

### Phytotherapy in dentistry: a literature review based on clinical data

#### ABSTRACT

**Aims:** To review the current literature looking for scientific support of herbal medicines usage in dentistry, which may present an alternative for dentists.

**Material and methods:** The literature search was performed combining “phytotherapy” and “dentistry” in the PubMed, MEDLINE, BBO, LILACS and SciELO databases, covering the period from January 2018 to March 2020. The data extracted were: alteration/oral disease, gender, age, number of participants, herbal medicine used, drug function and results.

**Results:** were selected 16 papers that employed different plants, such as Tulsi, Aloe vera, citronella, turmeric, propolis and cloves. The results found are promising and show the anti-inflammatory, analgesic, antibacterial, antioxidant, antifungal and antiviral action of herbal drugs, and their use for treating burning mouth syndrome, oral submucous fibrosis, xerostomia and halitosis.

**Conclusion:** despite the therapeutic activities of herbal medicines, additional studies with larger sample size and scientific rigor are necessary to prove their benefits for treating oral diseases.

Keywords: phytotherapy; dentistry; oral manifestations; medicinal plants

#### 1. INTRODUCTION

Herbal medicines are active substances produced with plants and popularly used as an effective alternative for treating several ailments, including oral diseases [1]. Currently, approximately 40% of the available medicines use natural sources directly or indirectly, 25% of which are obtained from plants [2]. Research on herbal medicines in dentistry has been expanded in the search for new alternatives that combine analgesic, anti-inflammatory, antimicrobial, curative, and regenerative activity, with less toxicity, better biocompatibility, and more affordable costs [3,4].

Morales-Bozo et al. [5] evaluated the effectiveness of a salivary substitute based on chamomile and flaxseed for treating xerostomia. Milani et al. [6] associated cognitive therapy with chamomile tea to treat patients diagnosed with burning mouth syndrome, concluding that there was an increase in well-being, maintenance of oral moisture and confidence in the therapeutic approach proposed. In 2019, Salehi et al. [4] reviewed works on plant-derived bioactives in the oral mucosa, citing the benefits of *Aloe vera* in regenerating tissue and

increasing cell proliferation quickly and effectively; besides its anti-inflammatory, immunomodulatory, analgesic, bacteriostatic, bactericidal and antioxidant effects. The authors also cited green tea acting on chronic periodontitis activity, anti-caries and anti-fungal (candidiasis), reducing the adverse effects of conventional drugs, culminating in less fungal resistance [4]. The World Health Organization (WHO) also recommended and encouraged using plants as a tool for oral hygiene [7]. However, the role of herbal drugs in controlling oral changes is still undervalued when compared to other diseases, such as skin diseases [8]. Thus, we aimed to review the current literature looking for scientific support of herbal medicines usage in dentistry, which may present an alternative for dentists.

## **2. MATERIAL AND METHODS**

### **2.1 Search strategies**

Literature search performed combining “phytotherapy” and “dentistry”, after previously identifying the chosen descriptors in articles published on the topic and in the Medical Subject Headings (MeSH). The PubMed, MEDLINE, BBO, LILACS and SciELO databases were accessed covering the period from January 2018 to March 2020.

### **2.2 Inclusion and exclusion criteria**

English-language publications with the title and abstract related to the topic were included. Incomplete articles, duplicated ones, studies on animals, and those that, when read, did not fit the proposed theme were excluded from the research.

