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Review Article

A Review on medicinal plants in dentistry

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Abstract

The dental afflictions are indubitably the most important global infectious diseases affecting both children and adults. The most significant dental illness is dental caries and periodontal pathologies. The major reason of oral health troubles is more inhabitants with pathogenic bacteria and for this reason, conservative treatment can often be in efficient because of bacterial resistance or may have unpleasant side effects.For that reason, studies in the field have focused on finding new therapeutic alternatives.The use of natural medicines for dental care is an ancient cross-cultural practice that persists in the majority of cultures today.Over the past decade, interest in drugs derived from medicinal plants has markedly increased. This study was designed at a literature review focusing on studies investigating herbal drugs and their therapeutic application, mechanism of action, side effects, toxicities and probable drug interactions. A small number of studies were established to hold their rational employ in dentistry. Because there is a rising employ of phytotherapeutic agents in dentistry, additional studies are required to evaluate their safety and efficacy for clinical use.

Keywords: Herbal medicine, Oral health, Dentistry, Caries, Infections

Introduction

The employ of medicinal plants has a long history in therapeutic and dental practice and they have long been used worldwide[1-3]. Anti-inflammatory, antidiabetic, Anticancer, Huntington's disease, antibacterial, analgesic, sedative agents, endodontic irrigants and antioxidant properties of plants with their biocompatibility explain the people's growing attention in the use of herbal medications[4-12].With the knowledge of curative properties of the medicinal plants against oral microorganisms and their incorporation in clinical practice we can aim to reduce if not remove this disease entity. Medicinal plants though produce slow recovery but their therapeutic effect is miraculous[13]. Above the earlier period, pharmaceutical companies have been involved in examined plants as basis for new phytotherapeutic agents with established efficiency, quality and safety [14-16]. Dental pathology is a worldwide fitness difficulty, disturbing both undersized and rising or urbanized countries. The most widespread oral pathologies are dental caries and periodontal disease and the gravest oral pathologies are oral and pharyngeal cancer and oral tissue lesions are too of important concern[17]. For these causes, the WHO believes that oral health is a right of every people [18]. An additional matter facing oral health is the huge number of children who are pretentious by tooth decay[19]. There are presently various treatments for oral pathologies, but these have disagreeable side consequences, such as altered oral microbiota or systemic gastrointestinal symptoms. Above 750 species of bacteria occupy the oral cavity (50% of which are yet to be identified) and a figure of these are concerned in oral diseases[20]. Therefore, there is a sensitive require for novel options to conservative treatments, medicinal plants being a region of attention. A significant instance in which plants locate their usefulness is the treatment of bacterial infections at the oral height since most conservative antibiotics are unsuccessful because of bacterial resistance and those that are efficient have disagreeable side consequences[21]. Because of this, natural compounds are a safer substitute to antibiotics in the treatment of oral infections and are too an approach in the deterrence and treatment of additional oral diseases, counting dental caries, but also additional grave diseases such as cancer. Consequently, the reason of this review is to present several new examples of customary medicinal plant extracts or phytochemicals that have been exposed to slow down the enlargement of oral pathogens, decrease the development of dental plaque and decrease the indications of oral illness.

Materials and Methods

The Medline, Pub Med and Google Scholar databases were electronically investigated for pertinent articles and books available in English using the keywords medicinal plant, herb, phytotherapy, dentistry and pediatric.

Overview of the use of plants in dentistry

Medicinal plants are a subject of attention for present investigates in the meadow of medicine, being ever more employed for the treatment of a great number of pathologies. Furthermore, numerous drugs presently employed in allopathic medicine have their source in medicinal plants. So, plants are together basis of conventional medicines and a

substitute to them[21]. Medicinal plants are ever more employed in dentistry because of the components they enclose. The plants employed in dental pathology have dissimilar therapeutic actions such as antimicrobial, antifungal, antiviral, anti-inflammatory, analgesic and also as endodontic irrigant Table 1. Based on these manifold remedial actions, natural compounds locate their usefulness in a huge amount of dental pathologies.

