



Original Research Article

Evaluation of healing and anti-plaque efficacy of antioxidant mouthrinse in patients with gingival inflammation – A single blind clinical study

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ABSTRACT

Objective: To evaluate the clinical efficacy of healing as well as anti plaque activity of an antioxidant mouthrinse containing sodium hyaluronate, coenzyme Q10, tea tree oil and aloe vera as active ingredients in a subject population of established clinical gingivitis.

Materials and Methods: A single blind study was conducted among 45 participants, all of whom were in the age group of 18-60 years. The study subjects were randomly divided into three groups of 15 each.

The control group where only oral hygiene instructions were given. Group B1 in which the participants underwent oral prophylaxis at baseline, day 7 and day 14. Group B2 where the participants were given the antioxidant mouthrinse to use thrice daily in addition to undergoing oral prophylaxis at baseline, day 7 and day 14.

The clinical parameters assessed were the probing pocket depth, Plaque Index by Sillness and Loe (1964) and Gingival Index by Loe and Sillness (1963). These were assessed at baseline, day 7 and day 14 for all the 3 groups.

Results: The results were found to be statistically significant at 14 days interval of plaque and gingival inflammation reduction in the B2 group as compared to the other two groups, however, with regard to reduction of periodontal depth, the result was not found to be significant.

Conclusion: This study supports the effectiveness of herbal constituents based antioxidant mouthwash in its role as an antiplaque and healing agent. It should be explored as a cost-effective, long-term antiplaque rinse with prophylactic and therapeutic benefits.

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1. Introduction

Periodontal diseases are chronic inflammatory conditions characterized by the loss of connective tissue, alveolar bone resorption and formation of periodontal pockets as a result of the complex interaction that occurs between pathogenic bacteria and the host's immune response. Periodontitis starts with inflammatory lesions of the gingiva, which, when left untreated, progress and eventually involve and compromise the entire periodontal apparatus of the affected teeth. Dental plaque is the primary etiologic factor in

periodontal diseases.¹

Mechanical plaque control is the most dependable oral hygiene measure, but mechanical oral hygiene methods of plaque removal also require time, motivation and manual dexterity.

Oral hygiene routines including daily toothbrushing and flossing are neither practiced consistently nor are they done for an adequate amount of time to thoroughly remove plaque. Also they are not 100% successful because of various anatomic features such as crowding and tooth alignment in the arch. These limitations of home oral care practices suggest the need for other better strategies. Many of the chemical antiplaque agents in various formulations

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have been tried as an adjunct to mechanical measures for improving the oral health. Many of the reviews have supported the feasibility of chemical approach in the control of plaque formation, thereby aiding individuals in achieving an acceptable gingival status.²

These antiplaque agents can be delivered in the form of mouthwashes, dentifrices, chewing gums, gels and chips. Mouthwashes are a safe and effective delivery system for antimicrobials and can play an important role in plaque reduction.

Out of all the antiplaque agents, chlorhexidine is considered as the gold standard agent for its clinical efficacy in chemical plaque control.³ It has broad antibacterial activity, with very low toxicity and strong affinity for epithelial tissues and mucous membranes. Besides its antiplaque effect, chlorhexidine is also substantive, thus reducing levels of microorganisms in saliva up to 90% for several hours. The use of chlorhexidine is burdened by some side-effects that could affect its patient compliance. The most notable of these is the staining that it produces,⁴ others being the alteration in taste and mucosal erosions, but these are less common.⁵ Essential oil rinses have also been evaluated and shown to be of value as an adjunct to mechanical oral procedures. However, the alcohol content of essential oil rinses and their unpleasant taste is unacceptable to some patients. Thus none of these chemical agents are without shortcomings. Therefore, the search for an ideal and safe antiplaque agent continues.

An increasing number of people all around the world are turning to the nature by using the natural herbal products in both prophylaxis and treatment of different diseases.

Plants are the source of more than 25% of prescription and over-the-counter preparations and the potential of natural agents for oral prophylaxis should therefore be considered.