### **2.3 Analysis**

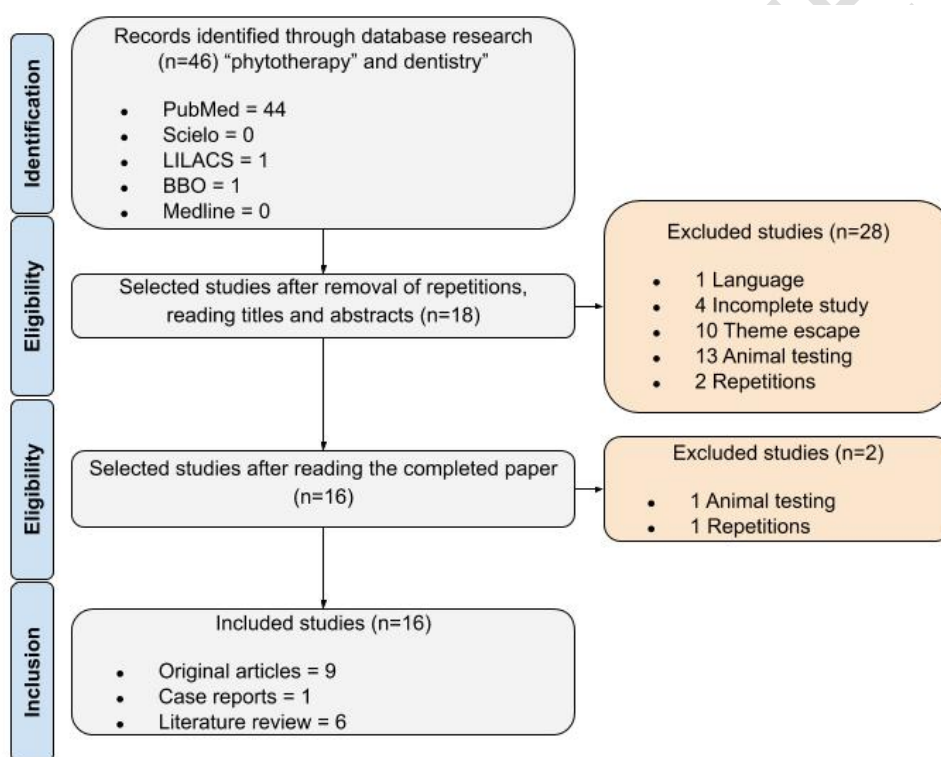
From the selected articles, *in vivo* or *in vitro*, the following information were extracted: oral alteration/disease, gender, age, number of participants, herbal

medicine used, drug function and results. From the literature reviews, only the mentioned herbal medicines, their function, and the conclusion of the study.

### 3. RESULTS AND DISCUSSION

The search resulted in 46 published papers, with 18 potentially eligible identified after applying the inclusion and exclusion criteria. After reading these papers in full, 16 studies remained: 09 original studies, 01 case report and 06 literature reviews (Figure 1).

**Figure 1:** flowchart of the selection and result of the papers



The results found are promising and show the anti-inflammatory, analgesic, antibacterial, antioxidant, antifungal and antiviral action of herbal medicines, and their use for treating burning mouth syndrome, oral submucous fibrosis, xerostomia, and halitosis (Table 1). These studies use several plants, such as Tulsi, *Aloe vera*, citronella, turmeric, propolis and cloves.

**Table 1.** Data found in the studies

Author, Year	Type of Study	Evaluation	n°.	Gender	Age	Herbal medicine	Result
De Souza et al. [9]	LR	Burning mouth	7 studies	-	-	Catuama, capsaicin 0.02%, chamomile gel, urea 10%, spray containing lycopene-enriched virgin olive oil (300ppm), <i>Aloe vera</i> 70% and <i>Hypericum perforatum</i> extract 300 mg	Significant improvement observed in catuama and capsaicin 0.02% oral rinse when compared with placebo. The others reported effectiveness in symptom reduction, but without statistical difference when compared with the placebo/control groups.
Resende et al. [10]	LR	Repair, regeneration, proliferation, mineralization, wound healing, and induced differentiation	35 studies ( <i>In vitro</i> )	-	-	Propolis, <i>Cocos nucifera</i> , <i>Aloe vera</i> , <i>Cammelia sinensis</i> , <i>Punica granatum</i> , <i>Nigella sativa</i> , <i>Ricinus communis</i> , <i>Croton lechleri</i> , <i>Marmosa rubra</i> , <i>Salvia officinalis</i> , <i>Capparis spinose</i> , <i>Curcuma longa</i> and soy milk	The plants showed potential effect on cell viability and proliferation. The articles evaluated mainly the action of plants on cells of the periodontal ligament. Propolis, coconut water and <i>Aloe vera</i> were the most common storage medium.
Santi et al. [11]	LR	Dental plaque and gingival inflammation in patients with gingivitis	-	-	-	<i>Camelia sinensis</i> , <i>Azadirachta indica</i> , <i>Anacardium occidentale</i> Linn, <i>Schinus terebinthifolius</i> and <i>Curcuma longa</i>	Five herbal products showed better results than chlorhexidine in dental plaque and gingival inflammation reductions.

