



**HERBAL MEDICAMENTS IN ENDODONTICS – A REVIEW**

**Karkala Venkappa Kishan<sup>1</sup>, VinukondaHima Bindu<sup>2</sup>, Shreya Bhor<sup>3</sup>, Suwidhi Ranka<sup>4</sup> and Anoli Hirani<sup>5</sup>**

<sup>1</sup>Professor, <sup>2,3,4,5</sup>PG Students, Department of Conservative Dentistry and Endodontics, KMSDCH, SVDU, Vadodara, India

**ARTICLE INFO**

**Article History:**

Received 4<sup>th</sup> February, 2020

Received in revised form 25<sup>th</sup>

March, 2020

Accepted 18<sup>th</sup> April, 2020

Published online 28<sup>th</sup> May, 2020

**Key words:**

Endodontics, Root canal microflora, Intracanal Medicaments, Herbal Medicaments, Phytotherapy.

**ABSTRACT**

The major objective in the root canal treatment was to disinfect the entire root canal system. Although cleaning and shaping with potent irrigants was effective in reducing the bacterial load some bacteria do remain behind and multiply, causing reinfection of the root canal. Placement of the medicaments act as an adjunct for effective disinfection of the root canal system. Considering the development of antibiotic resistance, and the potential side effects of chemical intracanal medicaments, there was a shift in trend towards the usage of herbal alternatives. This review was aimed to present the various herbals products and their usage as an Intracanal medicaments.

Copyright©2020 Karkala Venkappa Kishan et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**INTRODUCTION**

The micro-organisms are the prime cause for the root canal and periradicular infections (Nair 2006). Complete debridement and disinfection of the canals from the microflora is essential for the success of endodontic treatment (Bhardwaj, et.al. 2012). However, due to some factors like, complex nature of the root canals, there is incomplete disinfection of the root canal system and retained microflora in the root canal are one of most common causes for failed root canal treatment (Safavi et al., 1990). Hence, additional methods such as the use of intra-canal medicaments are required to maximize disinfection of root canal system and kill as many bacteria as possible (Spangberg et al., 2002).

Calcium hydroxide has been the prototype of any intracanal medicament used. However, Ca (OH)<sub>2</sub> is not effective in eliminating bacteria from the dentinal tubules. It was reported that Enterococcus faecalis present in the dentinal tubules was resistant to Ca (OH)<sub>2</sub> over 10 days.<sup>[5]</sup> With the rise in bacterial resistance to antibiotics, there is considerable interest over the usage of various herbal agents as anti-microbial agents.

Herbal products have been in use in medical and dental practice and this has increased in recent years due to their high antimicrobial activity, biocompatibility, anti-inflammatory and anti-oxidant properties (Dilsah et al., 2006).

Use of herbals for curing various diseases is known as “Phytotherapy or Phytomedicine or Ethnopharmacology”. The sources of Phytotherapeutic agents were grouped as - Plants, animals & minerals sources (Patil. 1973). Their usage in endodontics has wide applications with minimal complications. Hence this paper reviews on various herbals usage as an Intracanal medicaments.

**Herbals Role as an Intracanal Medicaments**

**Azadirachtaindica (Neem)**

The most useful traditional medicinal plant and is regarded as “Village dispensary” in India. Most parts of the plant such as fruits, seeds, leaves, bark and roots contain compounds with proven antiseptic, antiviral, antipyretic, anti-inflammatory, antiulcer and antifungal properties (Ambareen et al., 2014). It has been long used in the field of dentistry for its beneficial use in treating teeth and gum conditions. Nimbidin is the crude principle extract from the seed kernels of Azadirachtaindica. From this there are tetranortriterpenes isolates which are nimbin, nimbinin, nimbidinin, nimbolide and nimbidinic acid (Biswas et al., 2002). These active ingredients are responsible for anti-bacterial activity. Neem was found active against *Streptococcus mutans*, *Enterococcus faecalis* and is extremely effective against *Candida species* (Orstavik et al., 1990). Studies have showed Neem as a potent medicament against *E. faecalis* and can be used as an alternative to calcium hydroxide (Kusuma et al., 2018; Vinothkumar et al., 2013; Bohora et al., 2010).