Hyaluronic Acid (HA) is a naturally occurring linear polysaccharide of the extracellular matrix of connective tissue, synovial fluid and other tissues. It possesses various physiological and structural functions, which include cellular and extracellular interactions, interactions with growth factors and regulation of the osmotic pressure, and tissue lubrication.⁶

HA has shown anti-inflammatory and anti-bacterial effects with regard to the treatment of periodontal disease, which is mainly caused by the microorganisms present in subgingival plaque. It has been found that the equilibrium between the free radicals/reactive oxygen species (ROS) and antioxidants is the major prerequisite for healthy periodontal tissue.⁷

Coenzyme Q10 is a naturally occurring coenzyme formed from the conjugation of a benzoquinone ring with a hydrophobic isoprenoid chain of a varying chain length, depending on the species.⁸ Because of its ubiquitous presence in nature and its quinone structure (which is similar

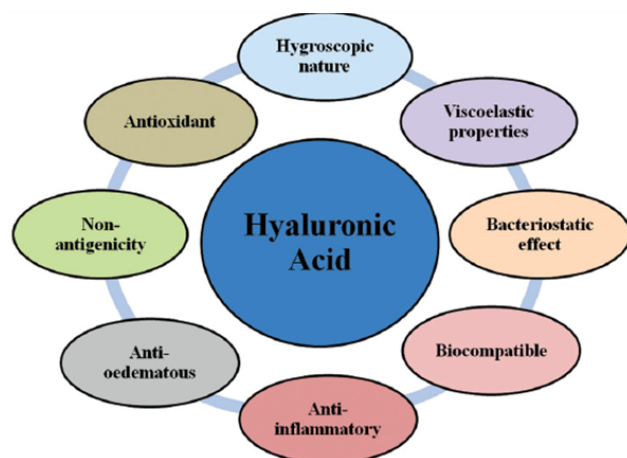


Fig. 1: Properties of hyaluronic acid

to that of Vitamin K), Coenzyme Q10 is also known as ubiquinone.⁹

Functions of CoQ10 include the following

1. Needed for energy conversion (ATP production)
2. An essential antioxidant
3. Regenerates other antioxidants
4. Stimulates cell growth and inhibits cell death
5. Decreased biosynthesis may cause deficiency

Aloe Vera: Its dental uses are multiple in nature.¹⁰

a) It is extremely helpful in the treatment of gum diseases like gingivitis, periodontitis.¹¹

b) It reduces bleeding, inflammation and swelling of the gums. It is a powerful antiseptic in pockets where normal cleaning is difficult, and its antifungal properties help greatly in the problem of denture stomatitis.^{12,13}

c) It is a powerful healing promoter and can be used following extractions.¹⁴

d) It has been used in root canal treatment as a sedative dressing and file lubrication during biomechanical preparation.¹⁰

Tea Tree Oil - derived from the paper bark tea tree. It is a widely looked on product and has a broad antimicrobial spectrum which includes antifungal and antiviral. Also has antioxidant and anti-inflammatory effect.¹⁵⁻²⁰

The effect of the local application of tea tree oil on diseased periodontal tissues has been shown to be useful in few studies.²¹ Elgendy et al. reported the significant improvement in clinical parameters like plaque index (PI), gingival bleeding index (GBI), probing pocket depth (PPD), clinical attachment level (CAL), and pentraxin-3 level in the gingival crevicular fluid in the scaling and root planing and tea tree oil gel group as compared to scaling and root planing alone at the end of 1, 3, 6, and 9 months.²²

Myrrh - is an oleo-gum resin extracted from the tree *Commiphora molmol* consists of volatile oil (Myrrhol),

resin (Myrrhin), gum and impurities. Myrrh contains many active ingredients with strong anti-inflammatory effects such as 1(10) 4-furanodien-6- one (78) which significantly reduces the levels of pro-inflammatory cytokines IL-6, IL- 23, IL-17, TGF-B, and INF-gamma induced by lipopolysaccharide.²³ In addition, Myrrh has an antimicrobial effect against *Streptococcus mutans*,²⁴ *Staphylococcus aureus* and *Candida albicans* which are common oral pathogens. It was found to be as effective as Chlorhexidine in decreasing microbial load after one week of use as a mouthwash,^{25,26} Myrrh was also found to promote oral wound healing³⁰ and was an effective over the counter remedy for treatment of aphthous ulcers.²⁷

2. Materials and Methods

This was a single centre, single blind clinical case study comprising 45 subjects. The study duration was 14 days. The subjects were taken from the out patient section of the Department of Periodontics, Subharti Dental College, Meerut.

The patients were randomly allocated into three groups of 15 subjects each:

Control group - only oral hygiene instructions, no treatment or intervention was given to the subjects. Clinical parameters assessment was done at baseline, 7 and 14 days.

Test group B1 – Clinical parameters assessment was done at baseline, oral prophylaxis was done. Parameters further assessed at day 7 and 14.