Moro et al. [12]	LR	Chronic periodontitis	7 papers	-	-	<i>Aloe vera</i> gel, 10% <i>Emblica officinalis</i> gel, bark of <i>Mimusops elengi</i> , bark of <i>Acacia arabica</i> and seeds of <i>Punica granatum</i> , <i>Garcinia mangostana</i> gel, <i>Centella asiatica</i> (1.4 and 1.9) and <i>Punica granatum</i> (0.2 and 0.3) extracts.	In systemically healthy patients with periodontitis, the local use of phytotherapies as adjuncts to scaling and root planning may have additional benefits in the reduction of probing pocket depth and clinical attachment level gain, when compared with scaling and root planning alone.
Al-Maweri et al. [13]	SR	Submucous fibrosis	6	-	-	<i>Aloe Vera</i>	<i>Aloe vera</i> may be effective in managing submucous fibrosis, without any side effects.
Aumeeruddy et al. [14]	SR	Phytochemistry, pharmacological properties, and bio-applications.	Not reported	-	-	<i>Salvadora persica</i> L.	<i>Salvadora persica</i> L. showed a wide scope of application and its uses extended beyond the traditional uses of its roots, stems, and twigs in oral care.
Lolayekar & Kadlkhodayan, [15]	OS	Change in salivary pH and viability of <i>S. mutans</i>	30 patients	Not reported	9 to 12 years	<i>Ocimum sanctum</i>	<i>Ocimum sanctum</i> has an antimicrobial effect on <i>S. mutans</i> present in the saliva, without causing any known systemic side effects and chewing of <i>Ocimum sanctum</i> leaves has no significant effect on the salivary pH levels.
Ferreira-Filho et al. [16]	OS	Caries	3	Not reported	5.67 years	<i>Bauhinia forficata</i> Link	Antimicrobial and mechanism to inhibit tooth demineralization of <i>Bauhinia forficata</i> Link.
Dar-Odeh et al. [8]	OS	Oral diseases among female patients	232 patients	100% F	18 to 69 years	Most of the natural remedies used (n = 17) were herbal, with cloves (71.1%) and <i>Salvadora persica</i> (26.7%)	Majority of patients use natural remedies to treat their oral disease. Patients were mostly satisfied with natural remedies in terms of effectiveness and lack of complications

<b>Albaptain et al. [7]</b>	OS	Dental plaque, sub-gingival microbiota, and gingival inflammation	28	57% F	18 to 71 years	<i>Salvadora persica</i> L.	There were no significant differences in the microflora after using active and inactive <i>Salvadora persica</i> .
<b>Milani et al. [6]</b>	CR	Burning mouth	2	100% F	59 and 68 years	<i>Matricaria recutita</i> (Camomile)	Psychological treatment along with <i>Matricaria recutita</i> phytotherapy displayed excellent results in the control of BMS.
<b>Isola et al. [17]</b>	OS	Surgical removal of impacted mandibular third molar	82	53% M	26.8 years	Herbal medicine: composed of baicalin ( <i>Scutellaria baicalensis</i> Georgi) 190 mg; bromelain ( <i>Ananas comosus</i> ) 50 mg; aescin ( <i>Aesculus hippocastanum</i> ) 30 mg	The herbal mixture of herbal extract with anti-inflammatory activity has shown to be safe and simple in controlling post-surgical discomfort after surgical removal of the third molar. There were favorable effects on the inflammatory process parameters.
<b>Veloso et al. [18]</b>	OS	Potential antibacterial and anti-halitosis activity	<i>In vitro</i>	-	-	<i>Caesalpinia ferrea</i> Mart., <i>Cinnamomum cassia</i> B., <i>Mallow sylvestris</i> L., <i>Punica granatum</i> L., <i>Rosmarinus officinalis</i> , <i>Aeolanthus suaveolens</i> , <i>Syzygium aromaticum</i> L. and <i>Tamarindus indica</i> L.	The extracts displayed antimicrobial activity against the tested microorganisms. The investigated plants have the potential to reduce the main substances related to halitosis of oral origin.
<b>Guandalini Cunha et al. [19]</b>	OS	Evaluation of cytotoxicity and antimicrobial efficacy	<i>In vitro</i>	-	-	<i>Cymbopogon nardus</i>	Citronella oil and alcohol-free chlorhexidine completely inhibited the growth of <i>S. aureus</i> and <i>C. albicans</i> biofilms in the adhesion phase. All solutions showed inhibitory activity against 24 h biofilm formation. However, citronella led to greater microbial reduction and presented the lowest cytotoxic effect.

