Herbal Dentifrices: Emerging Trends and Patterns

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Abstract: Background: Herbal extracts have been employed since ages in dentistry as tooth cleansing and antimicrobial agents. The use of herbal medicines continues to expand and trend rapidly across the world. Herbal extracts have been used in dentistry for multiple uses as reducing inflammation, as antimicrobial plaque agents, for preventing release of histamine and as antiseptics, antioxidants, antimicrobials and analgesics. They also aid in healing process and are very effective in controlling microbial plaque and other disorders related to gums.

Objective: The present review aims towards the combined review as well as compilation of available herbs under the category of various dental associated problems.

Materials and Methods: The herbs were studied by sectioning them as for looking after different works or findings done against dental caries, tooth ache, scouring teeth, gum troubles and herbs as mouth fresheners.

Results: Herbal extracts have been used on a large scale in dentistry as tooth cleansing and antimicrobial plaque agents. Many people take herbal derived medicines or herbal based products for the purpose of reducing inflammation, as antimicrobial agents, for preventing release of histamine and as antiseptics, antioxidants, antifungals, antibacterials, antivirals and analgesics. Herbal extracts are used in dentistry for treatment of various dental disorders.

Conclusion: The use of herbal medicines are blooming rapidly across the world. Herbal extracts and the various herbs on the whole or their specific parts have been used in dentistry. They relieve the problems of gums and act as excellent mouth fresheners. The natural herbal remedies act as an effective substitute to antibiotics and represent a promising approach for prevention and as therapeutic strategies for various oral infections as they are natural, eradicate the problem from its root and provide long lasting relief. The herbal remedies are advantageous over conventional treatment.

Keywords: Herbal, dentifrices, antimicrobial, caries, toothache, medicinal plants.

1. INTRODUCTION

Ayurveda has a 5000 years old wide and rich heritage of medicinal plants being used in the treatment of various disorders and diseases as alternative medicines [1]. A number of medicinal plants, traditionally used for over 1000 years named rasayana are present in the form of herbal preparations of different Indian traditional health care systems [2]. Oral hygiene is an important key to maintain good appearance, impression of an individual and boosts the confidence [3]. Dentifrices can be used as a prophylactic cosmetic and remedy for tooth to prevent their decay and bad breath. Dentifrices can be prepared by both artificial as well as herbal ingredients nowadays. Herb-
al formulations are high in demand due to its efficiency to avoid the side effects and other disadvantages as commercial tooth paste contains sodium laurel sulfate which can cause irritation and inflammation while doing the brush, no artificial ingredients or refined sweeteners, no harsh abrasives when compared with synthetic formulations [4]. The herbal dentifrices are available in different formulations such as toothpaste, tooth powder, mouthwashes, gels etc. [5]. Many herbal dentifrices claim to have antibacterial action, although there has a dearth of studies to investigate these claims [6]. Dental caries is a common dental disease, which occurs during childhood due to certain habits and continues to be a major public health problem [7].

Toothache is the most common reason behind oral pain. Although fractured teeth and exposed dentine may produce dentine hypersensitivity may also be the cause behind dental pain [8]. Scouring teeth is also the major problem, which may be due to acids present in the food items such as pickles, cranberries, tomato products as sauces, coffee, alcohol (wine) etc. [9]. Periodontitis, also generally called gum disease or periodontal disease, while gingivitis or gum inflammation usually precedes periodontitis are the common troubles of gum [10]. There are several reasons which lead to bad breath. The most common reasons are raw onions, stomach problems etc. Many herbs are used as oral deodorizers [11]. Covering the various issues related to dental care, in this article an effort has been made to review the various herbs as shown in Table 1, on the basis of their role in dental care. They have been divided separately as herbs for dental caries, herbs for the treatment of tooth care, herbs for scouring teeth, herbs for the cure of various problems related to gums and herbs as mouth fresheners.

