Baking soda dentifrice and periodontal health

A review of the literature

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ABSTRACT

Background. Mechanical disruption of dental biofilm is critical to maintain periodontal health. Baking soda–containing dentifrices have shown to be potential aids for improving gingival health and maintaining dental biofilm control.

Types of Studies Reviewed. Evidence from classic and contemporary literature is reviewed and summarized in this review. In vitro and in vivo (animal and human, respectively) studies and clinical trials have been analyzed.

Conclusions. Some clinical studies demonstrated the benefits of baking soda dentifrices in plaque and gingivitis reduction. Clinical trials with longer follow-up would be useful to confirm the impact of baking soda on gingival health.

Practical Implications. Regular dental biofilm control and adjunctive use of baking soda dentifrices in an otherwise healthy and compliant patient may provide success in maintenance of gingival health.

Key Words. Sodium bicarbonate; baking soda; periodontitis; gingivitis; dental plaque.

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In the 1970s, clinical investigations were undertaken to determine the effect of sodium bicarbonate (baking soda) and peroxide on the management of periodontal disease. The findings were that both microbiological and clinical outcomes improved after treatment. Two authors reported that baking soda and peroxide were effective in controlling periopathogenic microbiota and improving periodontal parameters.[1,2] Since control of dental biofilm is crucial to the prevention and management of periodontal disease, multiple investigations have been undertaken to study efficacy of baking soda in maintaining periodontal health. In this article, we review the evidence on the effectiveness of baking soda dentifrices in the prevention of periodontal disease.

PATHOGENESIS OF PERIODONTAL DISEASE

Diverse microflora including bacteria, viruses, fungi, and protozoa comprise dental biofilm.[3] Dental biofilm formation requires the initial attachment of bacteria to salivary molecules adsorbed to the tooth surface. Once attached, the bacteria divide and secrete polymers that provide a matrix or scaffold for further biofilm development. Other bacteria can then attach to adherent bacteria to increase the diversity and complexity of the biofilm.[4]

Biofilm associated with healthy gingiva is composed of a limited number of commensal microflora dominated by streptococci and actinomyces. In the absence of oral hygiene, the biofilm becomes more diverse in composition, including an increase in the proportion of gram-negative species and spirochetes, which release various biologically active products, including lipopolysaccharide (endotoxin), chemotactic peptides, protein toxins, and organic acids. These molecules diffuse into the gingival epithelium to initiate the host response that eventually results in gingivitis and in some circumstances, inflammatory periodontal diseases.[5] If left untreated, periodontitis could lead to destruction of all of the supporting tissues of the tooth and ultimately tooth loss, either by exfoliation or extraction.

Overwhelming evidence indicates daily disruption of dental biofilm development by mechanical means (toothbrushing and interdental cleansing) prevents biofilm

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development and subsequent periodontal inflammation.[6,7] Dentifrices are a common adjunct used to enhance the effectiveness of mechanical disruption of the biofilm and serve as a vehicle for the delivery of fluoride for caries prevention and other antimicrobial and abrasive agents.

BAKING SODA AND PERIODONTAL DISEASES

Periodontal disease is a result of host-microbe interactions that, if left undisturbed, provoke inflammation to cause gingivitis and ultimately loss of periodontal support. Periodontal disease can be prevented by daily, effective, oral hygiene. Periodontal therapy may be broadly divided into nonsurgical and surgical interventions. Nonsurgical intervention includes removal of biofilm and calcified deposits from the teeth and maintenance of periodontal health by effective plaque control. Dentifrices have a prominent place in the maintenance of dental and periodontal health, and various formulations are available on the market. Similarly, various baking soda–containing formulations are marketed and rationale for their use has been documented in the scientific literature.

Our review of the studies on baking soda dentifrices and periodontal microbial flora, gingivitis, and periodontitis, is summarized below.