Table 1 Overview of a various plants employed in dentistry

Scientific name	Product	Experiment	Ref
Anti-cariogenic properties of herbal agents			
Zingiber officinale	n-hexane, ethyl acetate, methanol and aqueous extracts	Antimicrobial analysis such as biofilm inhibition, time-kill kinetics, adherence inhibition was conducted	**22**
Satureja hortensis	extract and its essential oil	Antibacterial activity against *S. mutants* was evaluated by the disc diffusion method	**23**
Salvia officinalis	Glass-ionomer cement (GIC) modified with of *S. officinalis* extract	Antibacterial activity against *S. mutants* and *L. casei*was evaluated by agar disc diffusion method	**24**
Psidium guajava	*P. guajava* leaf extract used in herbal toothpaste	Herbal toothpaste was studied for its antimicrobial activity against, S.aureus, S. mutants, Bacillus subtilis, S. oralis, and Proteus vulgaris	**25**
Vaccinium vitis-idaea	Polyphenol-rich fraction	Evaluation of biofilm formation ability and bioactivity of *S. mutants, S. sobrinus*, and *S. sanguinis*	**26**
Tinospora cordifolia	Ethanolic extract	Seven different concentrations were prepared and tested against *S. mutans* in brain-heart infusion agar medium	**27**
Glycyrrhizaglabra/ Terminalia chebula	*G. glabra* and *T. chebula* extracts	The anti-adherence property of the herbal extract was evaluated using a glass surface adherence test	**28**
Trachyspermum ammi	*T. ammi* oil	Serial dilution and disc diffusion method was used for evaluation of T. ammi antibacterial efficacy	**29**
Mentha piperita	*M. piperita* leaf extract	Anti-microbial activity of the M. piperita was tested by the disc diffusion method	**30**
Camellia sinensis	The esterified derivative of EGCG	The number of colony-forming units was assessed for evaluation of EGCG efficiency against cariogenic bacteria	**31**
Psoraleae semen	*P. semen* ethanolic extract	Protein leakage evaluation and scanning electron microscopy was conducted to determine the efficacy of P. semen against bacterial cell membrane	**32**
Punica granatum	*P. granatum* gel	Agar well diffusion method was used for evaluation of P. granatum against cariogenic bacteria such as S. sanguis, S. mutans, and L. casei	**33**
Galla chinensis	*G. chinensis* crude aqueous extract	Anticariogenic efficacy of G. chinensis was evaluated by tests like Keyes' caries diagnosis and scoring technique and the mineral density analysis on molar animal teeth	**34**
Rosmarinus officinalis	Alcoholic extract dentifrice	Single-disc diffusion technique was used for evaluation of herbal dentifrice against cariogenic bacteria	**35**
Aloe vera	*Aloe vera* leaf extract	Agar and broth microdilution method was used for antibacterial evaluation	**36**
Houttuynia cordata	*H.cordata* ethanolic extract	Antibiofilm activity of *H. cordata* extract was evaluated against oral pathogens	**37**
Toddalia asiatica/Cortex Lycii/ Cimicifuga foetida/ Toddalia asiatica	Herbal mouthwash (LongZhang Gargle®)	An Agar diffusion test was conducted to determine antibacterial activity against *S. mutans*	**38**
Cistus incanus	*C. incanus* accelerated solvent extract	A live/dead assay was conducted for evaluation of *C. incanus* herbal extract	**39**
Camellia sinensi/Alium sativum/Citrus aurantiifolia	Herbal mouthwash	Agar diffusion test was conducted to determine antibacterial activity against *S. mutans* and *C. albicans*	**40**