\*Corresponding author: **Karkala Venkappa Kishan**

Professor, Phd Scholar, Department of Conservative Dentistry and Endodontics, KMSDCH, SVDU,

### **Garlic**

Garlic (*Allium sativum* L) has been found to have several pharmacological properties such as antimicrobial, antiplatelet, antithrombotic, and anticancer activity. It is found to be effective against *Streptococcus mutans*, *Staphylococcus aureus*, *Enterococcus faecalis* and *Escherichia coli* (Bakri *et al.*, 2005). A study conducted by Eswara K *et al* showed that garlic has better antimicrobial efficacy compared to calcium hydroxide (Eswar *et al.*, 2013). Other study conducted by Salih JM *et al* advocated that garlic is more effective against *staphylococcus aureus* than *Enterococcus faecalis* (Salih *et al.*, 2016).

### **Triphala**

Triphala is an Indian ayurvedic herbal formulation. As the name suggests, 'Tri' means three and 'Phala' means fruits. It is a combination of three dried fruits namely, *Terminalia chebula*, *Terminalia bellerica* and *Phyllanthusembelica*. It has potential anti-bacterial and anti-inflammatory properties. Its fruit is rich in citric acid, which may aid in removal of smear layer thereby acting as chelating agent (Ambareen *et al.*, 2014). A study Mugade SS *et.al* (Mugade *et al.*, 2017) showed that Triphala exhibited anti-bacterial efficacy almost similar to calcium hydroxide and can be used as an alternative to calcium hydroxide against *E. faecalis*.

### **Allium hirtifolium Boiss (Persian Shallot)**

It is the one of the most commonly used condiment of Asian cuisine. It is known for its medicinal values and is considered as important of *Allium* species. It has flavone, sulphur containing compounds and polyphenolic compounds which attribute to their anti-microbial and anti-oxidant effects (Wongmekiat *et al.*, 2008). It has shown the anti-microbial efficacy against many bacterial as well as fungal species. In a study conducted by Satvati SA *et al* (Satvati *et al.*, 2017) it was reported that *Allium hirtifolium* Boiss showed anti-microbial efficacy against *Enterococcus faecalis* even after being autoclaved when compared to Garlic. This could be probably due to the pivotal role of polar compounds of *A. hirtifolium* Boiss extract such as polyphenols. Reports according to another study (Amin *et.al* 2009) showed that the antimicrobial efficacy of *Allium hirtifolium* Boiss even at the temperature of 4°C and pH changes from 4 to 8. These can be the area of interest for its further investigations.

### **Curcumin longa (Turmeric)**

It was widely used medicinal herb known for many years. It has anti-microbial, antioxidant, anti-inflammatory, antispasmodic, anticancer and may other properties marking its use as phytotherapeutic agent in dental field. These properties due to the presence of polyphenolic compounds (Rai *et al.*, 2008). The mechanism of antibacterial action of curcuma and derivatives is not clear. Hypothesis have been proposed that hydrophobic and hydrogen bonding of phenolic compounds to membrane proteins, followed by partition in the lipid bilayer; perturbation of membrane permeability consequent to its expansion and increased fluidity causing the inhibition of membrane embedded enzymes; membrane disruption; destruction of electrons transport systems and cell wall perturbation (Mithra *et al.*, 2012). It was also suggested that curcumin, a polyphenolic compound strongly inhibits bacterial cell proliferation by inhibiting the assembly dynamics of protein-filamenting temperature-sensitive mutant Z (FTSZ)

profilaments in the Z- ring needed for bacterial cell division. Curcumin has been shown to have a potent antibacterial activity against a number of pathogenic bacteria including *Enterococcus* (Rai *et al.*, 2008).

