



Contribution of Herbs in Dentistry: Future Perspective for Dental Disorders

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ABSTRACT

Dental diseases affect individuals of all stage groups and races. Dental caries, oral cancer, noma, and oro-dental trauma are types of dental disease. Herbal remedies are feedstock and potential markers useful in the treatment of the majority of infection caused. Chemicals used in toothpaste can lead to oral skin irritation and allergy, and herbal drugs serve as better alternatives and are supposed to have low or no side effects. Microorganisms like Streptococcus mutans, Staphylococcus aureus, and Streptococcus mitis supposed to occupy space in dental diseases. Natural drugs tremendously utilized since ancient times, signifying the use of natural origin drugs in modern days. Many traditional formulations and plants are reported in Literature to use in dental ailment. The antibiotic resistance in treating oral infections gave way to selecting herbs as an alternative approach for treating dental diseases. The study explores various types of dental conditions, research updates, and traditional formulations related to it. In context, this article elaborates on the information on which future researches based.

KEYWORDS: Dental disease, Microorganism, Herbal plants, Traditional formulation, Herbs.

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INTRODUCTION

There is an intensification of the use of extraction of plant drugs in human ailments in current times. The search for operative, competent, harmless, and inexpensive replacements directed us for an upsurge in the practice of natural crude drugs in curing ailments. Many scientific research studies are there to validate natural medicine for avoiding and curing most of human diseases. [1]. According to Ayurveda, the source of the utmost diseases found in either exogenous or endogenous dosha of human beings. The disease procedure is supposed to respond between the bodily humor (Doshas) and tissues (Dhatu) and the atmosphere's prejudices. Therefore, Ayurveda's analysis suggests a time to time check of the interaction between health and disease [2]. There is an upsurge in herbal medicine used for the last few decades, as they believed to be safer than traditional treatments [3]. Oral fitness is an essential factor of complete wellbeing, happiness, and excellence of natural life. World health organization (WHO) defines oral health as "a state of being free from chronic mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking, and psychosocial wellbeing [4]. Oral sicknesses affected not less than 3.58 billion individuals universally, according to the global burden of disease study conducted in 2016. Permanent tooth caries was an extensive complaint among them. [2] Internationally, it is a matter of concern that 2.4 billion folks agonize from permanent teeth' dental disease, and 486 million offspring worry caries in their primary teeth [5]. According to WHO, poor dental health may profoundly affect overall health and excellence of life, and some oral ailments are related to chronic disorders [6]. Any disease can affect individuals of all stage groups and all races. It affects both grownups and offspring. When dental disease is left undiagnosed and untouched, it could lead to life-threatening circumstances; still, many dental diseases exist among the poor and deprived groups internationally [7, 8]. The utmost public conditions among dental ailments are gingivitis and caries. Different oral cavity organs such as the teeth, gums, or other tissues may be affected by dental disease. Apart from a toothache, which is a customarily experienced dental ailment, others may appear evidently as incapability to speak, grin or even chew with a fluctuating degree of severity [9].

DENTAL DISEASES**DENTAL CARIES (TOOTH DECAY)**

Caries is the limited devastation of teeth enamel by acidic breakdown process from fermented bacteria of nutritional sugars. The carious demineralization is visible on the enamel, but the illness progression is originated deep in bio-film that secures a tooth protective layer [10]. Free sugars are a crucial nutritional issue in dental caries' growth since dental caries do not arise in dietary sugars' absence. Dental caries progress when bacteria in the mouth break down the sugars yield acid that demineralizes the teeth' hard matters [11]. With the constant high eating of sugary materials, insufficient interaction with fluoride, and deprived of steady bacterial biofilm detachable. The general structure of tooth constructions is devastated, resulting in caries and discomfort, influences the excellence of life. If the condition persists, it can lead to tooth loss and complete contamination [5].

