Targeting oral care with natural products

INTRODUCTION
Oral care has received greater attention in the past decade, particularly in view of increasing scientific evidence that links poor oral health with the incidence of chronic diseases, such as cardiovascular disease. In general, oral care targets prevention of decay, as well as preservation of tooth and gum health.

Gum disease (periodontal disease) describes bacterial growth and production of metabolic substances that gradually destroy the tissue surrounding and supporting the teeth. The result is inflammation, pain and tooth loss. The causative bacteria reside in plaque, a deposit that forms on the base of the teeth and hardens to form “tartar”. These bacteria grow and attack the tissues causing “gingivitis” characterized by inflamed gums that bleed easily. If left untreated the condition progresses to “periodontal disease” wherein there is severe inflammation, bone damage and tooth loss.

Poor oral hygiene is the major cause of gum disease. Other causes include tobacco use, hormonal changes, stress, certain medications that affect saliva flow or induce abnormal growth of gum tissue, poor nutrition such as high sugar diets and vitamin and mineral deficiencies affecting immune response, illnesses, and physical damage due to clenching and grinding teeth. Poor oral hygiene, improper diet (such as excessive amount of sugary and starchy foods), dry mouth and related factors also trigger microbial attack on the teeth resulting in cavities. Canker sores resulting from poor nutrition and hygiene that affect immune functions are also encountered, and need to be addressed effectively.

Scientific evidence continues to indicate an association between periodontal infections, atherosclerosis and vascular disease. Since dental diseases can be prevented, they represent a modifiable risk factor; and maintaining good oral health should receive high priority in general health maintenance (1).

Current Status of the Oral Care Industry
According to a recent report, oral care is one of the smallest categories in the cosmetics and toiletries industry. However, the striking impact of oral care on general health offers potential for innovative products that cosmetically and nutritionally target healthy teeth and gums. The Center for Disease Control has formed the National Oral Health Surveillance System to improve oral health standards in high risk communities.

NATURAL ORAL CARE MEASURES
Oral care includes antimicrobial, anti-inflammatory and immune support. Traditional cultures have used natural materials for oral care, these are often chewed for healthful and cleansing benefits. Recent research provides scientific validation for the use of these materials as antimicrobial, anti-inflammatory and wound healing agents. Internal “cleansing” with natural materials is also reported to benefit oral health and to help in the management of associated conditions such as halitosis.

Antimicrobials target oral pathogens such as Streptococcus mutans, anti-inflammatory and “wound healing” natural extracts offer support to healthy gums and teeth. Examples of natural extracts with scientifically validated efficacy in oral care are presented here.

Coleus Oil
INCI: Coleus Forskohlii Root Oil
Coleus oil is an essential oil extracted from the roots of Coleus forskohlii, a plant from the Natural Order Labiatae (Lamiaceae), a family of mints and lavenders. This species
**Curcuma longa** and **Kaempferia galanga** are valued traditionally for their protective medicinal herbs in South-east Asia and are commonly used as spice ingredients and galangal) from the Zingiberaceae family are found to more effectively inhibit the growth of several other strains of drug-resistant bacteria more in vivo. Although the precise mechanism of antimicrobial action has as yet to be elucidated (12,14) oleuropein and related compounds appear to have surface-active properties that interfere with microbial cell membranes. Oleuropein could also interfere with the synthesis of amino acids that are crucial to viral replication and in the case of retroviruses, neutralize the production of reverse transcriptase and protease. Additionally, oleuropein is also reported to stimulate phagocytosis or the immune response to infection by pathogens (12).

**Neem Leaves Extract**

**INCI:** Melia Azadirachta

The Neem tree is traditionally labeled as “The Village Pharmacy” on account of its multifaceted healthful properties. Its properties range from immunomodulatory and anti-inflammatory effects to antimicrobial and pesticidal attributes. The leaves and seeds of Neem yield limonoids with wide biological applications. These have antibacterial, antiviral, insect repellent, anti-protozoal and anti-helmenthic properties (15). The neem twig is traditionally used as a “natural toothbrush.”

A recent study determined the efficacy of a mucoadhesive dental gel containing *Azadirachta indica* leaf extract (25 mg/g) using commercially available chlorhexidine gluconate (0.2% w/v) mouthwash as positive control. The results of the study suggested that the dental gel containing neem extract significantly reduced plaque index and bacterial count as compared to the control group (16).

