

## Herbs Used As Irrigants And Root Canal Irrigation Techniques - Part 2 - A Review

### Abstract

For success in endodontic treatment the root canal has to be cleaned and shaped thoroughly. Cleaning and shaping can be done with both hand and rotary instruments with copious irrigation. The main objective of irrigation is to remove inflamed and necrotic pulp tissue, microbes, biofilms, organic and inorganic debris from the root canal space. There is no single irrigating solution that alone sufficiently covers all of the functions required from an irrigant. The potential side effects of chemical irrigants, safety concerns and ineffectiveness of complete elimination of bacteria has lead to consumption of preparations from medicinal plants and these have been tried as root canal irrigants. These herbal preparations have high antimicrobial activity, biocompatibility, anti-inflammatory and anti-oxidant properties. This review article discusses the effectiveness of herbs used as root canal irrigant. Recently new agitation devices with various mechanisms of irrigant transfer have come into the market. This article presents an overview of the irrigant agitation methods currently available and their debridement efficacy.

### Key Words

Natural herbs, Propolis, Green Tea Polyphenols, tea tree oil Agitation, irrigation, Machine assisted irrigation.

### Introduction

The success of root canal treatment depends on complete elimination of micro flora, debris and irritants from root canal system. Irrigant solutions are very important during root canal preparation because they aid in the cleaning of the root canal, lubricate the files, flush out debris, have antimicrobial effect, provide tissue dissolution without damage to the periapical tissues and some have bleaching effect on teeth. The selection of an ideal irrigant depends mainly on its action on microorganisms and periapical tissue with the least side effects. Many irrigation solutions and techniques are proposed for complete elimination of microbes. Among the irrigating solutions sodium hypo chlorite is the most popular as it full fills most of the requirements of irrigation solution. However, it's inability to remove smear layer, short shelf life, unpleasant taste, toxic effects on periapical tissues has limited its use and attempts are made to search for newer irrigants which are less irritating and toxic to tissues and are bactericidal against e fecalis organisms<sup>[1]</sup> Herbal or natural products have been used in dental and medical practice for thousands of years and are becoming popular due to their high antimicrobial activity, biocompatibility, anti-inflammatory and anti-oxidant properties<sup>[2]</sup>.

The potential side effects, safety concerns and lack of ideal functions of irrigants has lead to shift to preparations from medicinal plants. Recent advances in the last decade have brought new agitation devices that rely on various mechanisms of irrigant transfer, soft tissue debridement and removal of smear layers. These devices may be divided into the manual and machine-assisted agitation systems. This article presents an overview of the irrigant agitation methods currently available and their debridement efficacy.

### Natural Agents Used As Irrigants

Propolis, Triphala, Meswak, Tree tea oil, Morinda Citrifolia, green tea polyphenols, Arctium Lappa.

### Natural/Herbal Alternatives Used As Irrigants

#### Advantages-

- Easily available
- Cost effectiveness
- Longer shelf life
- Low toxicity
- Anti microbial property
- Anti oxidant

### Propolis

Propolis is a resinous hive product consisting of mixture of constituents. Propolis has been used for treating different diseases and inflammatory

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conditions as both local and systemic applications. In nature, or when in room temperature, it is a sticky substance, but becomes hard and brittle at low temperature. It is composed of resin and balsams (50 - 70%), essential oil, sand wax (30 - 50%), pollen (5 - 10%) and other constituents which are amino acids, minerals, vitamins A,B complex, E and the highly active bio-chemical substance known as bioflavonoid (Vitamin P), phenols and aromatic compounds<sup>[3],[4],[5]</sup>. Flavonoids are well known plant compounds which have antibacterial, antifungal, antiviral, antioxidant, anti cariogenic and anti-inflammatory properties. It is less cytotoxic. Propolis is dispensed in various forms, such as tooth paste, mouthwash, lozenges, wine, cake, powder, jelly, tablets, soap and others. Al-Qathami and Al-Madi compared the antimicrobial efficacy of propolis, sodium hypochlorite and saline as an intracanal irrigants. Microbiological samples were taken from the teeth immediately after accessing the canal and after instrumentation and irrigation. The results of this study indicated that the propolis has antimicrobial activity equal to that of sodium hypochlorite<sup>[6]</sup>.

