



Review Article

Natural medicaments in dentistry

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Abstract

The major objective in root canal treatment is to disinfect the entire root canal system. Cleaning, shaping, and use of antimicrobial medicaments are effective in reducing the bacterial load to some extent, but some bacteria do remain behind and multiply, causing reinfection. Taking into consideration the ineffectiveness, potential side-effects and safety concerns of synthetic drugs, the herbal alternatives for endodontic usage might prove to be advantageous. Over the past decade, interest in drugs derived from medicinal plants has markedly increased. Phytomedicine has been used in dentistry as anti-inflammatory, antibiotic, analgesic, sedative and also as endodontic irrigant. Herbal preparations can be derived from the root, leaves, seeds, stem, and flowers. The PubMed database search revealed that the reference list for natural medicaments featured 1480 articles and in dentistry 173 articles. A forward search was undertaken on the selected articles and author names. This review focuses on various natural drugs and products as well as their therapeutic applications when used as phytomedicine in dentistry.

Key words: Dentistry, phytomedicines, therapeutic implication

Introduction

Natural products have been used since ancient times in folk medicine. In dentistry, phytomedicines have been widely used. Herbs with medicinal properties are useful and effective source for treatment of various disease processes. Even though chemo-mechanical preparation of root canal is able to reduce the number of bacteria, the intracanal medicament with antibacterial action is required to maximize the disinfection of root canal system.^[1] Sodium hypochlorite (NaOCl), 2% chlorhexidine (CHX) and calcium hydroxide possess varying degree of antibacterial activity.^[2] Although NaOCl has been widely used as root canal irrigating solution, it has several undesirable characteristics such as tissue toxicity, risk of emphysema when overfilled, allergic potential, disagreeable smell and taste and inability to remove the smear layer.^[3-5] The use of CHX as an irrigant is generally restricted because it can discolor the teeth and tongue can cause loss of taste, burning sensation of the oral mucosa and subjective dryness of the oral cavity. The effectiveness of CHX to clean the root canal walls is generally found to be inferior to NaOCl.^[3] Ca (OH)₂ is not effective in eliminating bacteria from the

dental tubules. It was reported that *Enterococcus faecalis* present in the dental tubules was resistant to Ca (OH)₂ over 10 days.^[6]

In endodontics because of the cytotoxic reactions of the most of the commercial intracanal medicaments used and their inability to eliminate bacteria from dental tubules, trend of recent medicine is to use biologic medication extracted from natural plants.^[7] The herbal products are also being increasingly used as sedatives, or plaque reduction and healthy gums.

- a. Phytotherapeutic substances are generally classified into three groups^[8]
 - Plant products
 - Animal products
 - Mineral origin.
- b. In dentistry, they are used as^[9]
 - Antimicrobial agents
 - Anti-inflammatory agents
 - Sedative and anxiolytics.
- c. Miscellaneous endodontic irrigants, medicaments and endodontic retreatment.

Materials and Methods

A PubMed search was made with the keywords; herbal, dentistry, phytomedicines and from the relevant articles medicaments found closest to these three keywords were selected for this review.

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Acacia nilotica Linn. (Babool - Indian gun Arabic)

It has long been used for the treatment of skin, sexual, stomach, and tooth problems. It has been proved as an effective medicine in the treatment of malaria, sore throat (aerial part) and toothache (bark). *Babool* has shown to possess antibacterial activity against *Streptococcus mutans* and *E. faecalis*.^[10] Antimicrobial function is believed to be due to tannins, phenolic compounds, essential oil, and flavonoids.^[11]

Aloe barbadensis Miller (Kumari - Aloe)

Aloe leaves contain a clear gel and green part of the leaf that surrounds the gel is used to produce juice or dried substance. It contains aloins and barbadoin as main chemical constituents. In dentistry, *A. vera* is used in cases of aphthous ulcers, lichen planus, alveolar osteitis.^[12] *A. vera* gel has inhibitory effects on *Streptococcus pyogenes* and *E. faecalis* because of anthraquinone.^[13] Its bactericidal activity is found to be less than Ca (OH)₂.^[14]

Arctium lappa Linn.