**Green Tea Extract**

**INCI:** Camellia Sinensis Leaf Extract

The catechins in green tea were found to inhibit *Staphylococcus* and *Yersinia enterocolitica*. Green tea extracts may make strains of drug-resistant bacteria more...
Green tea extract induced reversal of penicillin resistance. It was found that epicatechin gallate, markedly lowered the minimum inhibitory concentration (MIC) of oxacillin and other beta-lactams (17,18). Extracts of green tea were found to strongly inhibit Escherichia coli, Streptococcus salivarius and Streptococcus mutans, microorganisms found in the saliva and teeth of people suffering from dental caries (19). Green tea in combination with the synthetic antibiotic butylated hydroxyanisole (BHA) reduced the hydrophobicity of S. mutans and greatly inhibited (p<0.001) the formation of hyphae in Candida albicans. The increased antimicrobial activity of green tea is related to an impairment of the barrier function in microorganisms and a depletion of thiol groups (20).

Miswak (Salvadora persica)
Salvadora persica, often called chewing sticks or miswak, is a common oral hygiene tool in Asia, Middle East, and Africa. Salvadora persica chewing stick called miswak is frequently used in Saudi Arabia. The antimicrobial effects of miswak have been well documented. The antimicrobial effects of miswak are attributed to the high content of sodium chloride, potassium chloride, salvadoreu, salvadoreine, saponins, tannins, vitamin C, silica, resin, cyanogenic glycosides, and benzylisothiocyanate. Miswak is most effective against S. faecalis, P. aeruginosa and Staph. aureus, which is likely due to the nitrate content of miswak (22). The organic parts of the sticks of Salvadora persica are comprised mainly of cellulose, hemicellulose, and lignin (23). In one study, by using GC-MS analysis of the volatile oil extracted from Salvadora persica L. leaves, benzyl nitrile, eugenol, thymol, isothymol, eucalyptol, isoterpinolene, and beta-caryophyllene were identified (24). Other biological activities include anti-ulcer activity; a decotying of the plant is protective against stress-induced ulcers (25), indicating anti-inflammatory wound healing effects. In vitro studies examined the effects of aqueous extracts of miswak on healthy and periodontally involved human dentine with Scanning Electron Microscopy (SEM). Twenty-five percent aqueous extract of freshly prepared miswak was used for the study. Twelve human premolars teeth, (six healthy and six with periodontal disease), that were recently extracted for orthodontic and periodontal reasons were used in the study. Twenty-four SEM specimens were prepared and treated with miswak extract with different conditions, such as soaking. Soaking the healthy and periodontally diseased root dentine in miswak extract resulted in partial removal of smear layer and occlusion of dentinal tubules was observed in dentine specimens burnished with miswak solution (26).

Probiotics and Oral Care
A clinical study in Finland revealed that long-term consumption of a probiotic bacterium, Lactobacillus rhamnosus GG, in milk had beneficial effects in dental caries and in reducing caries risk in children (27). Other studies similarly report the effectiveness of probiotics in preventing gum disease and halitosis. Decreased gum bleeding and reduced gingivitis effected by the probiotic Lactobacillus reuteri is reported in literature (28). Colonization of the oral environment with probiotic cultures is reported to be effective in reducing bad breath as well. Replacement of bacteria implicated in halitosis by colonization with competitive bacteria such as Streptococcus salivarius K12, in a mouthwash for example, may potentially provide an effective strategy to reduce the severity of halitosis (29).

EMERGING TRENDS
The above summary of natural ingredients constitutes only a small fraction of the plethora of ingredients available for use in oral care products. Recent approaches to maintaining oral health target preventing bacterial biofilm (plaque) formation through molecular approaches and insight into quorum sensing mechanisms. Quorum sensing is the regulation of gene expression in bacteria in response to changes in cell-population density. Although the nature of the chemical signals, their relay mechanisms, and the target genes controlled by bacterial quorum sensing systems vary, in every case the ability to communicate with one another allows bacteria to coordinate the gene expression, and therefore the behavior, of the entire community. Therefore disrupting such communication between bacteria presents a practical means of preventing plaque formation (30). A number of natural molecules have shown promising results in this area, and could well become the future guardians of oral health.

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