims to discuss the following points:

- 1- Benefits of using *Salvadora Persica* as root canal irrigant.
- 2- Explain the antimicrobial effect of *S. Persica* alcoholic and water extract on bacterial growth.
- 3- Discuss its composition and active ingredients.
- 4- Comparing between *S. Persica* solutions and other chemicals used in the endodontic therapy.

- 5- Proving the strong action of *S. Persica* in inhibiting the re-growth of oral bacteria and enhancing periapical tissue healing.

Research Questions

The research aims to focus on:

- 1- What is *S. Persica* (Miswak/Siwak)?
- 2- Why can the dentist use *S. Persica* in the process of endodontic treatment?
- 3- Is Miswak has any negative effects on oral tissues?
- 4- What are the different extracts of *S. Persica*?
- 5- How Miswak is has an antimicrobial effect on microorganisms?
- 6- What are the other chemo-mechanical procedures used in treating necrotic pulps of teeth?

Discussion

The antimicrobial effect of *S. Persica* is thought to be due to high chemical content of some components as chlorides, tannins, trimethylamine, salvadorine, nitrate, thiocyanate and sulphur. Certain anionic components which are naturally found in plant species have been reported to possess antimicrobial action against various bacteria. These components are: Cl^- , SO_4^- , NO_3^- and SCN^- , in which the later one acts as a substrate for lactoperoxide to generate hypothiocyanite (OSCN^-) in the presence of hydrogen peroxide (H_2O_2). OSCN^- has been showed to react with sulfhydryl groups in bacterial enzymes, which finally leads to bacterial death. In this research, we will discuss the alcoholic (ethanolic) and water (aqueous) extracts of *S. Persica*. [1][3]

1- Alcoholic extract of *Salvadora Persica*:

Alcoholic extract of *S. Persica* has antimicrobial effect in vivo and in vitro as root canal irrigant. In comparing the antimicrobial effect of *S. Persica* alcoholic solution with the normal saline, it's found that the several solution concentrations of 1%, 5%, 10%, 15%, 20% are having a significant effect on both aerobic and anaerobic bacteria isolated from necrotic pulps of teeth. In the other hand, normal saline has not any significant effect on the same previous bacteria. Also, the 15% alcoholic extract of *S. Persica* was found to have the best antimicrobial effect (according to broth micro-dilution method). In nature, *Salvadora Persica* is found as a medical plant whose roots, twigs and stems are used in cleaning and disinfecting teeth and gum for several years ago, especially in Saudi Arabia. In addition to its effects on oral hygiene, it has also many other effects as antiplaque, anti-periodontic, anti-caries, anti-inflammatory and anti-fungal effects. [1]

Previous studies:

A study is performed to prove the antimicrobial action of alcoholic extract of *Salvadora Persica* on necrotic pulps when used as root canal irrigant. By using a sharp knife or cutter, 800g of *Salvadora Persica* chewing sticks (Miswak) had been cut into small parts, then grinded to be powder. Addition of 120 ml of 60% ethanol to 40g powder in a sterile flask and kept tightly closed for 3 days at room temperature. After that, make filtration of the sample using No.1 filter paper, and incubate at 37°C until being dry, and keep in vials in the refrigerator till needed. Microbiological samples of necrotic pulps were obtained from patients with certain characters. The patients should not have systemic disease history, not treated with any antibiotic at time of sampling, and there was no fistula or sinus at time of sampling. The samples were obtained from the root canals by 2 paper points one after one. 2 types of media were used in this study, one of them is brain heart infusion broth for aerobic bacterial growth, and the other is thioglycolate broth for anaerobic bacterial growth. The solutions under examination were normal saline, 0.2% chlorhexidine, 5.25% sodium hypochlorite, and alcoholic extract of *S. Persica* at concentrations of 1%, 5%, 10%, 15% and 20%, and control negative one. [1]

The results showed that 5.25% sodium hypochlorite, 0.2% chlorhexidine and all concentrations of *S. Persica* had a significant antimicrobial effect on aerobic and anaerobic bacteria, and the best one was 15% *Salvadora Persica* solution. 10% *Salvadora Persica* solution showed a similar antimicrobial action to 20% solution, and both showed higher effect than 1% and 5% solutions. Also, 15% *Salvadora Persica* solution showed similar effect to 0.2% chlorhexidine, while 5.25% sodium hypochlorite showed the highest antimicrobial effect among the used irrigants, which is not significantly different from 15% *Salvadora Persica* extract (see figure 2). The aim of using Miswak which is derived from *Salvadora Persica* in this study was depending on several factors, as the wide use of Miswak in Middle East countries, its availability, and its medical characters as antiplaque, anticaries, antiperiopathic, antiucrogenic, anti-inflammatory, antimycotic, antidiabetic and antiviral properties, and according to its commercial value. The results also showed higher antimicrobial effect for anaerobic bacteria more than aerobic bacteria but not significantly different. [1]