De Araújo et al. [1]	OS	Caries	<i>In vitro</i>	-	-	<i>Anacardium occidentale</i> L. and <i>Anadenanthera macrocarpa</i>	<i>Anacardium occidentale</i> extract has potential as an antimicrobial agent with low eukaryotic cell toxicity or mutagenic activity. <i>Anadenanthera macrocarpa</i> extract, although absent of antibacterial activity might be a safe and effective phytotherapeutic alternative.
Teodoro et al. [20]	OS	Antifungal activity	<i>In vitro</i>	-	-	<i>Buchenavia tomentosa</i>	The Acetone fraction presented the best antifungal activity among several extracts from <i>Buchenavia tomentosa</i> .
(*) Literature review (LR); Systematic review (SR); Original studies (OS); Case reports (CR)							

Ancient practice, the use of herbal agents has been increasingly investigated with greater scientific rigor to confirm its beneficial effects [9]. The main reason for more controlled studies is that differences in the cultivation, harvesting, processing and storage of the leaves result in a considerable change in the amount of therapeutic constituents, which can influence the final effect of the drug [15]. However, the studies found in the literature show promising results and effects in the herbal medicines usage in Dentistry.

Lolayekar & Kadkhodayan [15] evaluated the effect of chewing Tulsi leaves (*Ocimum sanctum* – “holy basil”) on salivary pH and viability of *S. mutans*, considered one of the factors for the development of tooth decay – which changes the pH of the biofilm resulting in the demineralization of the tooth surface – in children aged 9 to 12 years. The study confirmed the antimicrobial effect of the plant in *S. mutans* and the absence of side effects, but without changes in salivary pH. In 2020, Ferreira-Filho et al. [16] also studied the antimicrobial and dental demineralization effect in vitro, using the tincture of *Bauhinia forficata* Link, popularly known in Brazil as “cow’s foot”. The study aimed to evaluate initial *Streptococcus spp*, total count of microorganisms and the final superficial microhardness of the tooth [16]. The authors concluded that, despite the limitations of in vitro work, the tincture of *B. forficata* L. is a potential

substance against caries, due to its antimicrobial activity in mature biofilm and possible inhibitory mechanism of tooth demineralization [16]. Aside from Tulsī and tincture of *B. forficata* L., using chamomile to control dental plaque and treat gingivitis has been studied and proven [6]; propolis also showed an anti-inflammatory effect in osteogenic differentiation and bacterial growth reduction, maintaining the viability of oral cells [10].

*Aloe vera*, *Cymbopogon citratus*, *Quercus brantii*, *Coriandrum sativum*, *Mimusops elengi*, *Acacia arabica* showed anti-inflammatory, antibacterial and antioxidant properties, which may help control gingivitis and periodontal disease. [21–24]. The topical use of herbal medicines, allows for greater concentrations of active agents for long periods in periodontal pockets, which act as a regular drug storage [22].

Santi et al. [11] stated in their literature review that, in the studies found, herbal mouthwashes achieved significant reductions in dental plaque and gingival inflammation when compared with placebo rinses. Five products based on *Camelia sinensis*, *Azadirachta indica*, *Anacardium occidentale* Linn, *Schinus terebinthifolius* and *Curcuma longa* showed better results than chlorhexidine in reducing dental plaque and gingival inflammation. However, they cautioned that the majority of randomized controlled trials included in the review did not reach definitive conclusions [11], and the need for further studies to better assess the effect and clinical relevance of natural mouthwashes on gingival inflammation and biofilm control [11].

Regarding fungal infections, *Candida albicans* is a versatile microorganism that, under certain systemic conditions, can cause oral complications such as candidiasis and mucositis, especially in older, diabetic or immunocompromised patients [19]. Traditional antifungal drugs, such as azoles, amphotericin B and echinocandin, are generally used to treat candidiasis [25]; but the limited number of antifungal agents and misuse of the available drugs, resulted in many cases of resistance to treatment [25]. Thus, natural products are promising alternatives for solving these infections, presenting less toxicity and significant antimicrobial activity [26].

Considering the need for new methods to help control biofilm, aiming for maximum antimicrobial and antifungal efficacy with minimal side effects, Guandalini Cunha et al. [19] studied the effectiveness of two solutions based on



citronella oil in biofilms formed by *S. aureus* and *C. albicans*, compared with two commercial rinses without alcohol, one based on 0.12% chlorhexidine (Periogard) and the other with essential oils (LT, Listerine Zero). The authors concluded that citronella-based compounds had a greater anti-biofilm effect when compared with commercial solutions, regarding *S. aureus* and *C. albicans*. Considering the concentrations of active ingredients in commercial mouthwashes, citronella showed less cytotoxic effect [19], appearing as an active phytocomplex with antimicrobial and antifungal action, viable for creating a new mouthwash to help control biofilm.