ORAL CANCER

Oral cancer belongs to tumor growth in lips and affects almost all parts of a person's oral cavity and oropharynx. Age dependant frequency of oral cancer in the biosphere assessed at 4 cases per 100 000 people. However, there is extensive dissimilarity worldwide [12]. Men and older people are generally affected by oral cancer and vary powerfully by socioeconomic circumstances. In many parts of the Asia Pacific region, oral cancer incidence comes under the three top most carcinomas [8]. Chewing tobacco, Areca nut, and alcohol consumption are one of the main reasons for carcinoma of the oral cavity [13, 14]. Human papilloma virus infection is the main reason for an increasing number of oropharyngeal cancers in youths [14, 15]. Oropharyngeal carcinoma (OPC) is one of the ten recorded public cancers universally [15].

ORAL MANIFESTATIONS OF HIV INFECTION

Oral diseases arise in 30–80% of persons suffering from Human immunodeficiency virus (HIV), with significant differences reliant on the factors such as the utilization of usual anti-retroviral therapy. Oral disease can be because of viral, bacterial, or fungal infections. Candidiasis is a widespread and starting symptom of the disease. Oral HIV lesions cause uneasiness, dry mouth, chewing problems, and a permanent foundation of unscrupulous infection [15]. Diagnosis of HIV-related oral lesions can confirm HIV infection, measure the ailment stage, foresee immune position, and lead to appropriate therapeutic interference. The treatment and management of oral HIV lesions can considerably improve oral health, quality of life, and well-being [18].

ORO-DENTAL TRAUMA

Dental trauma belongs to significant damage to the tooth tissues inside the mouth and oral cavity. The world frequency of disturbance damages in either dentition is near to 20%. Dealing is expensive, lengthy, and occasionally consequences may be tooth loss, which leads to difficulties for facial and emotional expansion and excellence of lifespan [19-21].

NOMA

Noma is a non-maintenance of the structure of the face, mainly of underfed children. This predominance is primarily in one to four years of age group living with life threatening poverty, and adults with weak immune systems are seldom affected [22].

ADVERSE REACTIONS OF CONVENTIONAL DENTIFRICES

Around 1000 to 1500, ppm of fluorine is used to avoid dental caries [23]. Dental fluorosis considered as hypo-mineralization of tooth enamel triggered by the ingestion of extreme fluoride during enamel development. It looks at a range of visual variations in enamel producing degrees of basic tooth staining, and in some cases, physical damage to the teeth. The essential fluorine source that leads to fluorosis is toothpaste, drinking water, beverages, eating supplements, foods that contain fluoride, and dental cleaning agents like mouthwashes, gels, and fluorinated medicine [24]. Tooth bleaching with intense peroxides consequences in high rates of adverse reaction and serious biological hazards [25].

Bleach and peroxide are frequently used as bleaching mediators in commercial toothpaste. Bleach and peroxide both can be a nuisance to the oral cavity and skin in tiny doses and are well-thought-out to be hazardous resources as they can cause severe organic injuries in massive amounts. Sodium lauryl sulfate is used to make toothpaste foam. It is a recognized skin irritant, and many persons are very allergic to this chemical [26]. However, chlorohexidine created to be effective in reducing salivary mutants' streptococci. It is unsuccessful as a caries-preventive mediator [27].

ROLE OF MICROORGANISM AND THEIR MECHANISM OF ACTION IN ORAL DISEASE

Most dental caries classes include facultative and obligatory-anaerobic bacteria belonging to the *Eubacterium*, *Propioni bacterium*, *Bifido bacterium*, *Lactobacillus parvimonas*, and *Actinomyces genera* [8]. Other bacterial members include *Scardovi*, *Streptococci mitis*, *Anginosus*, *Enterococcus faecalis*, *Prevotella*, *Porphyromonas*, *Selenomonas*, and *Rothia dialer*, *Fusobacterium*, *Thiomonas veillonella*, *Granulicatella*,