It has antibacterial and antifungal activity, diuretic, anti-oxidant and anxiolytic action, platelet anti-aggregating effect, and HIV inhibitory action. In dentistry, *A. lappa* has been investigated due to its antimicrobial potential against oral microorganisms, specifically those associated with endodontic infections. An *in vitro* evaluation of antimicrobial activity of *A. lappa* against microorganisms specifically found in endodontic infections showed a great microbial inhibition of *A. lappa* against the tested endodontic pathogens. The microbial inhibition potential of *A. lappa* observed in this study opens the perspective for its use as an intracanal medication.^[15]

Azadirachta indica A. Juss (Nimba - Nimtree)

Each part of the *Neem* tree has some medicinal property and is thus commercially exploitable.^[16] This product has been proved to be effective against *E. faecalis* and *Candida albicans*.^[17] A study was conducted to evaluate the efficacy of *Neem* extract dental gel with commercially available CHX gluconate mouthwash as a positive control. Microbial evaluation of *S. mutans* and *Lactobacilli* species was carried out to determine the total decrease in the salivary bacterial count over a period of treatment. The results of the study suggested that the dental gel containing *Neem* extract had significantly reduced the plaque index and bacterial count than that of the control group.^[18]

Carvacrol

Carvacrol (thymol isomer) is present in the essential oil of *Origanum vulgare*, which is edible plant oil used in food products. It has a broad spectrum of antibacterial activity; it works by inhibiting ATPase activity and increasing the nonselective permeability of bacterial cell membranes. Therefore, it not only inhibits microbial colonization, but also makes microbes more sensitive to antibacterial agents. It has an antibacterial effect against *Enterobacteriaceae* family including *Escherichia coli*, *Salmonella enteritidis* and *Salmonella essen*. Antibacterial effect of carvacrol and its isomer thymol against six ATCC standard bacterial strains including *E. faecalis* has been proved. Carvacrol also has anti-inflammatory effects. It can restrain neutrophilic elastase enzyme and suppress prostaglandin production.^[19] Carvacrol has inhibitory action on *E. coli* and *Pseudomonas aeruginosa*. The cause of antimicrobial property is attributed to action on several targets in bacterial

cell and disruption of bacterial cell membrane. It also helps in repair of periapical tissues. This property is due to the presence of phenolic component, which stimulates pulpal fibers, phenomena known as hormesis.^[20,21]

Casearia sylvestris Sw. (Gulkhair - Wild coffee)

Alcoholic extract of *C. sylvestris* constitutes a rich source of phospholipase A2 inhibitors, which reduce the acute phase of the inflammatory process and prolongs the regenerative phase. It offers a wide range of uses: Healing, antiseptic, antiulcerative, diuretic, tonic, stimulant, and antimicrobial. It is shown as an alternative intracanal medicament.^[2]

Allium sativum Linn. (Rason - Garlic)

Garlic contains sulfur containing compound allin, which is converted to active ingredient "allicin" when the garlic bulb is crushed. This compound has an inhibitory effect upon the key enzymes involved in cholesterol biosynthesis, such as 3-hydroxy-3-methyl-glutaryl-CoA reductase. Hypocholesterolemic effect of garlic is exerted by a decrease in hepatic cholesterologenesis, whereas the triacylglycerol lowering effect appears to be due to inhibition of fatty acid synthesis, by mallic enzymes, fatty acid synthetase and glucose-6-phosphate dehydrogenase. Garlic helps to prevent lipid implantation on the arterial wall. Allicin destroys cell wall and cell membrane of root canal bacteria.^[22] This is used as irrigant alternative to NaOCl.^[23]

Marticaria recutitia Linn. (German chamomile)

The German chamomile has been used for centuries as a medicinal plant mostly for its anti-inflammatory, analgesic, antimicrobial, antispasmodic, and sedative properties. Chamomile was also found to be effective when used as a mouthwash to treat irritations and minor infections of the mouth and gingivae and is also used in some toothpaste.^[24]

Camellia sinensis (Chai - Tea)