Anacardium occidentale/ Mangifera indica	Herbal ethanolic extract	An Agar diffusion test was conducted to determine antibacterial activity against *S. mutans* and *E. faecalis*	**41**
Herbal medicine and periodontal health maintenance			
Acacia chundra//Adhatoda vasica/Mimusops elengi/ Piper nigrum/Pongamia pinnata/Quercus infectoria/ Syzygium aromaticum/ Terminalia/Zingiber officinale	Ayurvedic herbal extract	ELISA test was conducted for evaluation of IL-8 production by immortalized gingival keratinocytes after herbal extract treatment	**42**
Hippophae rhamnoides	*H. rhamnoides* pulp oil mouthwash	Biofilm Ring Test was conducted for evaluation of H. rhamnoides efficacy against *P. gingivalis, C. albicans,* and *S. gordonii*	**43**
Cinnamomum zeylanicum/ Salvadora persica	Herbal ethanolic extracts	Agar diffusion test was performed for evaluation of the antibacterial property of the herbal extract against A. actinomycetemcomitans and T. forsythia	**44**
Acacia nilotica/Murraya koenigii/Eucalyptus hybrid/ *Psidium guajava*	Herbal ethanolic extract	An Agar diffusion test was conducted to determine antibacterial activity against P. gingivalis and F. nucleatum	**45**
Allium sativum/Ziziphora clinopodioides	*Z. clinopodioides* and *A. sativum* essential oil	The broth macro dilution method and disk diffusion technique were conducted to evaluate the activity of essential oils on *S. aureus* and *P. aeruginosa*.	**46**
Houttuynia cordata	The decoction of dried *H. cordata* leaves	The microbial broth dilution method was used for evaluation of *H. cordata* antibacterial property	**47**
Polygoni multiflori	2,3,5,4-Tetrahydroxystilbene-2-O-beta-glucoside (THSG)	Evaluation of modulatory property of THSG on inflammatory responses caused by *P. gingivalis* in gingival fibroblasts	**48**
Morus alba	ethanolic extract	Antibacterial efficacy of the ethanolic extract was assessed by estimating minimum inhibitory concentration against common periodontal pathogens	**49**
Amellia sinensis	*A. sinensis* solution	Expression of interleukin-10, tumor necrosis factor and RANKL in diabetic rats were evaluated after treatment with *A. sinnensis* solution by immunohistochemistry	**50**
VitisViniferea	Commercially available grape seed extract	Brekoex Grape seed OPC 30® The modified agar dilution millpore method was conducted for evaluation of seed extract antibacterial property against *S. aureus*, *E. coli*, *C. albicans*, and *K. pneumonia*	**51**
Herbal medications and endodontic treatments			
Myrtus Communis/Eucalyptus Galbie	Methanolic extracts in combination with calcium hydroxide powder	Agar diffusion technique, tube dilution test, and microtiter plate assay were conducted for evaluation of antibacterial activity against *E. faecalis*	**52**
Angelica archanglica/Asurum European	Fufang bing peng irrigant	PCR, high-throughput sequencing analyses, and antibacterial test were conducted to evaluate the efficacy of the herbal irrigant against *E. faecalis*	**53**
Emblica officinalis/ Terminalia bellirica/ Terminalia chebula	Triphala extract	Dental canals were examined after rinsing with Triphala extract for evaluation of the smear layer by field emission scanning electron microscope	**54**
Morinda citrifolia	*M. citrifolia* juice	Disc and well diffusion tests were conducted for evaluation of *M. citrifolia*a gainst intracanal bacteria such as *E. faecalis* and *C. albicans*	**55**
Cymbopogon citratus/ Mentha piperita/ Ocimum sanctum	NaOCl herbal solution (9:1 ratio)	A combination of 6% NaOCl and herbal extracts was tested for pH and chlorine content	**56**
Psidium guajava/ Anacardium occidentale/	Herbal extracts	An Agar diffusion test was conducted for evaluation of herbal extracts against *E. faecalis* and *C.* albicans	**57**