### **Propolis**

Propolis is a biologically active natural resinous antibiotic which is obtained by honey bees from plant sources such as conifers and poplars. It has Flavonoids, Phenolics and Aromatics (Hu F *et al.*, 2005; Kosalec *et al.*, 2005). The flavonoids component of Propolis contributes to its various biologic properties such as anti-inflammatory, antibacterial, antiviral, antifungal, antioxidant and pharmacological properties such as healing, cytostatic & are cariostatic. Its significant anti-inflammatory action is due to presence of caffeic acid and phenylether (CAPE) (Scheller *et al.*, 1978). The ethanolic preparation of the propolis is effective and has bone regeneration and hard tissue bridge formation marking its use in vital pulp therapy. A study conducted by Kandaswamy *et.al* compared three medicaments and found that propolis exhibited good antimicrobial properties as an intracanal medicament (Banskota *et al.*, 2001). Propolis can be effectively used along with calcium hydroxide as dressing for elimination of endodontic especially against *E. faecalis* (Oncag *et al.*, 2006).

### **Casearia Sylvestris**

It is a medicinal plant commonly seen in tropical America and Brazil. It is commonly known as 'guacatonga'. It has anti-microbial, anti-ulcer, diuretic and healing properties. It has a rich source of phospholipase A2 inhibitors. Studies have shown that *Casaria Sylvestris* can be used as an alternate short-term intracanal medicament (Silva *et al.*, 2004).

### **Ricinus communis**

It is also known Castor oil or Castor acid. It is rich in ricinoleic acid which is responsible for its anti-microbial properties. According to the study by Lucas da Fonseca Roberti Garcia *et.al* it was found that Calcium hydroxide and *Ricinus communis* paste showed better anti-microbial efficacy than the Calcium hydroxide and Propylene glycol paste (Lucas *et al.*, 2009). In another study conducted by Marcio Carneiro Valera *et.al*, *Ricinus* showed complete eradication against *C. albicans* and exhibited significant anti-microbial action against *E. faecalis* (Valera *et al.*, 2013).

### **Papaine**

It is a natural product obtained from the latex of leaves and fruits of papaya. It is a proteolytic cysteine enzyme which exhibits anti-bacterial and anti-inflammatory properties. It also has debris removing effect. Due to this tissue dissolving efficacy of carious dentin it is used as a cariostatic agent. A study conducted by Anuj Bhardwaj *et.al*, it was said that the anti-microbial efficacy exhibited by Papaine was comparable with CHX and can be considered as an alternate to Calcium hydroxide (Bhardwaj *et al.*, 2012).

### **Citrus limon**

Lemon is a species that belong to the family Rutaceae, and is native of Asia. It is a natural source of citric acid. Lemon juice consists of 5% to 6% citric acid and has a pH of 2.2. A study conducted by Sawsan & Somaia, showed that the lemon has wide anti-microbial efficacy even against *E. faecalis* which

suggest that it can be used as an intracanal medicament (Abuzied *et al.*).

### **Nissin**

It is a natural antibiotic peptide isolated from *Streptococcus lactis*. It is considered as a class I bacteriocin and is found to be effective against Gram positive bacteria and pores. Its antibacterial action is by the formation of pores which form by interaction with Lipid II molecule, a main component of Gram positive bacteria cell membranes. Thus there is inhibition in cell wall synthesis. In a study conducted by Mahendra M *et al.* (Mahendra *et al.*, 2016), Nissin showed significant antimicrobial efficacy against *E. faecalis* and considered as a better intracanal medicament than calcium hydroxide (Hemadri, 2011).

### **Arctium lappa – Burdock**

This plant has been obtained from Japan and grown mostly in Brazil. They have many therapeutic applications. It possess antibacterial, antifungal, antiplatelet, antioxidant, diuretic, anxiolytic and HIV inhibitory effect. *Arctium lappa* contains sterols, tannins, sulphur containing polyacetylene, volatile fatty oils & polysaccharides. The active constituent of Burdock are sesquiterpene lactones and carbohydrate inulin (Pereira *et al.*, 2005). The antimicrobial properties of *Arctium lappa* was studied. From that it was concluded that the constituents of *Arctium lappa* showed a great effect against the most organisms such as *E. faecalis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis* & *Candida albicans*. This antimicrobial potential of the *Arctium lappa* makes it use as root canal medicament (Gentil *et al.*, 2006).

