



Natural Products Applications in Orthodontics: A Review

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Abstract

Aims: Natural products are used in dentistry to treat various dental diseases. They are considered an active alternative to antibiotics and could offer prevention and therapeutic approaches for oral infections. The main objective was to study the available information regarding the applications of natural products in orthodontics. **Materials and Methods:** We defined the natural products, and reviewed and explained their applications in general dentistry and orthodontics. **Conclusions:** This literature shows that several herbal products can control many inflammatory processes and are safer for longer than those chemical drugs.

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تطبيقات المنتجات الطبيعية في تقويم الأسنان: مراجعة

الملخص

الأهداف: تعتبر مستخلصات النباتات وغيرها من المواد الطبيعية بديلاً فعالاً للمضادات الحيوية في علاج أمراض الفم والأسنان. ويمكن أن تستخدم لأغراض الوقاية وعلاج مختلف الالتهابات الفموية. الهدف الرئيسي من هذا المقال لدراسة المعلومات المتوفرة في مجال استخدام المواد الطبيعية في مختلف مجالات طب الأسنان وبالأخص تقويم الأسنان. **المواد وطرائق العمل:** تعريف المستخلصات الطبيعية، مراجعة وشرح لمختلف تطبيقات هذه المواد في مجال تقويم الأسنان. **الاستنتاجات:** إمكانية استخدام المواد الطبيعية للسيطرة على العديد من الالتهابات الفموية وتعتبر آمنة للاستخدام لفترات طويلة مقارنة بالأدوية الكيميائية.

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INTRODUCTION

Currently, natural products have been developed as an effective and low-cost substitute for the treatment of many diseases of the mouth. Phytotherapy is the science that deals with the use of substances of natural origin as drugs or health-promoting agents ⁽¹⁾.

Oral cavity diseases are regarded to be a primary problem of health around the earth. The increase in the incidence of oral diseases, resistant pathogenic bacteria, opportunistic infections, and financial concerns in developing society, all lead to an important concern in the finding of other preventive and treatment procedures for diseases of the oral cavity ^(2,3). Herbs and natural phytochemicals could be depended on in the treatment of bacterial and fungal infections, so that are regarded to be the best substitutes for synthetic drugs ⁽⁴⁾.

Phytotherapeutic substances would be classified into ⁽⁵⁾:

- Materials extracted from plants
- Materials of animals' origin
- Materials of Minerals origin

Their uses in dentistry are as ⁽⁶⁾:

- Antimicrobial agents
- Anti-inflammatory agents
- Sedative and anxiolytics.

Many scientists have focused on the effect of herbal materials extracts and essential oils which showed favorable antimicrobial properties ⁽⁷⁻¹⁰⁾.

Many natural extracts like ginger, honey, thyme, curcumin and galla chinesis

extract are incorporated within toothpaste and mouth rinsing to interfere with caries and dental plaque formation ⁽¹¹⁾.

The usefulness of using natural medicine over synthetic medicine:

Natural medicines are less expensive when compared to synthetic medicines and most of the people who habituated in rural areas and villages have blind faith on them. Although synthetic medicines are more potent than herbal medicines sometimes but still herbal medicines have lower toxicity and minor side effect than synthetic medicines ⁽¹²⁾. Some side effects associated with them are: allergy, nausea, vomiting and colic, headache/dizziness and residual sedation ⁽¹³⁾.

Phytotherapeutic Interactions:

Important drug interactions can occur between some herbal products and conventional drugs; however, information on such association is scarce in the literature. *M. chamomilla* has a theoretical risk for potentiation of the anticoagulation effects of warfarin. *V. officinalis* was reported to prolong thiopental and pentobarbital-induced sleep. It might be expected to potentiate the sedative activity of drugs such as midazolam and diazepam. *M. officinalis* combined with alcohol and barbiturates might increase sedative and hypnotic effects ⁽¹³⁾.