Leptotrichia, and *Pseudo ramibacter*. Bacteroides and Anginosus species dominate mucosal tops and reach actual high concentrations in teeth plaque [28]. Microorganisms like *Streptococcus mutans*, *Staphylococcus aureus*, *Streptococcus mitis*, and *Candida albicans* have occupied in dental sicknesses [29]. The reason for the caries process is the same for all types of caries. Caries progress when bacteria in the mouth break down sugars to give an acid that demineralizes dentin's challenging matters. This contributes to the lowering of pH value and therefore, led to tooth enamel [30]. The prominent caries cause of *S. mutans* and *S. sobrinus* the capability to observe to the tooth exterior and lead to the quick breakdown of sucrose to organic acids and polysaccharides outside the cell [31]. It also helps in biofilm development, the acidogenicity, and end in acid tolerance [32, 33]. The strains that primarily live in the mouth *Streptococcus mutans*. It is a Gram-positive, facultative anaerobic bacterium usually in the human oral cavity and has a noteworthy tooth decay factor. Initial settlers of the tooth surface are mainly *Neisseria sp.* and *Streptococci*, with *S. mutans*. These developer species' progress and breakdown fluctuate local surroundings (like pH, Co adhesive property, and substrate accessibility), thereby allowing more rapid growth of the colonies, forming plaque. The acidic pH in the mouth causes the highly mineralized tooth to tend to be decaying. *S. mutans* is individual organisms with receptors that progress union to the surface of teeth. It is the grouping of plaque and acid that causes dental decay. Because of *S. mutans* role in tooth decay, many attempts have made a vaccine for it [26].

Destructive arrangements of periodontal disease have related to establishing specific clones of *Aggregati bacter*, action *Mycetemco mitans* in potential unit studies [38]. Species like *Porsphyromonas gingivalis*, also accompanying by severe or progressive periodontitis [34].

Traditionally, there are many ways for dental ailments, some of which can work as prophylaxis for dental disease. Many herbal drugs are there that can help in curing of inflammation and infection of dental disorders [35], are showed in Table 1.

TABLE- 1. HERBS USED FOR DENTAL TREATMENT.

Biological Source	Use in Dental Disorder	References
<i>Achyranthus aspera</i>	Akarkara is specified in toothache, mouth diseases, dry mouth and paralysis of the tongue. Decoction of Akarkara root is utilized for gargling in dental caries, toothache and tonsillitis.	Srivastava R <i>et al.</i> [36]
<i>Syzygium aromaticum</i>	Clove has been utilized in clinical dentistry in root canal treatment, surgical dressings, pulp capping agents, cavity liners and in a temporary filling of cavity.	Pulikottil SJ <i>et al.</i> [37]
<i>Solanum tobaccum</i>	Nicotinia tobacum dried powder or wet paste powder for tooth application of powder into holes to arrest caries.	Agbor MA <i>et al.</i> [38]
<i>Azadirachta indica</i>	Neem twigs are used as mouth deodorant, toothache reliever and for cleaning. In some parts of India, the brushwood also preferred as to avoid gingivitis.	Lakshmi T <i>et al</i> [39]
Babool	Babool work well in oral hygiene measure.	Sharma A <i>et al</i> [40]
<i>Mentha piperita</i>	It usually works as medication for dental health.	Fayed MAA <i>et al</i> [41]
<i>Acacia catechu</i>	A minor section of catechu with a little cinnamon and nutmeg placed in tooth for pain. It is also used as medicine for bleeding, ulceration and sponginess of the gums.	Kumar V <i>et al</i> [42]
<i>Barleria prinitis</i>	The leaves of Vajradanti are used for treating bleeding gums and toothache.	Aneja KR <i>et al</i> [43]

RESEARCH UPDATE ON PLANTS AND FORMULATION RESPONSIBLE FOR DENTAL DISORDERS

Some revisions of industrial Ayurvedic formulation and discovering the action of outdated therapeutic plants in contradiction of bacteria responsible for dental disease have been limited of creation modest herbal preparation like toothpaste valuation of standard parameters and study of basic water or chemical solvent extracts. In maximum cases, the scientific research is to authenticate the old-style therapeutic use of the plant. An Ayurvedic toothpaste is arranged by using herbal extracts of cinnamon bark, name stems and barks, leaves of Babul and guava. Microbial study against *E. coli* was also achieved. Appearance, pH, homogeneity, odour, spreadability, microbial content, relative density, viscosity, abrasiveness and foamability were also evaluated [44].