2. MATERIALS AND METHODS

Literature was reviewed in a narrative manner in order to pertain the information about herbs that deals with overcoming the various problems that arise post-partum. The search was done on Google Scholar, MEDSCAPE, BMC, Science Direct, MEDLINE database, SCOPEMED and other relevant databases, using keywords like herbal, dentifrices, antimicrobial, caries, toothache separately for a time period of 1988-2014, dealing mainly with the reviews, researches, findings of seminars, symposium, conferences over the topic of herbal dental care. The information was also extracted from various Ayurvedic treatises, text books of Ayurveda and books of Pharmacognosy available in Library of Pranveer Singh Institute of Technology, Kanpur and NBRI Lucknow. Available dissertations/thesis and various research articles were also investigated.

2.1. Herbs for Dental Caries

Dental caries is the term used scientifically for tooth decay or cavities. It is caused by specific types of bacteria. They produce certain acids that destroys the tooth's enamel and the layer under it, the dentine [12]. Lack of minerals in the diet as calcium, magnesium and phosphorus deficiency, along with lack of fat soluble vitamins such as A, D, E and K especially vitamin D deficiency are also the reason behind caries. Too much consumption of phytic acid-rich foods also contributes to it. Excess consumption of processed sugar in the form of fast food, junk food, desserts etc. in the recent times has marked shift in the problems related to oral health. Herbal cures are being sought in the recent times because of the pronounced cumulative and irreversible reactions of modern drugs as poisonous ingredients include: Sodium fluoride, triclosan, on swallowing a large amount of toothpaste containing fluoride causes Convulsions, Diarrhea, Difficulty in breathing, Drooling Heart attack etc. [13, 14]. There are larger number of herbs and their derivatives which are very effective in the treatment of dental caries.

*Achyranthes aspera*, belonging to the family Amaranthaceae, commonly known as puthkanda. Six species of Achyranthes occur in warm temperate and tropical regions of the world. Both leaves and roots are used against dental pain. Its root is used as a toothbrush, as it is very good for dental caries [15]. It is one such less palpated seasonal plant, known as Aghada in Marathi, Latjeera in Hindi & Rough Chaff tree in English. There are studies which scientifically validate the traditional use of *A. aspera* as a natural brush for teeth cleaning and state that phytochemicals of this traditionally used dental caries preventive natural chewing stick plant could be harnessed for dental caries. Various studies reports have revealed that the aqueous solution of *A. aspera* has shown antibacterial activity against *Staphylococcus aureus*, *Streptococcus hemolyticus* and *Bacillus typhosus*,
<table>
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<tr>
<th>S. No.</th>
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<th>Constituents</th>
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<tr>
<td>1.</td>
<td><em>Clove</em></td>
<td>Terpenes</td>
<td>Oil from buds</td>
<td>Dental analgesic</td>
<td></td>
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<tr>
<td>2.</td>
<td><em>Lemon</em></td>
<td>Terpenes</td>
<td>Essential oil from leaves</td>
<td>Heals disorders of gums</td>
<td></td>
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<td>3.</td>
<td><em>Liquorice</em></td>
<td>Flavanoids</td>
<td>Aqueous and alcoholic extracts of root</td>
<td>Anti-inflammatory</td>
<td></td>
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<tr>
<td>4.</td>
<td><em>Ginger</em></td>
<td>Pungent oil</td>
<td>Oil from roots and rhizomes</td>
<td>Analgesic for teeth and gums</td>
<td></td>
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<td>5.</td>
<td><em>Cinnamon</em></td>
<td>Aromatic principles</td>
<td>Powdered bark</td>
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while alcoholic and aqueous extract of its leaves possess antibacterial activity against *S. aureus* and *Escherichia coli*, which are the main causative factors behind the dental caries [16].

*Calotropis procera*, belonging to family Asclepiadaceae, commonly known as Ak. The plant *Calotropis* is one of the widely distributed along the world geographical area. Three varieties of *Arka* are mentioned in the Hindu literature of Dhanvantari Nigantu as Suklarkah, Rajarkah, and Sveta mandarah. It is widely used in the Indian traditional medicinal system. *Calotropis gigantea* mouth rinse as anticariogenic agents with 0.2% chlorhexidine and Listerine mouth rinse. The five major compounds identified in the leaves are methyl β-carboline-1-carboxylate (1), (+)-dehydrovomifoliol (2), pleurone (3), calotropagenin (4), and calotoxin (5). The antimicrobial activity of *C. gigantea* root bark extracts have revealed its antibacterial potentials against *Sarcina lutea, Bacillus megaterium*, its latex is used for the treatment of dental caries [17].