Applications of Natural products in dentistry

Natural extracts are mostly used in endodontics as an irrigants solution and as intracanal medicament. The *Rosmarinus ofcinalis* extract contains a bactericidal effect against *E.faecalis* when used as an irrigant solution, with no significant difference in comparison to 2% chlorohexidine and 2.5% sodium hypochlorite⁽¹⁴⁾. Nigella Sativa oil, could be considered as an alternative to formocresol in pulpotomy paste. It has anti-inflammatory effect and does not affect pulp vitality⁽¹⁵⁾. Also, propolis could be used in direct and indirect pulp capping as it promotes hard tissue formation⁽¹⁶⁾. Eucalyptus oil, orange oil, and clove oil can dissolve resin-coated Gutta-percha cones. Orange oil is more potent than other solvents in dissolving resin-coated Gutta-percha⁽¹⁷⁾.

Aloe vera gel as SaliCept Patches is used as prophylaxis for developing alveolar osteitis after third molar removal surgery and showed promising results when compared to clindamycin-soaked Gelfoam. The SaliCept Patch showed a significant decrease in alveolar osteitis compared to clindamycin-soaked Gelfoam⁽¹⁸⁾. Aloe vera-containing mouth rinse exhibits a significant decrease in gingival inflammation and bleeding and there was no difference between aloe vera and chlorohexidine-containing mouth rinses in reducing the number of aerobic and anaerobic bacteria⁽¹⁹⁾. Turmeric (Curcuma

longa) is widely used as an antioxidant, analgesic, anti-inflammatory, antiseptic, and anticarcinogenic agent⁽²⁰⁾. 2% turmeric gel is applied topically to scaling and root planning significantly affecting the enzymatic activity of pathogenic bacteria⁽²¹⁾. Thyme essential oil act as an active ingredient of some denture cleanser and is superior in preserving denture base resin's surface compared to other commercial denture cleanser⁽²²⁾.

Coconut oil with a continuous drug-delivery system was successfully added as a potent antifungal material to the soft denture liner. It was found that the addition of 1.5% coconut oil to the soft-liner led to a strong antifungal effect, with the least effect on the shear bond strength of the denture base⁽²³⁾. Triphala churna showed better antifungal properties when used as a denture cleanser in comparison to chlorhexidine gluconate⁽²⁴⁾.

Applications of natural products in orthodontics:

Local application:

One of the most important local applications of natural products is the as active ingredient in mouth rinses to prevent periodontal diseases and dental caries in orthodontic patients, mouth rinses containing herbal extract of *Salvadora persica*(siwak) and *Azadirachta indica*, resulted in a maximum reduction in the plaque scores of orthodontically treated patients, They reduce the papillary bleeding index scores more than chlorohexidine

0.2%^(25, 26). *Acacia catechu* was significantly equally effective antiplaque and antigingivitis agent as 0.2% chlorhexidine gluconate with no side effects in patients treated with fixed orthodontic appliance⁽²⁷⁾.

Chandra Shekar et al. study showed that polyherbal mixture mouth rinse containing *Eucalyptus hybrid*, *Acacia nilotica*, *Psidium guajava*, and *Murraya koenigii L.sprengel* was effective against dental caries and periodontal diseases microorganisms involved in orthodontically treated patients⁽²⁸⁾. *Acacia catechu* bark, *Thymus vulgaris*, and chamomile extract had better antimicrobial activity against *Streptococcus sangius* and *Streptococcus mutans* in patients with fixed orthodontic appliances than those treated with Chlorhexidine⁽²⁹⁻³²⁾.

Another study suggested that Curcumin based mouth rinses have promising anti-plaque and anti-gingivitis properties⁽³³⁾. *Acacia Arabica* Tea Tree Oil and Aloe Vera gels are used in the treatment of gingival inflammation and enlargement in orthodontic patients, also could be used for the prevention of traumatic oral ulceration^(34, 35).