Enzo A. Palombo used a collection of 32 medicinal plants for making economics toothpaste and evaluated antimicrobial study of oral streptococci. Some of Plants include are *Curcuma longa*, *Camellia sinensis*, *Echinacea sp*, *Azadirachta indica*, *Aloe Vera*, *Mentha spicata* and *Catharanthus pussilus*. Natural egg shell and common salt were also used. *B. subtilis* for positive control. They have also evaluated accelerated stability test for every 2 months [45].

Allium sativum is well known to be used as an antimicrobial agent. The said activity against the Gram-negative microorganism like *Streptococcus mutans* and *Lactobacillus acidophilus* was demonstrated. Allicin is the main chemical constituent responsible for it. The comparison was also done with chlorohexidine. The present study showed a more inhibitory effect of garlic on *Lactobacillus acidophilus* compared to *Streptococcus mutans*. This might be a result of genetic differences among the organisms [46].

An Italian red wine and white wine were studied for antimicrobial activity against *S. mutans*, *S. vestibularis*, *S. anginosus*, *S. intermedius*, *S. constellatus*, *S. oralis*, *S. sanguinis*, and *S. pyogenes*. With the supply of 5% CO₂ at 37 °C in the culture of Todd Hewitt broth bacteria were studied. As alcohol interferes in proper investigation of streptococcal growth dealcoholisation procedure was done. Both wines exhibited action. The agents accountable for such actions were succinic, malic, lactic, tartaric citric and acetic acid. The non-natural mixture of the organic acids verified at the concentrations originate in wine had a greater antimicrobial effect than the beverages, representing that the wine they are repressed by other mechanisms [47].

Nine pure essential oils including Cedarwood oil, clove oil, wintergreen oil, lime oil, cinnamon oil, lemongrass oil, spearmint oil, peppermint oil, and eucalyptus oil were used for research because of their known potential. Blood agar medium at standard temperature is used for *Streptococcus mutans* inoculation. Agar well diffusion method was utilized for measurement of antibacterial procedure. A zone of inhibition was determined by filter paper in with Vernier caliper. The study concluded that cinnamon oil showed maximum activity against *Streptococcus mutans* followed by lemongrass oil and sandalwood oil [48]. The various traditional formulations are used for dental disorders are showed in Table 2 [49].

TABLE 2. TRADITIONAL FORMULATIONS USED FOR DENTAL DISORDERS

Plant Name	Family	Part Used	Traditional formulation
<i>Abutilon indicum</i>	Malvaceae	Leaves	The decoction of leaves used for rinsing mouth, treats toothache.
<i>Acacia catechu</i>	Mimosaceae	Resinous extract from wood	Make a powder by mixing ten parts of Catechu, two parts of <i>Areca catechu</i> Camphor, Nutmeg, and Cardamoms. Lastly add gum, <i>Acacia arabica</i> and make bolls that can be put in the mouth for infections in the oral cavity.
<i>Agave americana</i>	Amatyllidaceae	Leaves and roots	Gum exuding from leaves and roots to cure toothache.
<i>Anacyclus pyrethrum</i>	Ownpositae	Root	Extraction of roots by the decoction method can be used as a mouthwash in caries.
<i>Ferula foetida</i>	Umbelliferae	Oleo gum resin	A mixture of Opium and Asafoetida can be placed in the cavity to relieve Pain.
<i>Moringa oleifera</i>	Moringaceae	Root and Bark	The Fresh expressed juice of root bark is used to poured in the cavity to relieve Pain.
<i>Pistacia lentiscus</i>	Anacardiaceae	Resin	Resin of this tree is called Mastiche and is utilized by dental experts for filling tooth cavity. A solution of two parts of gum dissolved in 1 mg of either chloroform or ether and by pouring it on a cotton ball, work as a strong pad after vanishing of solvent has the consequence of protecting the teeth and refreshing the breath when used as a toothpaste.

Historically, there are many evidences of using plants for dental diseases[50].Now a Days, most of the countries brushing is common, widely for of tooth cleanliness[5].However, it is of utmost importance to understand the mechanisms of plants which is vital in dental disorders[52, 53], showed in Table 3 and types of Dental diseases in Figure 1.