*Jatropha curcas*, belonging to family Euphorbiaceae, also known as Japhrota, is a multipurpose shrub. In some regions of Africa, the fresh twig of *Jatropha curcas* is used as a toothbrush to treat gumboil conditions as well as to strengthen the gum. In addition, the latex from the stem is collected by the traditional healers and used for a mouth rinse, to treat gum bleeding, toothache, and in some cases for soothing babies’ inflamed tongues. It is rich in saturated fatty acids such as palmitic acid, stearic acid, unsaturated fatty acids, oleic acid, linoleic acid. Its twigs are used as a toothbrush, which are also effective against dental caries. Its latex is used to make toothpaste [18, 19].

2.2. Liquorice

Chinese licorice or *Glycyrrhiza glabra* root, which is found in northern mainland China, has been a staple in traditional Chinese medicine. Aqueous and alcoholic extracts of liquorice root are effective against *Streptococcus mutans* and *Lactobacillus acidophilus*. Minimum inhibitory concentration of aqueous and ethanolic licorice root extract against *S. mutans* and *L. acidophilus* were found to be 25% and 12.5%, respectively in the reported studies. Licoricidin and licorisoflavan A inhibited two of the major bacteria responsible for dental cavities and two of the bacteria that promote gum disease and licoricidin also inhibited a third gum disease bacterium. Licorice root is also used as a breath freshening ingredient in some natural toothpastes. Its roots as well as stolons as shown in Table (1) are equally effective, due to presence of flavonoid glycosides in them for the removal of dental caries [20, 21].

2.3. Herbs for Tooth Ache

Untreated dental decay has been reported as the most important reason for toothache which can impact routine daily activities such as eating, studying, concentrating on delicate tasks, and so on [22-25].

2.4. Ginger Root

Ginger, botanically *Zingeber officinale*, its root can also ease painful toothache. Among natural food sources, ginger rhizome belongs to natural herbals with their antimicrobial activities. Pungent oil contents of these herbals harbor some polyphenolic ketones are effective anti-microbials. The antibacterial properties present in it due to zingeberaceous derivatives, and terpenoids present in the root, gum pain and toothache caused by swelling, infection or even a nasty cut can be eased by allowing the juice of the root to penetrate the painful areas [26].

2.5. Clove

The antimicrobial activities of clove have been proved against microbes like bacteria and fungi due to presence of terpenes in its volatile oil. It helps fight tooth decay and cavities [27]. Cloves are the aromatic flower buds of a tree in the family Myrtaceae, *Syzygium aromaticum*. They are native to the Maluku Islands in Indonesia and are commonly used as a spice [28, 29]. This toothpaste is ideal for those with sensitive teeth and gums as the clove oil present is known to have anaesthetic properties. Clove oil is also an analgesic, which can help prevent tooth decay [30, 31]. Complete bactericidal effect is exhibited against all the foodborne pathogens as *Escherichia coli, Staphylococcus aureus* and *Bacillus cereus* by the 3% aqueous extract of clove. Concentration of 1% clove extract also showed good inhibitory action against bacteria shows analgesic activity against tooth pain [32].
2.6. Turmeric

*Curcuma longa, domestica* have been used as seasonings in many ethnic cuisines in various countries such as Bangladesh, India, and Pakistan, provides protection against free radical damage because it is a strong antioxidant. Turmeric is a well-known anti-inflammatory and antimicrobial herb, making it useful for home dental care. An orange pulp contained inside the rhizome constitutes the source of turmeric medicinal powder. It helped remove plaque, bacteria, and inflammation comparably well with traditional mouthwashes, when used properly. It is rich in curcumin and other terpenoids. Curcumin in turmeric can prevent gingivitis or gum disease. It helps to remove plaque, bacteria, and inflammation comparably well with traditional mouthwashes, when used properly [33].