Green tea extracts and pomegranate peels showed a greater inhibition effect on *streptococcus mutans* bacteria and reduce their attachment to the tooth surface. The combinations of plant extracts showed a synergistic effect and offer more potent antimicrobial efficacy⁽³⁶⁾.

Omidkhoda *et al.* tested the efficiency of *Salvadora persica*

incorporated mouth rinse on the maintenance of force within orthodontic elastic chains. The force decay percentage of the orthodontic elastic chains showed the lowest rate when immersed in *persica* mouth rinses as compared to other mouth rinses⁽³⁷⁾.

Incorporation of *Galla chinensis* extract into orthodontic acrylic would be advantageous for antimicrobial activity and flexural strength⁽³⁸⁾.

Addition of 1% Curcumin nanoparticles and propolis nanoparticles with 2% and 5% concentration to the orthodontic adhesive had a significant anti-cariogenic action with little or no effect on shear bond strength⁽³⁹⁻⁴¹⁾. Different studies were conducted to evaluate the antimicrobial properties of orthodontic adhesive incorporated by cationic curcumin doped zinc oxide nanoparticles and 3% Cinnamon Nano particles respectively showed high antibacterial effect against cariogenic bacteria like *Streptococcus mutans*, *Lactobacillus acidophilus*, and *Streptococcus sobrinus* without compromising the shear bond strength^(42,43).

One study has shown that the reduced shear bond strength of orthodontic brackets after bleaching can be reduced by local application of an antioxidant agent such as mangosteen peel extract^(44,45).

Behnaz et al. stated that different antimicrobial agents (like herbal products) incorporated in bonding systems increased the antimicrobial properties with no

significant negative effect on the shear bond strength of orthodontic brackets ⁽⁴⁶⁾.

Systemic applications:

Systemic applications of natural products in orthodontics are concentrated on alveolar bone remodelling and periodontal apparatus turnover either to accelerate tooth movement or to control tooth movement to prevent relapse.

Traditional Chinese medicine decoction is advantageous to the alveolar bone remodelling by inducing osteoclast differentiation during orthodontic tooth movement. ⁽⁴⁷⁾. *Salvia miltiorrhiza* aqueous extract and its main ingredient promotes orthodontic tooth movement and healing of periodontal ligaments via producing more osteoclasts ⁽⁴⁸⁾. Other studies found that *Rhizoma Drynariae*, *Salvia*, and icariin promote bone remodeling of alveolar bone and accelerate orthodontic tooth movement ⁽⁴⁹⁻⁵¹⁾. Yuan et al. investigated the *Osthole*'s effect on periodontal remodeling in rats during orthodontic tooth movement. They found that *Osthole* increases the number of osteoclasts in the periodontium and promotes bone remodeling at the early stage of treatment, its effect is dose-dependence during orthodontic tooth movement ⁽⁵²⁾. Local injection of *Akebiasaponin* D solution can accelerate orthodontic tooth movement ⁽⁵³⁾.

Al-Hamdany et al ⁽⁵⁴⁾ evaluated the effects of olive oil consumption on orthodontic relapse clinically and histologically after the retention period. Supplementation with olive oil, especially

at 15.4 ml/kg by weight per day concentration during an orthodontic retention period, resulted in less clinical orthodontic relapse in the rabbit model. On histological examination, olive oil increased osteocytes and osteoblasts counts and more bone mineralization at the connective tissue layer forming alveolar bone at the end of 4 weeks after the orthodontic retention period.

Systemic and local administration of Curcumin, *Cissus Quadrangularis*, Virgin Coconut oil, Green Tea, *Nigella Sativa*, and dried plum could be used possibly for promoting alveolar bone remodeling around orthodontic micro implants and increasing their stability ⁽⁵⁵⁻⁵⁸⁾.

CONCLUSIONS

Nowadays natural products are replacing synthetic products in different pharmacological treatments of many oral diseases and/or modifying the bone response to orthodontic tooth movement as there are more available, less expensive, and fewer side effects when compared to synthetic products.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication and/or funding of this manuscript.

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