Baking soda and periodontal microbial flora. Studies by Keyes and colleagues[1,2] found that baking soda and 3% peroxide have bactericidal activity as evidenced by the absence or significant reduction in select periodontal microflora. In later investigations, other compounds (magnesium sulfate, citric acid, and tosylchloramide) showed similar bactericidal potential. In addition, electronmicroscopy found that exposure of microbes to baking soda resulted in disruption of bacterial cell wall and cell membrane integrity.[8] In short-term (24 hours and 4 days) evaluations, baking soda–containing dentifrice showed moderate reduction (12%-30%) in vital bacterial cell count; however, by comparison, this was lower than chlorhexidine (19%-64%) and a fluoride dentifrice (28%-51%).[9] Similarly, a comparison of the antimicrobial effect of 2 fluoride formulations (sodium fluoride [NaF] and stannous fluoride [SnF_2]), essential oil–containing mouthwash, and combination formulation of baking soda and peroxide, baking soda-peroxide dentifrice was found to be comparable with NaF dentifrice (control) but had lesser antimicrobial effect when compared with both SnF_2 and essential oil–containing mouthwash.[10] Baking soda is often used in combination with peroxide, and their combined effect against selected microorganisms was shown to be synergistic in an in vitro setting.[11] The effect of baking soda with peroxide on periodontal flora was studied in conjunction with effect on gingival cells, and it was noted that a 6-fold reduction in concentration of peroxide from the original Keyes procedure was needed to allow for the survival of gingival cells.[12]

Often, patients with periodontal disease experience loss of clinical attachment resulting in root and furcation exposure, with root caries as a possible complication. In an in vitro study comparing the effect of baking soda dentifrice and control dentifrices on cariogenic microflora, 67% baking soda dentifrice showed significantly greater antibacterial activity against cariogenic microflora.[13] The study found differences in the pH of the 3 dentifrices, with baking soda dentifrice being alkaline (pH = 8.5). On further testing, antimicrobial activity persisted regardless of pH adjustments.

Some of the bacteria selected in the previously described in vitro studies were also evaluated in a rat model, where topical application of 5 dentifrices with and without baking soda were compared. In this study, all dentifrices reduced plaque and modestly reduced dental caries.[13] Further studies of baking soda dentifrices with and without fluoride in rat models showed that baking soda dentifrices (both with and without fluoride) were effective in caries reduction.[14,15]

Baking soda for the prevention of periodontal disease. A double-blind, parallel-design clinical trial compared the efficacy of stabilized SnF_2 dentifrice, baking soda-peroxide dentifrice, essential oil–containing mouthwash, and conventional NaF dentifrice on gingival health and plaque control. This 6-month study demonstrated that SnF_2 alone and in combination with essential oils prevented gingivitis, while the baking soda–peroxide formulation did not reduce plaque and gingival inflammation.[16] However, in 2 examiner-blinded, placebo-controlled clinical trials with 6-month follow-ups, baking soda dentifrice was significantly better than the control fluoride dentifrice in reducing gingival inflammation and improving plaque control. The control dentifrice was matched for fluoride concentration (parts per million) and contained no baking soda.[17,18] A combined formulation of baking soda and peroxide may have demonstrated a synergistic effect on select microbiota in an in vitro setting,[11] but a similar effect in vivo has not been clearly demonstrated.[16,19]

Two dentifrice formulations containing higher concentrations of baking soda (52% and 65%) were evaluated for 6-months for both microbiological and clinical parameters and improvement was noted in both plaque control and gingival inflammation with approximately 50% and 75% reduction, respectively.[20] When 2 herbal dentifrices—1 containing baking soda as an abrasive, and the other containing a comparable abrasive—were compared, no significant difference was noted in control of gingivitis between groups. Results from these studies[16,21] suggest that herbal ingredients in baking soda

ABBREVIATION KEY. **NaF:** Sodium fluoride. **SnF:** Stannous fluoride. **SRP:** Scaling and root planing.