Test group B2 – Clinical parameters assessment was done at baseline, oral prophylaxis was done. Subjects were given antioxidant mouthrinse. The mouthrinse was to be used undiluted, thrice daily for 14 days. Parameters further assessed at day 7 and 14.

2.1. Inclusion criteria

1. Patients who were in good health in the range of 18–60 years of age.
2. Minimum of 20 teeth should be present in the dentition
3. Patients classified as stage II, stage III and stage IV gingivitis will be included in the study.
4. Patients who were willing to participate in the study by duly signing an informed consent form.

2.2. Exclusion criteria

1. Deep periodontal pockets (of depth greater than 4 mm)
2. Subjects with any orthodontic appliances or prostheses that would interfere with the evaluation
3. If subjects are found to be allergic to any ingredients used in study or exhibited any gross oral pathology, eating disorders, chronic disease, pregnancy & lactation, acute myocardial infarction within the past six months, use of pacemaker, uncontrolled metabolic disease, major psychiatric disorder, heavy smoking

or alcohol abuse, any systemic disease including any disease requiring repeated or regular analgesia or anti-inflammatory drugs or antihistamines.

2.3. Parameters studied for clinical evaluation

1. PD (Probing depth) – reduction in periodontal pocket depth – (Inclusion criteria will need to mention that PPD of > 4 mm to be considered) Normal PPD is 2-3 mm, so the amount of reduction achieved on usage of MW is an indicator of healing in tissues.
2. Plaque index by Sillness and Loe (1964).
3. Gingival index by Loe and Sillness (1963).

2.4. Statistical methods

Statistical analysis was performed using SPSS software version 21.0.

One Way ANOVA - parametric test was used to evaluate the efficacy of mouthwash in the reduction of plaque, gingival inflammation and periodontal depth at baseline, day 7 and day 14.

3. Results

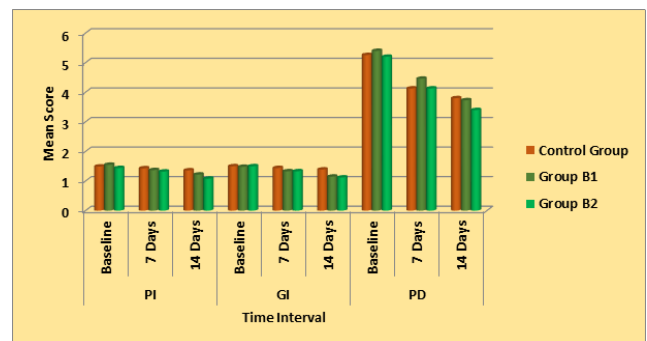


Fig. 2: Descriptive data of change in PI, GI and PD at different intervals of time after mouthwash usage

X axis- time interval Y- axis- Mean value of PI, GI and PD

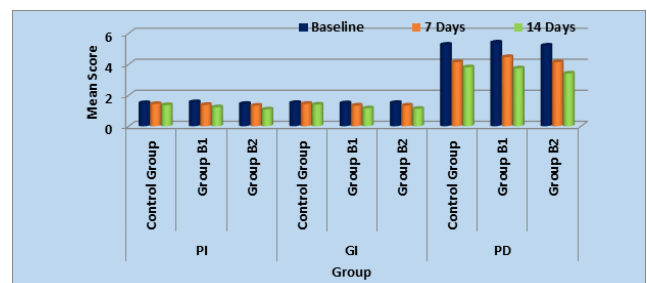


Fig. 3: Mean difference change in PI, GI and PD at different intervals of time after mouthwash usage

X axis - time interval Y- axis- Mean value of PI, GI and PD

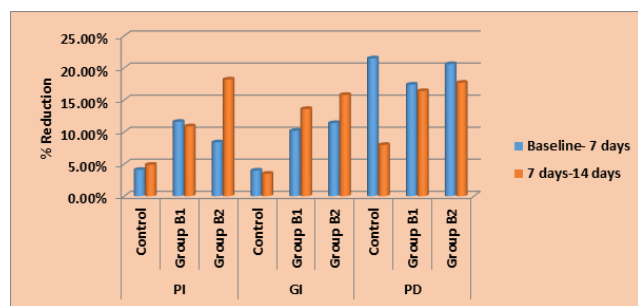


Fig. 4: Percentage reduction in clinical parameters
X axis- time interval PI, GI, PD scores were recorded in different groups Y- axis- percentage reduction

It was found that subjects of Group B2 (oral prophylaxis and mouthwash use) showed better reduction in plaque, gingival inflammation and periodontal depth as compared to other two group subjects. The results were found to be statistically significant at 14 days interval of plaque and gingival inflammation reduction. However, no significant result was found in relation to reduction of periodontal depth amongst the three subject groups.