It decreases inflammation, which is the main causative reason behind the dental ache. It reduces histamine levels by increasing the production of natural cortisone by the adrenal glands [34].

2.7. Capsicum

Also known as *Capsicum annuum*. *Capsicum frutescens* is also a major source of capsanthin, which is the major analgesic content of it. Topical capsaicin formulations are very effective to manage pain. Low-concentration capsaicin containing creams, lotions, and patches intended for daily skin application have been available in most countries since the early 1980s [32-34]. Capsicum species, rich in capsaicin, capsanthin have also been used as folk remedies for toothache [35].

2.8. Ficus

Methanolic extract of *Ficus platyphylla* can be used in inflammation and toothache [36]. Few scientific evidences have concluded that extracts of *F. benghalensis* did have significant analgesic and antipyretic activities from hot-plate, writhing, and yeast-induced hyperthermia models [37]. Inflammation is the main point of global scientific research because of its implication in almost all human and animal diseases [38, 39].

2.9. Herbs for Scouring Teeth

Tooth erosion happens when acids wear away the enamel on teeth. Enamel erosion can be caused by excessive soft drinks and fruit drinks consumption causing high levels of phosphoric and citric acids. Diets high in sugar and starches also leads to scouring teeth.

2.10. Berberis

Commonly known as daruhaldi, botanically, *Berberis aristata*. Peeled stem of berberis is good source of alkaloids like berberine is considered good for scouring teeth [40]. Herbal extracts have been incorporated for many uses in dentistry as tooth cleansing and antimicrobial plaque agents. The dental gel prepared from its extracts has been proven to effectively control gingivitis and microbial plaque formation in children [41]. Barberry juice from Berberis vulgaris contains large amount of Vitamin C and so it increases the activity of immune system, stimulates to absorb iron and avoids scurvy [42].

2.11. *Citrus auriantum*

Commonly known as orange. Its leaves are used for scouring teeth and are good as a mouth freshener [43]. The various terpenes as gurjunene [44], nerol, neral are the main aromatic principles, which are curative in action. The analgesic and anti-inflammatory properties of *Citrus aurantium* L. blossoms essential oil (neroli) are used for its curative action [45].

2.12. Guava

*Psidium guajava* L. is a small medicinal tree that is native to South America. It is popularly known as guava (family Myrtaceae) oleic acid, ursolic acid obtained from its [46]. Leaves and stem are used for scouring teeth [47]. Guava leaves are potent anti-inflammatory action and a powerful antibacterial action which fights against infection to kill germs. Thus consuming guava leaves works as a fantastic home remedy for toothache. The juice of guava leaves has also been known to cure toothaches, swollen gums and oral ulcers [48].

2.13. Cinnamon

Its leaves are used for scouring teeth, it is good for treatment of gum inflammation by mixing honey and cinnamon and rubbing it on the gums. Steeping cinnamon sticks in warm water and drinking also helps. Bark of *Cinnamomum zeylanicum* helps to prevent tooth decay, gum disease and helps to fight odor when used regularly [49]. A half or one
teaspoon of cinnamon a day can kill bacteria in the mouth and prevents inflammation. Addition of cinnamon to green tea is even more beneficial for mouth and body [50].

2.14. Herbs for Gum Trouble

Gum problem is gingivitis and is common in 50% of the adult population. Gingivitis refers to the inflammation of the gums. Gum inflammation includes bleeding during tooth-brushing, swollen-looking gums and red gums. Periodontitis is similar to gingivitis except it also results in gum tissue and jawbone loss [51].

2.15. Myrrh

The three main constituents of myrrh or Commiphora molmol are resin, gum, and volatile oil. It is a oleo-gum-resin. The gum consists of 20% proteins and 65% carbohydrates and are made up of galactose, 4-O-methylglucuronic acid and arabinose. Myrrh had been used in the management of pharyngitis, tonsillitis, gingivitis, stomatitis and ulcers. Topical application and local application as an anodyne to treat infections of the oral cavity is also considerably met by this resinous plant [52-54].