The antioxidative properties of unfermented tea can be attributed to the ability of the polyphenols contained in the leaves of *Thea chinensis*, especially the gallic catechins, to inactivate free radicals.^[25,26] Green and black teas both contain flavonoids that inhibit the growth and activity of the bacteria associated with tooth decay. Tea also contains natural fluoride, which may be helpful in preventing dental caries. An *in vitro* study conducted to evaluate the antimicrobial efficacy of *Triphala* (one of the well-known Indian Ayurvedic herbal formulation consisting of dried and powdered fruits of three medicinal plants namely *Terminalia bellerica*, *Terminalia chebula* and *Emblia officinalis*),^[4] green tea polyphenols (GTPs), MTAD and 5% NaOCl against *E. faecalis* biofilm formed on tooth substrate showed maximum antibacterial activity with NaOCl and statistically significant antibacterial activity with *Triphala*, GTPs and MTAD.^[27]

Citrus limonum Risso. (Nimbuka - Lemon)

Fresh lemon solution is used as root canal medicament due to its wide antibacterial efficiency including *E. faecalis*. Oil of lemon is topically used for the treatment of oral thrush and stomatitis.^[28]

Morinda citrifolia Linn. (Ashyuka - Indian mulberry)

A number of major components have been identified in the Noni plant such as scopoletin, octoanoic acid, potassium,

vitamin C, terpenoids, alkaloids, anthraquinones (such as nordamnacanthal, morindone, rubiadin, and rubiadin-1-methyl ether, anthraquinone glycoside), β -sitosterol, carotene, vitamin A, flavone glycosides, linoleic acid, Alizarin, amino acids, acubin, L-asperuloside, caproic acid, caprylic acid, ursolic acid, rutin, and a putative proxeronine.^[29] These compounds have been shown to fight against infectious bacteria strains such as *P. aeruginosa*, *Proteus morgani*, *Staphylococcus aureus*, *Bacillus subtilis*, *E. coli*, *Salmonella*, and *Shigella*.^[30] Its juice has a broad range of therapeutic effects including antibacterial, anti-inflammatory, antiviral, antitumor, antihelminthic, analgesic, hypotensive, and immune enhancing effects.

The antimicrobial activity of 2% CHX gel, propolis, *Morinda citrifolia* juice and Ca (OH)₂ has been compared on *E. faecalis* infected root canal dentin at two different depths and three intervals. It was concluded that propolis and *M. citrifolia* were effective against *E. faecalis* in dentin on extracted teeth.^[31]

Orange Oil (Narangah)

This is composed mostly of d-limonene. It also has a long chain aliphatic hydrocarbon alcohols, aldehydes like octanal. It is suggested as an alternative to chloroform or xylene for gutta-percha softening and also in dissolving endodontic sealers.^[32]

Propolis (Propolis resin)

Pharmacologically active constituents in propolis are flavonoids, phenolics, and aromatics. It exhibits various biologic activities, including antimicrobial, anti-inflammatory, antioxidant, anesthetic and cytotoxic properties.^[33] The anti-inflammatory property of propolis is due to the presence of caffeic acid and phenethyl ester in propolis. In dental practice it is used as a pulp capping agent, intracanal irrigant, mouth rinse, cariostatic agent, treatment of periodontitis and denture stomatitis, etc.^[34] The antimicrobial activity of propolis with Ca (OH)₂ as intracanal medicament against *E. faecalis* found that propolis was effective in eliminating the microorganisms.^[35]

Study showed less pain, less incidence of postoperative complications and less swelling in the honey treated wounds after surgical removal of impacted third molars than in the untreated control group.^[36] It has been reported in another study^[37] that natural honey showed antibacterial action against anaerobic bacteroides present in dental abscess and osteomyelitis.^[38] It has also been proposed that antioxidants be used to protect the periodontal tissues from the damaging free radicals formed in the inflammatory response. Honey contains a substantial level of antioxidants.^[39-41] In a study, eight honeys and three types of propolis were tested and the result proved them effective as an anticalculus agent in toothpastes and mouthwashes.^[42] Recent studies indicated that honey possessed moderate antitumor and pronounced anti-metastatic effects in five different strains of rat and mouse tumors. Furthermore, honey potentiated the antitumor activity of chemotherapeutic drugs such as 5-fluorouracil and cyclophosphamide.^[43] Studies suggested that chewing "honey leather" can reduce inflammation of the gingiva.^[44-46] Candy made with honey may be useful for prevention of halitosis.^[47] It was found that the minimum inhibitory concentrations of honey for *Streptococcus mitis*, *Streptococcus sobrinus* and *Lactobacillus casei* were 7%, 7.5-8.5%, and 8-12%,