*Salvadora persica* L. (*S. persica*), considered an important medicinal plant with bioactive compounds and several pharmacological properties, appears as an alternative for treating oral diseases [7,14]. The main antimicrobial of *S. persica* is benzyl isocyanate (BITC), an antiviral against Herpes simplex, which inhibits the growth and production of acids by *Streptococcus mutans* and is fungistatic for *Candida albicans*. However, it is highly volatile and rapidly evaporates from the oral cavity [7,14]. *Buchenavia tomentosa*, a natural plant from central Brazil, showed promising antifungal activity for *Candida albicans*, reducing its ability to form biofilms, hyphae and adhere to oral epithelial cells [27,28]. Just like cloves, used since antiquity to relieve dental pain and to treat oral candidiasis and herpes infections [8].

Burning mouth syndrome – a condition characterized by burning or pain symptoms, especially in the tongue, lips, hard and soft palate, with no clinical signs – is managed by numerous treatments: drugs, laser therapy, acupuncture, and psychological counseling. Aside from traditional therapies, chamomile (*Matricaria recutita*) has shown satisfactory results in maintaining oral moisture, with no reported adverse effects [6], as well as catuama and 0.02% capsaicin rinse, suggesting that these therapies should be studied in greater depth [9]. However, this syndrome requires the patients' psychological characteristics assessment, not just the treatment employed [9].

Another disease that includes pain/burning sensation is oral submucous fibrosis, a debilitating chronic disease with a high risk of malignant transformation: pain/burning, vesicle formation, hypomobility of the hard palate and tongue, loss of taste and sensitivity, intolerance to spicy foods, speech and swallowing problems, and severe limitation on mouth opening. Hence, a recent

study employed *Aloe vera* as a natural alternative for controlling the complications of this disease, for its several therapeutic benefits: analgesic, anti-inflammatory, immunomodulatory, antioxidant, anti-neoplastic and wound regeneration actions, with no reported side effects. However, its effectiveness in controlling submucous fibrosis is still controversial [13].

Regarding the feeling of dry mouth and halitosis, the study by Dar-Odeh et al. [8] reported the use of olive oil for dry mouth and halitosis and tahini (sesame paste) for dry mouth and oral ulcers. Veloso et al. reported that pomegranate and *jucá* (*Libidibia ferrea*) can potentially combat microorganisms related to halitosis, as the studied extracts inhibited oral microorganisms that produce volatile sulfur compounds [18].

Regarding pain, numerous strategies have been developed to manage postoperative discomfort, such as the pharmacological approach, which inhibits the synthesis and/or release of mediators of acute inflammation. Corticosteroids and non-steroidal anti-inflammatory drugs (NSAIDs) have shown immunosuppression, anti-inflammatory and analgesic effects [29]; but these cause a subsequent decrease in the renewal of serotonin in the central nervous system, leading to central inhibition of prostaglandin, resulting in undesirable adverse effects [30]. As an alternative to these medications, studies proposed natural substances such as bromelain, which has shown anti-inflammatory activity, mainly anti-edema action due to proteases present in its composition.

Isola et al. [17] proved the effectiveness of a herbal medicine composed of baicalin, 190 mg; bromelain, 50 mg; aescin, 30 mg. Baicalin has antibacterial [31], antiviral [32], anti-tumor [33] and anti-inflammatory properties [34], in addition to improving osteoblasts activity in bone formation [35] and negatively regulating inflammation pathways. Aescin showed anti-inflammatory action with an anti-edematous effect through its antihistamine and anti-serotonergic components, which reduces the adhesiveness and migration of neutrophils. The authors found a more favorable response to postoperative pain, when compared with the placebo group and the group that received ibuprofen. However, reduction in facial edema and improvement in mouth opening was observed in the three groups, with no significant difference in the results after extraction of impacted lower third molars [17].

Regarding cloves, its analgesic effect is attributed to the activation of calcium and chloride channels in ganglion cells and the agonist activity of capsaicin [8]. However, natural drugs, when applied topically, can result in complications such as burns caused by garlic to relieve toothache [8]

#### 4. CONCLUSION

Although herbal medicines have been used since ancient times for treating oral diseases and have important therapeutic activities such as anti-inflammatory, analgesic, antibacterial, antioxidant, antifungal and antiviral actions, additional studies with greater sample sizes and scientific rigor are necessary for proving their benefits in treating oral diseases.

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