### **Aloe barbadensis– Aloe vera**

*Aloe vera* belongs to Liliaceae family. *Aloe* leaves contain clear gel and green part of the leaf that surrounds the gel which has been widely used in cosmetic and medicinal products. Its leaf extracts contain anthraquinones which is responsible for its anti-bacterial properties. It also contains several active constituents vitamins, minerals, enzymes, sugars, lignin, saponins, salicylic acids and aminoacids (Wynn, 2005). Aloin and emodin act as analgesics, antibacterials and antivirals. It is effective against *S. pyogenes* and *E. faecalis* due to the presence of anthrax quinine. A study conducted by Kurian B *et al* in 2016 showed MIC (Minimal Inhibitory Concentration) of *Aloe vera* was superior to calcium hydroxide in eliminating *E. faecalis* and its antibacterial activity increased with time period (Kurian *et al.*, 2016). Compared to other natural extracts, *Aloe vera* has broad spectrum antibacterial activity against various oral pathogens.

### **Glycyrrhizaglabra– Licorice**

They are frequently used Kampo medicines. It exhibits anti-inflammatory, antiviral & anti-carcinogenic effects. It consists of a triterpenoid compound namely Glycyrrhizin that imparts sweet taste to the licorice root<sup>53, 54</sup> Because of this Glycyrrhizin, it possess antimicrobial effect especially against *E. faecalis* (Bodet *et al.*, 2008). Licorice also inhibits most of the cariogenic bacterias like *Streptococcus mutans* (Segal *et al.*, 1985). Its biocompatibility is compared to that of calcium hydroxide due to the presence of pentacyclitriterpenoid structure. But it has slightly acidic pH whereas calcium hydroxide having strong alkaline pH of 12 (Badr *et al.*, 2011).

### **Agaricusbisporus – Mushroom**

It has both low and high molecular weight (LMW, HMW) active compounds. Because of these compounds, it possess medicinal properties like immune modulatory, anti-inflammatory, antiviral, anti-oxidant and antimicrobial properties. The low molecular weight components present in mushroom are plectasin, confuentin, grifolin and neogrifolin which imparts capacity to penetrate deep into dentinal tubules (Alves *et al.*, 2012). The gel form of mushroom is used as intracanal medicament. This is prepared by sun drying, grinding and boiling it with distilled water which then followed by adding hydroxyl ethyl cellulose as thickening agent in 2:1 ratio and injected into the canal with a syringe. Also it has been revealed that the gel form of the extract increases the contact time which enhances its performance. It has highest efficacy against gram negative bacterias (Kurian *et al.*, 2016).

## **CONCLUSION**

With the growing anti-microbial resistance, usage of herbals can be considered as alternatives with their added advantages of biocompatibility. They are easily available, less toxic, cost effective and doesn't have anti-bacterial resistance. Many In-Vitro studies have shown their promising results. However, clinical studies exploring their efficacy and interactions need to be carried out.

## **References**

- Abuzied ST, Eissa SA. Comparative Study on Antibacterial Activities of two Natural Plants Versus Three Different Intracanal Medicaments. Available from: [http://www.kau.edu.sa/Files/165/Researches/19240\\_Comparative%20Study%20On.pdf](http://www.kau.edu.sa/Files/165/Researches/19240_Comparative%20Study%20On.pdf).
- Alves MJ, Ferreira IC, Dias J, Teixeira V, Martins A, Pintado M. 2012. A review on antimicrobial activity of mushroom (*Basidiomycetes*) extracts and isolated compounds. *Planta Med.*, 78:1707-18.
- Ambareen Z, Chinappa A. 2014. Go green-keep the root canal clean!!! *Int J Dent Sci Res.*, 2(6B):21-25.
- Amin M, Montazeri EA, Mashhadizadeh MA, Sheikh AF. 2009. Characterization of shallot, an antimicrobial extract of *Allium ascalonicum*. *Pak J Med Sci.* 25:948-952.
- Badr AE, Omar N, Badria FA. 2011. A laboratory evaluation of the antibacterial and cytotoxic effect of liquorice when used as root canal medicament. *IntEndod J.*, 44:51-8.
- Bakri IM, Douglas C. 2005. Inhibitory effect of garlic extract on oral bacteria. *Archives of Oral Biology.*, 50: 645-651.
- Banskota AH, Tezuka Y, Kadota S. 2001. Recent progress in pharmacological research of propolis. *Phytother Res.*, 15:561-71.
- Bhardwaj A, Ballal S, and Velmurugan N. 2012. Comparative evaluation of the antimicrobial activity of natural extracts of *Morindacitrifolia*, papain and aloe vera (all in gel formulation), 2% chlorhexidine gel and calcium hydroxide, against *Enterococcus faecalis*: An in vitro study. *J of Cons Dent.*, 15(3): 293.
- Biswas K, Chattopadhyay I. 2002. Biological activities and medicinal properties of neem. *Curr Sci.*, 82:1336-245.
- Bodet C, La VD, Gafner S, Bergeron C, Grenier D. 2008. A Licorice extract reduces lipopolysaccharide induced pro-inflammatory cytokine secretion by macrophages and whole blood. *J Periodontol.*, 79:1752-61.
- Bohara A, Hegde V, Kokate S. Comparison of antibacterial efficiency of neem leaf extract and 2% sodium hypochlorite