respectively. The production of acid by these bacteria was also inhibited.^[48,49] Direct pulp capping with propolis in rats may delay dental pulp inflammation and stimulate reparative dentin.^[50] Another study conducted on premolars for direct pulp capping also showed that propolis is equally efficacious as calcium hydroxide.^[51,52]

Psidium guajava Linn. (Perukam - Guava)

The fruits and leaves of this shrub contain essential oil rich in cineol, tannins, triptenes and flavonoids. Ethanol extracts of it has higher antimicrobial activity, especially against *E. faecalis*.^[53] The leaf extracts of *P. guajava* have some pharmacological activities, such as anti-inflammatory, antidiarrheal besides antimicrobial activities. It has also been used extensively as a hypoglycaemic agent. The active flavonoid compound gujaverin isolated from the methanol leaf extract of *P. guajava* has been demonstrated by one of the researcher to be a potential antiplaque agent by inhibiting the growth of *S. mutans*.^[54]

Psoralea corylifolia Linn. (Bakuchi - Psoralea seeds)

P. corylifolia extract contains a number of bioactive compounds including flavonoids, coumarins, meroterpenes and benzofuran glycosides that are the molecular basis of its action. Neobavaisoflavone is isolated from fruits and seeds of *P. corylifolia*.^[55] This is found to be effective against *E. faecalis*. It acts by causing injury to the cell membrane and inhibiting DNA polymerase.^[25]

Rhus lancia (L.f.) F.A. Barkley (African Sumac)

It contains gallic tannins and gallic acid. Tannins exhibit antibacterial and antifungal properties. Gallic acid is antioxidant and bactericidal. Gallic acid has been found to reduce periapical inflammation. Water extract of *Rhus* plants help in the opening of blocked dentinal tubules.^[24]

Salvadora persica Linn. (Peelu – Mustard tree)

Many studies have demonstrated that extracts of *S. persica* possess various antiplaque, antiperiopathic, anticaries, anti-inflammatory and antimycotic effects. Its chewing sticks contain trimethyl amine, salvadorime chloride and fluoride in large amounts.^[56] Tests have shown that these sticks contain natural antibiotics, fluoride, and other anti-cavity components. 15% alcoholic extracts of it has maximum antimicrobial action. It can be used as a substitute for NaOCl and chlorhexidine as root canal irrigant.^[57,58]

Syzygium aromaticum (L.) Merrill and Perry (Lavanga - Clove)

Essential oil shows antioxidant, antibacterial, and anodyne effects.^[9,24]

Melaleuca alternifolia (Maiden and Betche) Cheel (Tea Tree Oil)

Tea tree oil's major active component is terpinen-4-ol (typically 30-40%).^[24,25] In order to avoid the undesirable effects of NaOCl, a scanning electron microscopy study was conducted using two medicinal plants that is German chamomile extract and tea tree oil which might disinfect the root canal system with less toxicity when used as irrigants. It was concluded that the efficacy of chamomile to remove the smear layer was

superior to NaOCl alone, but less than NaOCl combined with ethylene di-amine tetra acetic acid.^[59]

Triphala (Haritaki, Bibhitaki and Amalaki)

Triphala is one of the well-known Indian Ayurvedic herbal formulation consisting of dried and powdered fruits of three medicinal plants namely *Terminalia Bellerica* (Gaertn.) Roxb., *Terminalia chebula* Retz. and *Embellica officinalis* Gaertn.^[4] It can be used as an effective antiplaque agent due to its antioxidant properties and it can effectively inhibit the biofilm formation.^[60] Its fruit is rich in citric acid, which may aid in removal of smear layer thereby acting as chelating agent and also found to be alternative to NaOCl for root canal irrigation.^[4]