Carica papaya/ Aloe vera			
Morinda citrifolia/ Emblica officinalis/ Terminalia bellirica/ Terminalia chebula	*M. citrifolia* extract/Triphala juice	Colony-forming units of *E. faecalis* and *C. albicans* were evaluated after intracanal irrigation with Triphala juice, *M. citrifolia* extract and CHX	**58**
Curcuma longa	*C. longa* gel	Evaluation of anti-bacterial property of *C. longa* against *E, faecalis* infection found in dentinal tubules	**59**
Cymbopogon citratus/ Ocimum basilicum/ Camellia sinensis	*C. citarus* oil/*O. basilicum* oil/obicure tea extract	Broth micro dilution method was used for evaluating the antimicrobial efficacy of herbal extracts against *E. faecalis* found on gutta-percha cones	**60**
Emblica officinalis/ Psidium guajava	Alcoholic extracts	The Agar disk-diffusion method was used for evaluating the efficiency of herbal extracts and BioPure MTAD® against *E. faecalis*	**61**
Morinda citrifolia,/ Azadirachta indica/ Aloe vera	Aqueous extracts	An Agar diffusion test was conducted for evaluating herbal extract's efficacy against *E. faecalis*	**62**
Allium sativum	Water extract	Fluorescence microscopic analysis and microbial viability assay were used for evaluation of antibacterial efficacy against *E. faecalis*	**63**
Ferula gummosa	*F. gummosa* essential oil	Broth micro-dilution evaluation and disk diffusion test were conducted to evaluate the antibacterial efficacy of *F. gummosa* oil	**64**
Herbal medicine and anti-fungal properties			
Nigella Sativa	Alcoholic extract	Candida colony count evaluation was conducted after rinsing *C. albicans*-contaminated acrylic resin specimens with *N. sativa* extract	**65**
Equisetum giganteum/ Punica granatum	Combination of herbal ethanolic extracts with denture adhesive	Evaluation of the herbal extracts' efficacy against *C. albicans* by confocal laser scanning microscopy analysis, colony-forming units count, cell viability analysis, and scanning electron microscopy	**66**
Isodon flavidus	Methanolic extract	Evaluation of anti-fungal property of *I. flavidus* by biofilm breakdown assay against *C. albicans* and *T. rubrum*	**67**
Lippia citriodora	Aqueous and ethanolic extract	Evaluation of anti-fungal property of *L. citriodora* by the disk and well diffusion tests	**68**
Centratherum anthelminticum/ Ocimum sanctum	Seed oils	Evaluation of anti-fungal property of herbal oils by disc diffusion and broth micro dilution methods	**69**
Zataria multiflora	0.5 mg/ml *Z. multiflora* extract	Evaluation of anti-fungal property of Z. multiflora herbal extract against *C. albicans* by mean viable microbial count	**70**
Origanumdubium	Origanum oil combined with tissue conditioner	Evaluation of anti-fungal property of *O. dubium* herbal extract against *C. albicans* by agar punch well method	**71**
Anti-inflammatory and wound healing properties			
*P. ginseng/G. glabra/Z. jujuba/ P. ternata/*Z. *officinale/* Scutellaria/Coptis	Hangeshashinto	Evaluation of the effects of Hangeshashinto on scratch induced wound healing in vitro and in vivo	**72**
Schisandtrin chinensis	*Schisandrin C*	Evaluation of reactive oxidative stress and nitric oxide production in dental pulp cells by muse cell analysis	**72**
Camellia sinensis	Herbal extract	Evaluation of inflammatory cell infiltration in oral epithelium after treatment with *C. sinensis* herbal extract in rats by histological analysis	**74**
Antineoplastic properties in herbal medications			
Geranium thunbergii	Geraniin	Evaluation of anti-neoplastic property of Geraniin against SCC cells by western blot assay	**75**
Vernonia cinerea	8α-tigloyloxyhirsutinolide-	Evaluation of anti-proliferative property of 8αTGH against	**76**