- against *E. faecalis*, *C. Albicans* and mixed culture. *Endodontology*. 2010;22:10-13.
- Dilsah Cogulu, Atac Uzel, Kadriye Sorkun et al. 2006. Efficacy of propolis as an intracanal medicament against *Enterococcus faecalis*- *Gen Dent.*, 54:319-22
- Eswar K, Venkateshbabu N, Rajeswari K, Kandaswamy D. 2013. Dentinal tubule disinfection with 2% chlorhexidine, garlic extract, and calcium hydroxide against *Enterococcus faecalis* by using real-time polymerase chain reaction: *In vitro* study. *J Conserv Dent.*, 16:194-8.
- Gentil M, Pereira JV, Sousa YT, Pietro R, Neto MD, Vansan LP et al. 2006. In vitro evaluation of the antibacterial activity of *Arctium lappa* as a phytotherapeutic agent used in intracanal dressings. *Phytother Res.*, 20:184-6.
- Hemadri M. 2011. Nisin Vs Calcium Hydroxide – Antimicrobial Efficacy on *Enterococcus faecalis* – An In-vitro Study. *Int J of Cont dent.* 2(3).
- Hu F, Hepburn HR, Li Y, Chen M, Radloff SE, Daya S, et al. 2005. Effects of ethanol and water extracts of propolis (bee glue) on acute inflammatory animal models. *J Ethnopharmacol.*, 100:276-83.
- Kakehashi S, Stanley HR, Fitzgerald RJ. 1965. The effects of surgical exposures of dental pulps in germfree and conventional laboratory rats. *Oral Surg Oral Med Oral Pathol*; 20: 340-9.
- Kosalec I, Pepeljnjak S, Bakmaz M, Vladimir Knezevi S. 2005. Flavonoid analysis and antimicrobial activity of commercially available propolis products. *Acta Pharm.*, 55:423-30.
- Kurian B, Swapna DV, Nadig RR, Ranjini MA, Rashmi K, Bolar SR. 2016. Efficacy of calcium hydroxide, mushroom, and Aloe vera as an intracanal medicament against *Enterococcus faecalis*: An *in vitro* study. *Endodontology*, 28:137-42.
- Kusuma CS, Manjunath V, Gehlot PM. Comparative Evaluation of Neem, Aloe vera, Chlorhexidine and Calcium Hydroxide as an Intracanal Medicament against *E. faecalis*-An *in vitro* Study. *J. clin. diagn. res.* 2018;12(3).
- Lucas DFRG et al. 2009. Antimicrobial activity of a calcium hydroxide and Ricinus communis oil paste against microorganisms commonly found in endodontic infections. *Rev OdontoCiênc.*, 24(4): 406-409.
- Mahendra M, Agrawal N, Munaga S, Tyagi S. 2016. Antimicrobial activity of different biological extracts as intracanal medicament against *Enterococcus faecalis*: An *in vitro* study. *Endod.*, 28:166-70.
- Mithra NH et al. 2012. An *in vitro* evaluation of curcuma longa against endodontic pathogens. *Int. J. Res Phytochem.*, 2(1)1-6.
- Mugade SS, Sharma A, Shah N, Mandlik J, Ghogare A. 2017. Antimicrobial Efficacy of triphala and curcumin extract in Comparison with Calcium hydroxide against *E. faecalis* as an Intracanal medicament an *In Vitro* Study. *P Ind J Res.*, 6(1):876-879
- Nair PN. 2006. On the causes of persistent apical periodontitis: a review. *Int Endod J.*, 39:249-81.
- Oncag O, Cogulu D, Uzel A, Sorkun K. 2006. Efficacy of propolis as an intracanal medicament against *Enterococcus faecalis*. *Gen Dent.*, 54:319-22.