Curcuma longa Linn. (Haridra - Turmeric)

The active constituents of turmeric are the flavonoid curcumin (diferuloylmethane) and various volatile oils, including tumerone, atlantone, and zingiberone. It possess good antioxidant, hepatoprotective, antimicrobial, and anticancer activity.^[31]

A researcher conducted an *in vitro* study to evaluate the antimicrobial efficacy of curcumin against *E. faecalis* considering NaOCl (3%) as reference for comparison. The result of his study revealed that curcumin had significant antibacterial activity against *E. faecalis* and thus can be used in endodontics for root canal failures.^[61,62] Curcumin in surfactant preparations showed its potential as a photosensitizer in antibacterial photodynamic therapy *in vitro*.^[63]

Glycyrrhiza glabra Linn. (Yashtimadhu - Liquorice)

A number of pharmaceutical effects of liquorice are known anti-inflammatory, antiviral and anticarcinogenic.^[64,65] It has been evaluated for the management of oral lichen planus. The study reported that liquorice extract was as effective as triamcinolone acetonide, but safer and may be used as an alternative treatment for lichen planus.^[66] Glycyrrhizin, a triterpenoid compound, accounts for the sweet taste of liquorice root. The antibacterial activity of liquorice and glycyrrhizin on different strains of *S. mutans* was also studied and their effects on the adherence of *S. mutans* to glass. Liquorice extract exhibited a more profound activity in both adherence and anti-bacterial assays than that of glycyrrhizin.^[67] Liquorice has also shown greater biocompatibility with fibroblasts cells compared to calcium hydroxide, which was severely toxic to the cells. A mixture of liquorice and calcium hydroxide showed moderate cytotoxicity.^[68]

Discussion

Over the past decade, interest in drugs derived from medicinal plants has markedly increased. Literature has addressed many plants with a potential source for new therapies in endodontics. In dentistry, phytomedicine has been used as anti-inflammatory, antibiotic, analgesic, sedative, and also as endodontic irrigant [Table 1].

The major drawbacks of the many antimicrobial and pulp therapeutic agents used in dentistry since long have been immune suppression, hypersensitivity, allergic reactions and resistance of microorganisms to these drugs; also some are mutagenic and cytotoxic. Therefore, there is a need to conduct extensive researches to find plant based alternatives for the conventional drugs.^[69] Studies have found herbal agents such as *A. nilotica*, *A. barbadensis*, *A. lappa*, *A. indica*, carvacrol, *C. sylvestris*, *A. sativum*, *M. recutitia* L, *C. sinensis*, *C. limonum*, *M. citrifolia*, propolis, *P. guajava*, *P. corylifolia*, *R. lancia*, *S. persica*, *S. aromaticum*, *M. alternifolia*, *C. longa*, *G. glabra* can be used as an alternative intracanal medicament and can be used as potential root canal irrigants because of their anti-inflammatory, antimicrobial and immune-modulating activity. Propolis and *M. citrifolia* were found to be effective against *E. faecalis* (most common bacteria isolated from recurrent and failed root canal cases) in dentin on extracted teeth.^[31] In our study too, the results indicated that propolis had an effective antifungal action on *C. albicans* (which is the most common fungus seen in root canals) similar to that of NaOCl.^[70]

Herbal agents like propolis, *A. vera* have healing potential thus making them good pulp therapeutic agents.^[50,69] Propolis, GTPs have shown to preserve periodontal cell viability and thus used as storage media for avulsed tooth.^[39-42,69]

Triphala has free radical scavenging property thus aiding in the protection of gum cells effectively from free radicals produced by the microorganisms.^[71] Some essential oils like orange have endodontic filling material dissolving capacity thus making them readily useful in endodontic retreatments.^[32,69] Herbal agents like German chamomile is used in mouthwashes to reduce gingival inflammation and plaque formation.^[24]

Conclusion

The major advantages of using natural alternatives are easy availability, cost-effectiveness, increased shelf life, low toxicity