	13-O-acetate	SCC cells by SRB colorimetric method	
Syzygium cumini	Herbal extract	Evaluation of anti-proliferative property of *S. cumini* against SCC cell lines by MTT assay	**77**
Eclipta prostrata	Herbal extract	Evaluation of *E. prostrata* property on metastasis promoting proteins production in SCC cell lines	**78**
Rheum palmatum	Herbal extract	Evaluation of *R. palmatum* herbal extract against SCC cell metastasis by western blot and gelatin zymography	**79**
Nigella sativa/Aloe vera/ Salvadora persica	Herbal extracts	Evaluation of anti-neoplastic property of herbal extracts against HeLa cell lines	**80**
Salvia miltiorrhiza	Herbal extract	property of S. miltorrhiza extracts against oral neoplastic cells by western blotting analysis	**81**
Gynostemma pentaphyllum	Gypenosides	Evaluation of Gypenosides's effects on cell viability and apoptosis, and oral neoplastic cell DNA	**82**
Cudrania tricuspidata	Cudraxanthone H	Evaluation of anti-proliferative property of Cudraxanthone H against SCC cell lines by western blotting and fluorescent nuclear staining	**83**
Bone regeneration and herbal medicine			
G. glabra/V. vinifera/A. officinarum/U. dioica/S. aromaticum/S. vulgaris/ H. perforatum	Mecsinahemostopper	Evaluation of hard tissue regeneration by using histologic and radiologic analyses after treatment with the herbal agent and low-level laser therapy in rats	**84**
Morinda citrifolia	Aqueous extract	Evaluation of osteogenic differentiation in human periodontal ligament cells after treatment with *M. citrifolia*	**85**
Aloe vera	Acemannan	Evaluation of bone formation after tooth extraction by dual-energy X-ray absorptiometry and histologic analysis	**86**

Toxicity

There are several people which claim herbalmedicines to be devoid of side effects that is amyth. There still are masses which still completelydepend on herbal medicine so much so that havereplaced the daily prescribed dose of allopathicfor diabetes, hypertension, thyroid disease, etc[87-90] with herbal medicines where the patient have pledged to have the medicines lifelong. There are several sites online which are trying to trade herbal medicines under the tag of being free from side effects. In countries like India which are in the race of becoming a developed country no regulations and laws are made against the trade of Ayurveda medicines which use herbs and their extracts. People are drawn to such traders and start using herbal medicines under the notion of them being free from side effects[91, 92]. However toxicities due to herbalism can be due to improper intake, self-treatment as they are easily available in the market, under qualified practitioners and intake of sub standard products. Herbs manifest their toxicities in the form of nephrotoxicity, cardio toxicity, hepatotoxicity, neurotoxicity and skin toxicity[19-95]. Various manifestations of most commonly used herbs are indicated in the Table 2 along with their recommended indications[96].

Table 2 Manifestations of plants

Name	Toxicity	Indication	Ref.
Cranberry	Nephrolithiasis	Dietary supplement	97
Willow Bark	Renal Dysfunction	Anti Rheumatic	98
Aconite , Monks Hood	Ventricular Arrhythmia	Pain	99
Black Cohosh	Acute hepatitis	Menopausal symptoms	100
Kava kava	Acute liver failure	Tranquilizer	101
Valerian	Liver toxicity	Sedative	102

CONCLUSION

Herbal medicine has gained considerable popularity during the past decade. The chief benefits of using natural options are easy accessibility, cost-effectiveness, improved shelf life, low toxicity and lack of microbial confrontation accounted up to now. Herbal agents have been employed in dentistry for plummeting inflammation, as antifungal, antibacterials, antimicrobial plaque agents, antiseptics, antioxidants, antimicrobials, antivirals, and analgesics. They also help in healing and are efficient in scheming microbial plaque in gingivitis and periodontitis and thus improving immunity. Many researchers in the meadow of dentistry and pharmacology have devoted their time and resources to evaluation of natural products, discovering their bioactive

compounds and finding applications for them in a variety of features of oral health maintenance. In this paper, we tried to create a complete review of recent scientific studies about medicinal plants and their current status in the meadow of dentistry. The gathered data can be employed as a basis for future endeavors to discover novel natural medicaments with lower costs and side effects for oro-dental pathologies.

Future Direction

Herbal medicine shows assure consequences in almost every aspect of oro-dental treatment plans. Although numerous of the studies with reference to the beneficial properties of herbal medicine in dentistry claim that herbal products can be employed as alternatives for conventional drugs, without bearing common side effects, the majority of them lack proper evidence about their protection and biocompatibility. Most of these researches are conducted at *in-vitro* and pre-clinical settings. Therefore, there is an urgent need to increase research efforts and funding aimed at clinical trials on efficacy, safety, cost-effectiveness, and characterization of these natural compounds. Alternative and herbal therapy can be helpful for the people all around the earth, especially in resource limited countries. This can support and justify the requirement for upcoming studies with up to date and reliable protocols and techniques.

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Conflict of interest

None

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