### Meswak

Salvadora Persica, is a medical plant whose roots, twigs or stems have been used for centuries as oral hygiene tools in many parts of the world, particularly in Saudi Arabia. Many studies have demonstrated that alcoholic extracts of Salvadora Persica of 1%, 5%, 10%, 15%, and 20%, possess various antiplaque, antiperiopathic, anticaries, anti-inflammatory and antimycotic effects. 15% alcoholic extract of Salvadora Persica had antimicrobial effect which was equal to sodium hypochlorite and chlorhexidine when compared to normal saline<sup>[7]</sup>.

### Triphala

It is a plant extract of medicinal plants which are rich in citric acid and have antimicrobial properties. Studies have shown the irrigant to be effective in killing *E. Fecalis* micro-organisms and remove smear layer. This combined effect is attributed to the combination of formulations of three medicinal plants<sup>[8]</sup>.

### Green Tea

It is a traditional drink of Japan and China and is prepared from the young shoots of tea plant *Camellia Sinensis*. The polyphenols found in Green tea are more commonly known as flavanols or catechins. Green tea polyphenols have significant antioxidant, anticariogenic, anti-inflammatory, thermogenic, probiotic and antimicrobial properties in numerous human, animal and in vitro studies<sup>[9]</sup>. It can be used as an effective antiplaque agent because of its antioxidant properties and it can effectively inhibit the biofilm formation<sup>[10]</sup>. Tea also contains natural fluoride, which may be helpful in preventing dental caries.

### Tree Tea Extract

Tea tree oil (*Melaleuca alternifolia*) one more commonly known anti septic agent, is a native Australian plant with many properties such as being an antiseptic, an antifungal agent and a mild solvent. Tea tree oil's major active component is terpinen-4-ol (typically 30-40%). This compound is responsible for its antibacterial and antifungal properties<sup>[11]</sup>.

### Arctium Lappa

Arctium lappa is a plant brought from Japan and acclimated in Brazil because of its therapeutical properties, which is widely used in popular medicine. It has

anti-bacterial and antifungal activity, diuretic, anti-oxidant and anxiolytic action, platelet anti-aggregating effect and HIV- inhibitory action. An in vitro evaluation of antimicrobial activity of Arctium lappa against microorganisms specifically found in endodontic infections showed a great microbial inhibition of Arctium lappa against the tested endodontic pathogens. The microbial inhibition potential of Arctium lappa observed in this study opens perspective for its use as an intracanal medication.<sup>[12]</sup>

### Irrigation Devices And Techniques

Effective irrigation can be achieved by using proper delivery techniques. Conventional irrigation has been performed with a plastic syringe and an open-ended needle, in recent years a number of novel needle-tip designs and equipment have emerged for better results and meet challenges of irrigation. The basic requirement is to use techniques and solutions that reduce surface tension that would improve the effectiveness of flow and action of irrigants. The main objective being that irrigant should reach into dentinal tubules, accessory canals and apical ramifications.

### Manual irrigation techniques

#### 1. Syringes & Needles

Plastic syringes of different sizes (1–20 ml) are most commonly used for irrigation.

Large-volume syringes are time-saving but are difficult to control for pressure, usually 1- to 5-ml syringes are recommended instead of larger ones. All syringes used for root canal irrigation must have a Luer-Lok design. Because of the chemical reactions between irrigants, separate syringes should be used for each solution. Conventional irrigation with syringes has been advocated as an efficient method of irrigant. This technique is still widely accepted by both general practitioners and endodontists. The technique involves dispensing of an irrigant into a canal through needles/cannulas of variable gauges, 25-gauge needles are commonly used. They are replaced by 27-gauge needles, now 30-gauge and even 31-gauge needles are taking over for routine used in root canal irrigation. As 27 gauge corresponds to International Standards Organization size 0.42 and 30 gauge to size 0.31,

smaller needle sizes are preferred as they can enter the canal easily, either passively or with agitation. Some of these needles are designed to dispense an irrigant through their most distal ends, whereas others are designed to deliver an irrigant laterally through closed-ended, side-vented channels. The latter design has been proposed to improve the hydrodynamic activation of an irrigant and reduce the chance of apical extrusion<sup>[13]</sup>. It is crucial that the needle/cannula should remain loose inside the canal during irrigation. This allows the irrigant to reflux and causes more debris to be displaced coronally, at the same time avoiding the expression of irrigant into periapical tissues. One of the advantages of syringe irrigation is that it allows comparatively easy control of the depth of needle penetration within the canal and the volume of irrigant that is flushed through the canal<sup>[14]</sup>. Several modifications of the needle-tip design have been introduced in recent years to facilitate effectiveness and minimize safety risks. In a study 30-gauge needle NaviTip FX (Ultradent) with brush-covered and 30-gauge needle NaviTip without brush is also used for irrigation. Navi tip fx was better in cleaning coronal thirds of instrumented root canals but there was not much difference between navi tip fx and navi tip in debriding middle and apical third of root canal<sup>[15]</sup>.