- Orstavik D, Haapasalo M. Disinfection by endodontic irrigants and dressings of experimentally infected dentinal tubules. *Endod Dent Traumatol* 1990;6:142-9.
- Patil DR. 1973 “Cultural history from the vayupurana” 1st ed. Motilal Banarasis Publishers, New Delhi., 230.
- Pereira JV, Bergamo DC, Pereira JO, Franca Sde C, Pietro RC, Silva- Sousa YT. 2005. Antimicrobial activity of *Arctium lappa* constituents against microorganisms commonly found in endodontic infections. *Braz Dent J.*, 16(3): 192-196.
- Rai D, Singh JK, Roy N, Panda D. 2008. Curcumin inhibits FtsZ assembly: an attractive mechanism for its antibacterial activity. *Biochem J.*, 410:147-55.
- Safavi KE, Spanberg SW, Langeland K. 1990. Root canal dentinal tubule disinfection. *J Endod.*, 16:207-10.
- Salih JM, Monawer AT, Abdulkahar IM. Anti-bacterial Activity of Garlic Against Multi-Drug Resistant *Staphylococcus Aureus* and *Enterococcus faecalis* In Duhok City. *J. Univer. Duhok.* 2016;19(1):114-22.
- Satvati SA, Shooriabi M, Amin M, Shiehzadeh F. 2017. Evaluation of the Antimicrobial activity of *Tribulus terrestris*, *Allium sativum*, *Salvia officinalis*, and *Allium hirtifolium* Boiss against *Enterococcus faecalis*. *Int J Ent Path.*, 5(2):63-7.
- Scheller S, Ilewicz L, Luciak M, Skrobidurska D, Stojko A, Matuga W. 1978. Biological properties and clinical application of propolis. IX. Experimental observation on the influence of ethanol extract of propolis (EEP) on dental pulp regeneration. *Arzneimittel-Forschung.*, 28(2):289-91.
- Segal R, Pisanty S, Wormser R, Azaz E, Sela MN. 1985. Anticariogenic activity of licorice and Glycyrrhizine I: Inhibition of *in vitro* plaque formation by *Streptococcus mutans*. *J Pharm Sci.*, 74:79-81.
- Silva FB, Almeida JM, Sousa SM. 2004. Natural medicaments in endodontics: a comparative study of the anti-inflammatory action. *Braz Oral Res.*, 18(2):174-9.
- Spangberg LSW, Haapasalo M. 2002. Rationale and efficacy of root canal medicaments and root filling materials with the emphasis on treatment outcome. *Endod Topics.*, 2:35-58.
- Valera MC, Oliveira LEMLD, Jorge AOC, ShygeiÉ, and Carvalho CAT. 2013. In vitro antimicrobial activity of auxiliary chemical substances and natural extracts on *Candida albicans* and *Enterococcus faecalis* in root canals. *J Appl Oral Sci.*, 21(2): 118-123.
- Vinothkumar TS, Rubin MI, Balaji L, Kandaswamy D. In vitro evaluation of five different herbal extracts as an antimicrobial endodontic irrigant using real time quantitative polymerase chain reaction. *J Conserv Dent.* 2013;16:167-70.
- Wongmekiat O, Leelarugayub N, Thamprasert K. 2008. Beneficial effect of shallot (*Allium ascalonicum* L.) extract on cyclosporine nephrotoxicity in rats. *Food Chem Toxicol.*, 46(5):1844-1850. doi:10.1016/j.fct.2008.01.029.
- Wynn RL. 2005. *Aloe veragel*: Update for dentistry. *Gen Dent.*, 53:6-9.

\*\*\*\*\*