Another study was performed to study the ethanolic extract of *S. Persica* against *S. fecalis* and *C. albicans*. The results showed that 200mg/ml ethanolic extract was effective against those bacteria within 10 minutes. But 50% ethanolic extract failed to show inhibition of fungal growth. While 25% ethanolic extract (50mg/ml) failed to show both antibacterial and antifungal effect. It's thought that polyphenol tannins -which is a heat stable component- is responsible for this antimicrobial activity. While, Benzyl isothiocyanate (BIT) responsible for inhibiting the bacterial growth and preventing its acid production. [3]

2- Water extract of *Salvadora Persica*:

Evaluating the antimicrobial effect of 10% *Salvadora Persica* extract as an irrigant in endodontic therapy by many studies made on it. One of these studies had proved that 10% *Salvadora Persica* has inhibited the aerobic and anaerobic bacterial growth by 91.7% and 89.6% respectively (see figure 3). 10% water extract is obtained by adding 10g *Salvadora Persica* to 90ml distilled water. [2]

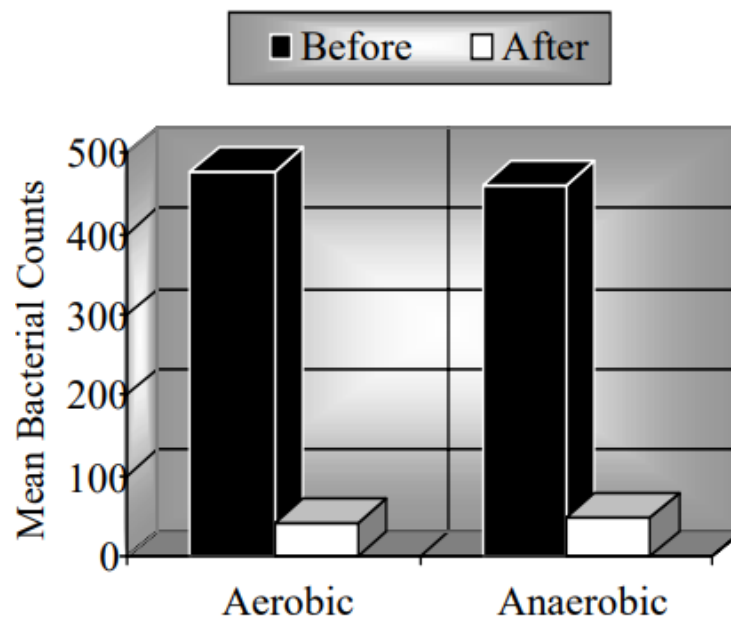


Figure (3): results of the aerobic and anaerobic bacterial growth when using 10% water extract of *Salvadora Persica*. [2]

Conclusion & Recommendations

Salvadora Persica chewing sticks are a natural product totally, safe, cheap, well tolerated extract solutions. It had showed an effective antimicrobial effect against aerobic and anaerobic bacteria in vivo and invitro when using as root canal irrigant during the endodontic treatment. It has no side effects on vital tissues which make it more preferable for use than other chemicals as chlorhexidine and sodium hypochlorite. All concentrations of alcoholic extract of *S. Persica* of 1%, 5%, 10%, 15% and 20% have showed effective antibacterial action of both aerobic and anaerobic bacteria, with most efficacy when using 15% extract solution. 10% water extract of *S. Persica* showed also effective antibacterial effect against the previous mentioned bacteria. So, most of dentists are preferring to use extracts of Miswak in endodontic treatment of teeth with necrotic pulps.

During the endodontic therapy, the proper choice of instrumentation and irrigating solutions that help and enhance bacterial neutralization and toxin inactivation without any side effects and permitting the healing process of the periapical tissues is a mandatory procedure. So Miswak is found to be as a good substitute for sodium hypochlorite. The World Health Organization (WHO) in 1987 has encouraged the use of S.

Persica in an international consensus report on oral hygiene. The total extracts of *S. persica* prepared in water, phosphate-buffered saline (PBS), and organic solvents have been tested for their antibacterial and antifungal effects. The alcoholic extract is found to have more significant antimicrobial effect than the water extract. [1][2]

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