TABLE 3: LIST OF PLANTS REPORTED TO USE IN SPECIFIC DENTAL DISORDERS.

Common Name	Scientific Name	Plant Parts	Diseases treated	Chemical constituents	References
Cola nut tree	<i>Cola nitida</i>	Bark and fruit Solution	Sore mouth and toothache	2-4 % Caffeine, Theobromine, tannins, alkaloids, saponins and flavonoids	Agbor MA <i>et al.</i> [38]
Cinnamon	<i>Cinnamomum verum</i>	Bark	Tooth decay and bad breath	Cinnamaldehyde	Akshat S <i>et al.</i> [54]
Aloe	<i>Aloe vera</i>	Leaves	Oral ulcers	Aloin, Cellulase, lipase	Elumalai M <i>et al.</i> [55]
Clove	<i>Syzygium aromaticum</i>	Essential oil	Relieve toothache and bleeding gums	eugenol, eugenol acetate and β -caryophyllene	Buggapati L <i>et al.</i> [56]
Curry plant	<i>Helichrysum italicum</i>	Leaves	Bad breath	Grinimbine, Murrayaine and Yuehchukene	Karygianni <i>et al.</i> [57]
Marigold	<i>Calendula officinalis</i>	Tincture	Gingivitis	flavonoids, coumarins, volatile oil, and carotenoids	Safiaghdam H <i>et al.</i> [58]. Muley B <i>et al.</i> [59] Yoshikawa M <i>et al.</i> [60]
Chamomilla	<i>Matricaria chamomilla</i>	Tincture	Oral aphthae	Apigenin, α -bisabolola	Safiaghdam H <i>et al.</i> [58]
Opuntia	<i>Ficus indica</i>	Fruit and flower	Oral ulcer and tooth abscess	Alanine, Arginine, Vitamin C, E and K	Sánchez C <i>et al.</i> [61]
Japonica	<i>Alnus japonica</i>	Extract	Inhibit biofilm formation	quercetin and tannic acid	Slobodnikova <i>et al.</i> [62]
Tobacco	<i>Nicotiana tabacum</i>	Smoke	Cariou lesions	Nicotine, Benzopyrene	Janeet <i>et al.</i> [63]
Acacia gum	<i>Acacia arabica</i>	Gum	inhibit early plaque formation.	Arabin, Calcium and Magnesium	Devi <i>et al.</i> [64]
Guaco	<i>Mikania glomerata</i>	aerial parts	Inhibition of <i>S. mutans</i> biofilm	Methyl cinnamate, Octadecanoic acid and squalene	Moreira MR <i>et al.</i> [65]
Garlic	<i>Allium sativum</i>	bulb	Dental Caries	Allicin, carbohydrate, total protein, alkaloids, saponins, flavonoids, tannins and steroids	Bin C <i>et al.</i> [66]
Black Pepper	<i>Piper nigrum</i>	Fruit	Periodontal disease	Piperine	Pentapati K-C <i>et al.</i> [67] Srinath <i>et al.</i> [68]
Black myrobalans	<i>Terminalia chebula</i>	fruit extract	Dental caries	Tannins, Anthraquinones	Megala N <i>et al.</i> [69] Prakash <i>et al.</i> [70] Shanbhag VKL <i>et al.</i> [71]
Kantkari	<i>Solanum Xanthocarpum</i>	Seeds	Dental caries	Apigenin, quercetin solanocarpine, carpesterol, solanocarpidine, potassium nitrate, diosgenin, sitosterol, isochlorogenic acid, chronogenic acid, caffeic acidsolasonine, solamargine.	Amrutesh S <i>et al.</i> [72]
Wintergreen inflamed gums for temporary	<i>Gaultheria procumbens</i>	Whole plant	sore tooth inflamed gums	Methyl Salicylate	Kumar G <i>et al.</i> [73]