Endobrush (1990) (C&S Micro instruments Ltd, Markham, Ontario, Canada), is a spiral brush designed for endodontic use that consists of nylon bristles set in twisted wires with an attached handle and has a relatively constant diameter along the entire length. Max-i-Probe Irrigation probes (**Fig A**)



Fig-a : Maxi Probe

are available in 5 sizes from 23gauge to 30gauge, in 40-packs, 100-packs, and probe with 3cc syringe packages. The 28 & 30 gauge is very thin and highly flexible and are recommended for curved and narrow canals. Each probe and syringe comes in pre-sterilized packets. The probes are easily identified with colour-coordinated hubs and tamper-proof seals. The luer lock mechanism connector fits securely on any disposable syringe. These probes are used for irrigation during the cleaning and shaping of root canal. The instruments are designed to create a turbulence to dislodge and help flush the bacteria and other debris out of the canal. They help minimize the risk of accidental extrusion of the solution into the periapical tissue.

## 2. Manual-dynamic irrigation

Manual-dynamic irrigation has been advocated as a method of root canal irrigation as a result of its simplicity and cost-effectiveness, the laborious nature of this hand-activated procedure still hinders its application in routine clinical practice. A well-fitting gutta-percha master cone is moved up and down in short 2- to 3-mm strokes (manual dynamic irrigation) within an instrumented canal. This produces an effective hydrodynamic effect and significantly improves the displacement and exchange of any given reagent<sup>[16]</sup>. The push-pull motion of a well fitting gutta-percha point in the canal might generate higher intracanal pressure changes during pushing movements, leading to more effective delivery of irrigant to the "untouched" canal surfaces. The frequency of push-pull motion of the gutta-percha point (3.3 Hz, 100 strokes per 30 seconds) is higher than the frequency (1.6 Hz) of positive-negative hydrodynamic pressure generated by RinsEndo<sup>[17]</sup> in the root canal system.

## Machine assisted irrigation

### 1. Sonic irrigation

Tronstad et al<sup>[18]</sup> were the first to report the use of a sonic instrument for endodontics in 1985. Sonic irrigation is different from ultrasonic irrigation in that it operates at a lower frequency (1–6 kHz) and produces smaller shear stresses<sup>[19]</sup>. The sonic energy also generates significantly higher amplitude or greater back-and-forth tip movement<sup>[18]</sup>. Sonic activation has been shown to be an effective method for disinfecting root canals. The positive



Fig-b : Vibringe

relationship between acoustic streaming velocity and frequency might explain the superior efficiency of the ultrasonic systems over the sonic systems.

### Vibringe

Vibringe (Vibringe BV, Amsterdam, The Netherlands) (Fig B) is a new sonic irrigation system that combines battery-driven vibrations (9000 cpm) with manually operated irrigation of the root canal. Vibringe uses the traditional type of syringe/needle delivery and causes sonic vibration.

### EndoActivator

EndoActivator (Advanced Endodontics, Santa Barbara, CA, USA) is a new type of irrigation facilitator. It is based on sonic vibration (up to 10,000 cpm) of a plastic tip in the root canal. This consists of a small battery operated cordless hand piece which delivers sonic energy on to the nylon tips which can be attached to the hand piece. The advantage of attaching Nylon tips would make the device more flexible and less prone for breakage when compared to ultrasonic files. This device promises to produce even more acoustic streaming than conventional ultrasonic devices. The system has 3 different sizes of tips that are easily attached (snap-on) to the hand piece that creates the sonic vibrations. EndoActivator does not deliver new irrigant to the canal but it facilitates the penetration and renewal of the irrigant in the canal. Two recent studies have indicated that the use of EndoActivator facilitates irrigant penetration and mechanical cleansing compared with needle irrigation, with no increase in the risk of irrigant extrusion through the apex.<sup>[20], [21]</sup>

## 2. Pressure alternation devices

### RinsEndo

The RinsEndo system (Durr Dental Co) is based on a pressure-suction mechanism with approximately 100



Fig-c : Endo Vac

cycles per minute. With this system, 65 mL of a rinsing solution oscillating at a frequency of 1.6 Hz is drawn from an attached syringe and transported to the root canal via an adapted cannula. During the suction phase, the used solution and air are extracted from the root canal and automatically merged with fresh rinsing solution. The pressure-suction cycles change approximately 100 times per minute. Hauser et al<sup>[22]</sup> evaluated the efficacy of the RinsEndo system compared to the conventional method for root canal cleaning, using a labelling solution. The authors concluded that the RinsEndo system was more effective than conventional irrigation as to the capacity of penetration in the dentin tubules.