2.16. Neem

Neem or Azadirachta indica consists of sodium nimbin, various alkaloids as salannin, nimbin, azadirachtin, nimbidiol, quercetin and nimbidin. Neem leaves contain fiber, carbohydrates and at least 10 proteins, calcium, carotenoids and fluoride. All the parts of this tree are helpful therapeutically in one or either ways. Neem shows antimicrobial, anti-inflammatory, analgesic, antioxidant activity. Studies have shown that neem is used in the treatment of dental caries, gingivitis, periodontitis [55, 56].

2.17. Ginseng

Chemical constituents of ginseng are triterpenes, saponins,oleanolic acid. It is analgesic, antimicrobial, anti-inflammatory in nature and therefore is used in periodontitis [57-59].

2.18. Green Tea

Green tea is rich in polyphenolic contents comprising of several tannins as catechin, epicatechin, gallocatechin, epigallocatechin, epicatechin gallate and epigallocatechin gallate. It is anti-inflammatory, antibacterial, antiviral in action due to which, it is used in the treatment of periodontal diseases [60, 61].

2.19. Herbal Mouth Fresheners

There are several reasons which lead to bad breath. The most common reason is to eat something like raw onions, whereas other reasons could be related to stomach problems, etc. No matter what, it is good to keep mouth fresheners handy. An unpleasant lingering taste and dryness in the mouth are the most common signs of bad breath. A number of triggering factors like poor oral hygiene, tobacco or alcohol consumption or gum disease can lead to a build-up of harmful bacteria in the mouth which give off a persistent bad smell. Consuming highly acidic and sulphur-rich foods like garlic and onion also contributes to bad breath.

2.20. Peppermint

Leaves of Mentha piperata are better alternatives than popping some chewing gums or breath-mints. These refreshen the breath, due to presence of menthol and are healthy too. These leaves prevents from bad teeth condition [62, 63].

2.21. Citrus Limon

This citrus extract deodorizes the mouth and also eliminates any bacteria that may be growing in there. Lemons are rich in Vitamin C which helps to prevent gum inflammation and gum diseases – both of which are major causes of bad breath. Lemons are a rich source of flavonoids that are powerful natural anti-oxidants and anti-bacterial agents. These help in preventing the harmful bacteria from sticking to the teeth and tongue, which can later result in bad breath. One of the properties of flavonoids with their physiological action in the plants is their antifungal and antiviral activity. Quercetin and hesperitin actively inhibit the replication of Herpes simplex virus, Polio viruses, Para influenza and Syncytial viruses. Naringin metabolites have antibacterial activity. Bergamot peel has natural antimicrobials that are active against Gram-negative bacteria [64-68].

2.22. Rosemary

Another herb that can be easily found in most kitchens is rosemary or Rosmarinus officinalis L., may help to reduce inflammation. This is because
of which there is an easy access to the herb that is highly capable of freshening mouth. Its leaves in a glass of hot water, when gargled with eliminates bacteria, and naturally freshens and clean breath [69, 70].

2.23. Parsley

"Parsley" or “Petroselinum crispum” or “Petroselinum hortense” easily freshens breath as it is commonly used for the purpose of garnishing. Parsley is good at masking bad breath with its characteristic smell. Scientists say that chlorophyll present abundantly in it is an excellent all-natural deodorizer [71, 72]. The mouth rinse made from it is rich in anti-inflammatory and antimicrobial agents, which are effective against the broad spectrum of oral bacteria, causing gingivitis, plaque and periodontal disease. Such herbal mouth rinse are beneficial for maintaining oral health [73, 74].