relief					
Apamarg	<i>Achyranthes aspera L</i>	Whole plant	Cures pyorrhea	Saponins A and B. D-Glucouronic Acid.	Hazarika <i>Pet al.</i> [74] Yadav R <i>et al.</i> [75] Shahazadi P. [76]
Ber	<i>Zizyphus mauritiana</i>	Yong stem	Clean teeth and mouth freshener	Tannins, Flavonoids Saponin	Hazarika P <i>et al.</i> [74] Mbahi MA <i>et al.</i> [77]
Blood root	<i>Sanguinari canadensis</i>	Whole plant	Tooth lose	Sanguinarine, chelerythrine, chelirubinene	VogelRlet <i>al.</i> [78] Croaker A <i>et al.</i> [79]
Jasmine	<i>Jasminum officinale L.</i>	Flower	Mouth rashes	Iridoidal glycoside, Linalool, Oleanolic acid, methyl anthranilate	Siddamallayya, <i>Net al.</i> [80] Kunhachan <i>Pet al.</i> [81]
Clove	<i>Syzygium aromaticum</i>	Clove buds	Toothache		Barnes] <i>et al.</i> [82]
Sugar cane Grami naceae	<i>Saccharum officinarum L.</i>	Whole plant	Strength hens the teeth.	Cellulose, Hemicellulose, lignin.	Ahmad <i>et al.</i> [83] Kim <i>et al.</i> [84]

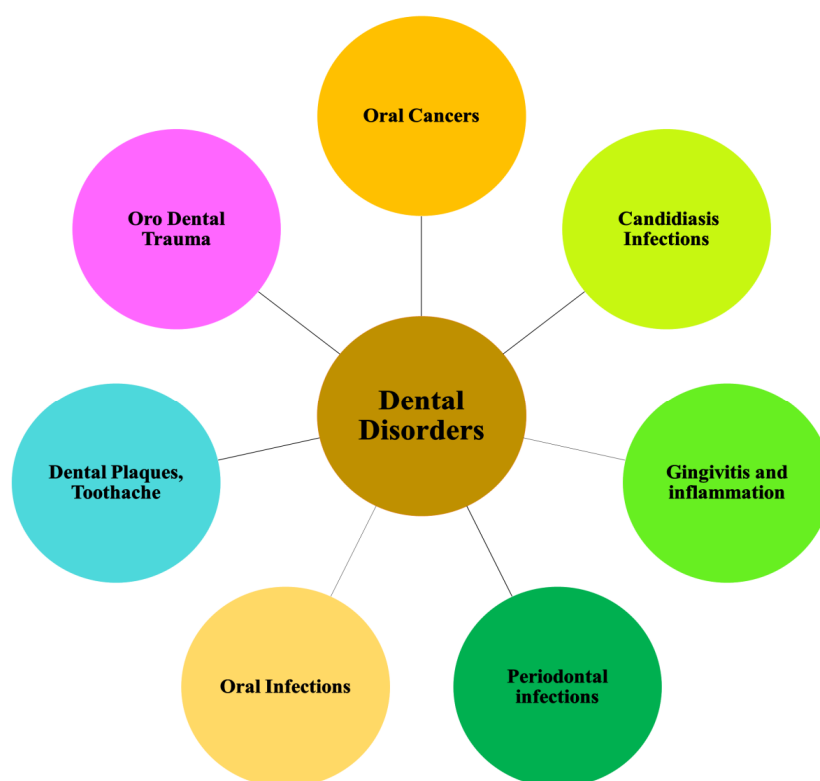


FIGURE 1. DENTAL DISORDERS AND THEIR VARIOUS TYPES

CONCLUSION

The current article summarizes that dental diseases have a substantial impact on the public life of humans. It is persuasive prose that accentuates dental disorders and possibilities to use traditional formulations using contemporary systematic research. The stress on herbal products promotes significant research areas, practitioners, and Dentists treating dental patients with positive outcomes. A literature survey also gives an update on microorganisms responsible for dental diseases and the antibacterial activity of plants for oral disorders. The current review also conveys the broader implications and lightens further research on herbal drugs and many future dental disorders treatments and helps humankind.

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CONFLICT OF INTEREST

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