### EndoVac

EndoVac (Discus Dental, Culver City, CA, USA) (Fig C) is a new approach to irrigation, instead of irrigant through a needle, the EndoVac system uses a negative-pressure approach whereby the irrigant placed in the pulp chamber is sucked down the root canal and back up again through a thin needle with a special design. There is evidence that, compared with traditional needle irrigation and some other systems, the EndoVac system lowers the risks associated with irrigation close to the apical foramen considerably. The reverse flow of irrigants helps in apical cleaning at the 1-mm level and a strong antibacterial effect with sodium hypochlorite.

## 3. Sterilox

Sterilox is a device that uses Electro chemical activation (ECA) as a tool for irrigation. The ECA technology is based on the process of transferring liquids into a metastable state via an electrochemical unipolar (anode or cathode) action through the use of an element/ reactor ('Flow-through Electrolytic Module' or FEM). The FEM is capable of producing types of solutions that have bactericidal

and sporicidal activity, are odourless, safe to human tissue and noncorrosive for most metal. FEMs have been incorporated into a variety of delivery systems (devices) for creating electrochemically activated solutions. The ECA devices have been in widespread commercial use in Russia and the Commonwealth of Independent States for a number of years, mainly in the areas of hospital disinfection, sterilization, and in agricultural and industrial processes.

#### 4. Photo activated disinfection (PAD)

The PAD device is a new device that uses a photoactivated solution for bacterial destruction. It is provided with Side venting irrigation needles prevent apical extrusion of irrigants & Notched needle tips. The PAD device has two components 1) PAD solution A dilute solution containing pharmaceutical grade trolonium chloride. 2) Save Dent laser A low power 635 nm laser light source which optimally activates the solution through a disposable handpiece. The procedure is relatively simple. After application of the PAD solution into the canals and a brief interval to allow penetration and attachment to bacteria, laser light delivered using the special handpiece tip activates the disinfection process, and the bacteria are destroyed. PAD solution is activated by 635nm light and acts as a photosensitizer, releasing reactive oxygen species that disrupt the membrane of the microorganism. Independently, the laser and solution have no effect, but in combination produce a powerful anti-bacterial action but is expensive.

#### 5. Ultra sonics

Ultrasonic energy is used for cleaning and disinfection of the root canal. The comparative effectiveness of ultrasonics and hand-instrumentation techniques has been evaluated in several studies. Most of these studies concluded that ultrasonics along with irrigant, cleaned the root-canal system better than simple irrigation and hand-instrumentation alone. Cavitation and acoustic streaming generated by ultrasonic irrigation contributed to the biologic chemical activity.<sup>[23]</sup> Ultrasonic files must have free movement in the canal without making contact with the canal wall to work effectively.<sup>[24]</sup> Several studies have indicated the importance of ultrasonic irrigation for optimal debridement in

areas like anastomoses between double canals, isthmuses, and fins.<sup>[25], [26], [27]</sup>

#### 6. Rotary irrigation

The Quantec-E irrigation system (SybronEndo, Orange, CA) is a self contained fluid delivery unit that is attached to the Quantec-E Endo System. It uses a pump console, 2 irrigation reservoirs, and tubing to provide continuous irrigation during rotary instrumentation.<sup>[28]</sup> Continuous irrigant agitation during active rotary instrumentation would generate an increased volume of irrigant, increase irrigant contact time, and facilitate greater depth of irrigant penetration inside the root canal. This irrigation has resulted in more effective canal debridement compared with syringe needle irrigation.<sup>[28]</sup>

#### Conclusion

Herbal medicines are used in endodontics and are gaining popularity, as herbs are generally safe if used with proper knowledge, but they can be harmful if misused. Herbs can also be considered for use for endodontic treatment procedures as they have been proved to be effective with minimal side effects. Effective irrigant delivery and agitation are prerequisites for successful endodontic treatment. Effective irrigation can be achieved by using proper delivery techniques. Combination of irrigants and sequential use of irrigants will help to achieve all the prerequisites of irrigation of root canal leading to success in root canal treatment.

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