Table 1: Classification of herbal drugs used in dentistry based on their actions

Uses in dentistry	Names of the herbal agents
Antimicrobial action	<i>Acacia nilotica</i> , <i>Aloe barbadensis</i> , <i>Arctium lappa</i> , <i>Azadirachta indica</i> , Carvacrol, <i>Casearia sylvestris</i> , <i>Allium sativum</i> , <i>Marticularia recutitia</i> , <i>Camellia sinensis</i> , <i>Citrus limonum</i> , <i>Morinda citrifolia</i> , Propolis, <i>Psidium guajava</i> , <i>Psoralea corylifolia</i> , <i>Rhus lancia</i> , <i>Salavadora persica</i> , <i>Syzygium aromaticum</i> , <i>Melaleuca alternifolia</i> , <i>Curcuma longa</i> , <i>Glycyrrhiza glabra</i>
Anti-inflammatory action	<i>Casearia sylvestris</i> , <i>Marticularia recutitia</i> , <i>Camellia sinensis</i> , <i>Morinda citrifolia</i> , Propolis, <i>Psidium guajava</i> , <i>Rhus lancia</i> , <i>Salavadora persica</i> , <i>Glycyrrhiza glabra</i>
Sedative and anxiolytics	<i>Arctium lappa</i> , <i>Marticularia recutitia</i>
Miscellaneous action (endodontic irrigants, medicaments and endodontic retreatment)	<i>Arctium lappa</i> , <i>Azadirachta indica</i> , <i>Casearia sylvestris</i> , <i>Allium sativum</i> , <i>Morinda citrifolia</i> , <i>Camellia sinensis</i> , <i>Citrus limonum</i> , Orange Oil, Propolis, <i>Salavadora persica</i> , <i>Melaleuca alternifolia</i> , <i>Triphala</i> , <i>Curcuma longa</i>

and lack of microbial resistance reported so far. Herbal agents have been used in dentistry for reducing inflammation, as antimicrobial plaque agents, antiseptics, antioxidants, antimicrobials, antifungals, antibacterials, antivirals, and analgesics. They also aid in healing and are effective in controlling microbial plaque in gingivitis and periodontitis and thereby improving immunity. Though the *in vitro* results appear promising, many clinical trials are warranted to evaluate biocompatibility and safety factor before they can be recommended for clinical use conclusively.

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हिन्दीसारांश

दन्तविज्ञान में प्राकृतिक चिकित्सा

दक्षीता जे. सिन्हा, आशिष ए. सिन्हा

कैनाल उपचार का प्रमुख उद्देश्य रुट कैनाल प्रणाली को शुद्ध करना है। दांतों की सफाई, जीवाणु रोधी दवाओं का प्रयोग, तथा कुछ हद तक जीवाणु भार कम करने में यह पद्धति प्रभावी रही है, लेकिन कुछ शेष जीवाणु पुनः वृद्धि करके संक्रमण पैदा करते हैं। आधुनिक जीवाणुरोधी दवाओं की प्रभावहीनता, संभावित दुष्प्रभाव और कृत्रिम दवाओं के उपयोग से सुरक्षात्मक चिंता इत्यादि कारणों से एंडोडॉन्टिक औषधीय विकल्प अधिक लाभप्रद साबित हो सकता है। विगत वर्षों में औषधीय वनस्पतियों से प्राप्त दवाओं में उल्लेखनीय वृद्धि हुई है। इनका जीवाणुरोधी, वेदना शामक के साथ ही एंडोडॉन्टिक के रूप में दंत चिकित्सा में प्रयोग किया गया है। यह औषधी वनस्पतियों के मूल, पत्र, पुष्प, वल्कल, काष्ठ, बीज इत्यादि से प्राप्त की जाती हैं। पब मेड की डाटाबेस सूची में १४८० लेखों और दंत चिकित्सा में कुल १७३ लेखों के प्रकाशन का पता चलता है। पुनः एक खोज लेख और लेखक के नाम पर कि गई जो कि दंत चिकित्सा में फायटोमेडिसिन के प्रयोग के विषय पर था। वर्तमान समीक्षात्मक लेख विभिन्न प्राकृतिक दवाओं और उनके उत्पादों के साथ ही उनके चिकित्सकीय प्रयोगों पर केन्द्रित है।