3. PERSPECTIVES AND OTHER HERBS

This review done above strongly suggests the potential of using different herbs rich in antibacterial, antifungal and antiviral properties to meet up the various problems associated with dental care. Herbal extracts are used in dentistry as tooth cleansing and antimicrobial plaque agents. Many people take herbal medicines or herbal products for the purpose of decreasing inflammation, as antimicrobial plaque agents, antiseptics, antioxidants, antimicrobials, antifungals, antibacterials, antivirals and analgesics. Chamomile shows anti-inflammatory properties, which helps to decrease gingival inflammation. Echinacea has been studied to stimulate the immune response and to activate leukocytes. Sage has been known to decrease tissue bleeding and myrrh is a natural anti-septic. The medicinal properties of peppermint oil are analgesic, anti-septic, anti-inflammatory, and antimicrobial. Many herbs are very beneficial due to presence of certain active phytoconstituents, which provide assistance against dental related issues. They are effective against dental caries, ache, scouring teeth, gum troubles and bad breath. Topical application of coenzyme Q10 significant decreases the plaque index, gingival cervical fluid flow, probing depth. Applying CoQ10 to gums might control periodontitis because when antioxidants scavenge reactive oxygen atoms, it can reduce collagen destruction. Topical CoQ10 reduces the depths of pockets that have developed around the teeth and improve gum attachment to teeth. During few clinical studies, CoQ10 supplements led to faster healing and tissue repair in patients with periodontal disease. It is important to routinely use both topical CoQ10 and its supplements for patients with periodontal disease. Some natural toothpastes and mouth-rinse products contain CoQ10. To use CoQ10 powder for periodontal disease, powder is added to water and used as a rinse [75-79]. Numerous studies have proven the antimicrobial properties of herbs like neem, whose extracts have shown to alter bacterial adhesion and the ability of streptococci to colonize the tooth surface [80, 81]. In vivo studies have proved that, the use of German chamomile mouthwash twice daily for 4 weeks, could reduce both the plaque accumulation and gingival inflammation [82]. Mathur et al. studied mint leaves and found the highest inhibitory effect was observed against S. mutans [83]. Thus providing scientific evidence for the use of mint in herbal dentifrices.

CONCLUSION

The use of herbal medicines are on a wider scale and are blooming rapidly across the world. Many people take herbal medicines, extracts, herbal products now for their health care in different national healthcare settings. Herbal extracts and the various herbs on the whole or their specific parts have been used in dentistry. The use of herbal dentifrices has declined the various problems as dental plaque active ingredients of the herbal extracts dentifrices penetrates the biofilm and prevent plaque accumulation. Results of other clinical studies and trials have confirmed the long-term plaque and gingival bleeding-reduction properties of herbal dentifrices. They relieve the problems of gums and act as excellent mouth fresheners. Aloe vera containing herbal dentifrices in improving plaque control and gingival health. The natural herbal remedies are a promising and effective alternative to antibiotics and represents an effective approach for prevention and as therapeutic measure for various oral infections as they are natural, eradicate the problem from its root and provide long lasting relief [84-87]. M. fragrans has a great potential benefit in the field of dentistry, as its ethanol extract has proven to provide antibacterial activity against cariogenic bacteria. Toothpaste obtained from the alcoholic extract of P. granatum showed activity against cariogenic S.
mutans, S. sanguinis, and S. mitis bacteria, demonstrating its antibacterial effect. Regular application of herbal extract dentifrices provided significant reduction of dental plaque accumulation and some gingival inflammation signs such as gingival bleeding. These agents possess bactericidal activity against most of the periodontal pathogens [88]. Future clinical research should be on the assurance of herbal dentifrice on the prevention of plaque and gingivitis as compared to conventional dentifrice. The long-term effects of triclosan and stannous fluoride should be considered in it to make sure that Herbal dentifrices are available globally as “over-the-counter” oral hygiene products. Various scientific findings as claimed for certain herbs are yet to be confirmed through various trials. Therefore much scientific data is not present in the review.

Further long-term randomized studies on effective reduction of plaque and gingivitis is required. No adverse reactions to dentifrices products must be proven on large scale. One of the ingredients in synthetic toothpastes is fluoride and that plays a vital role in the prevention of cavities. While that used to be a great plus point for synthetic toothpastes, there is a greater need to fulfill their herbal substitutes. Tricoslan – An anti-bacterial agent added to toothpaste to kill germs in the mouth. Controversial studies claims that the ingredient increases antimicrobial resistance, disrupts hormones and causes a higher risk of allergy.

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