4. Discussion

Biofilm development in the marginal gingiva and periodontal pockets are important changes in the pathogenesis of periodontal disease. Scaling and root planing are effective in reducing the microflora. Herbal derivatives play an important role in altering the microflora and acting as an adjunct to scaling and root planing. Oxidative stress plays a vital role in the pathogenesis of periodontal disease, as well as many other disorders. It is believed that antioxidants can defend against inflammatory diseases. Numerous health benefits of botanicals like aloe vera, myrrh, tea tree oil have been reported. They have antioxidant and anti-inflammatory properties which contribute in caries prevention and gingival health enhancement.

HA is an essential component of the periodontal ligament matrix and plays various important roles in cell adhesion, migration and differentiation mediated by the various HA binding proteins and cell-surface receptors such as CD44.²⁸

HA has been studied as a metabolite or diagnostic marker of inflammation in the gingival crevicular fluid (GCF) as well as a significant factor in growth, development and repair of tissues.²⁹

A deficiency of coenzyme Q10 at its enzyme sites in gingival tissue may exist independently of or due to periodontal disease. If a deficiency of coenzyme Q10 exists in gingival tissue for nutritional causes and independently of periodontal disease, then the advent of periodontal disease can enhance the gingival deficiency of coenzyme Q10. In such patients, dental treatment including plaque and

calculus will improve the oral hygiene, but not that part of the deficiency of coenzyme Q10 due to systemic cause; therapy with coenzyme Q10 can be included with the oral hygiene for an improved treatment of the existing periodontal disease.³⁰

The concept of reactive oxygen species induced destruction has led to the search for an appropriate complimentary antioxidant therapy in the treatment of inflammatory periodontal diseases. The pharmacology of coenzyme Q10 indicates that it may be an agent for treatment of periodontitis. On the basis of on new concepts of synergism with nutritional supplements and host response, coenzyme Q10 may possibly be effective as a topical and/or systemic role or adjunctive treatment for periodontitis either as a stand-alone biological or in combination with other synergistic antioxidants (i.e., vitamins C and E).

Davis³¹ stated that wound healing with aloe vera is due to increased blood supply, increased oxygenation, which stimulates fibroblast activity as well as collagen proliferation in tissues. Davis³² in his in vitro and in vivo studies showed healing with fibroblast proliferation. Wound healing by means of growth factors such as gibberellins, auxins and mannose phosphate, which bind to insulin-like growth factor receptors to improve healing, is also seen. Yagi et al.³³ stated presence of glycoprotein with cell proliferation improves healing. Aloe vera also contains vitamins A, C, E, B12 and folic acid. Vitamin C, which is involved in collagen synthesis, increases concentration of oxygen at the wound site because of dilatation of blood vessels. Aloe vera penetrates and dilates capillaries going to an injured site, which improves healing.

The components of tea tree oil have lipophilic properties which facilitate its diffusion through the epithelium and readily absorbed with its anti-inflammatory property into the gingival connective tissues that serve to be a unique, nontoxic agent that would be as effective to the current range of chemotherapeutic periodontal treatment options³⁴ in addition, Tea tree oil suppresses the monocyte production of inflammatory mediators and superoxide, and thereby may prevent tissue damage that may be seen in more chronic inflammatory states. The anti-inflammatory activity of tea tree oil upon its topical application could control inflammatory responses to foreign antigens and enable neutrophils to be fully active in an acute inflammatory response and eliminate foreign antigens, concealing monocyte inflammatory mediator and superoxide production and thereby preventing oxidative tissue damage that may be seen in chronic inflammatory states. The antimicrobial activity of tea tree oil is already well-established.³⁵

Myrrh, in addition to its anti-inflammatory, antiulcer³⁶ and astringent effect, also exhibits antibacterial effects on different species including that on oral microflora.³⁷

The antibacterial and anti-inflammatory properties of myrrh explain its ability to reduce dental plaque and gingival inflammation. Myrrh extract has the potential to be an alternative remedy in daily oral hygiene practices as an adjunct to mechanical plaque control.

5. Conclusion

Mouthwashes containing herbal and antioxidant rich constituents are found to be effective in reducing plaque and gingival inflammation. Considering the fact that the chemical formulations of most commercially available mouth rinses are chemically based, expensive, and have considerable side effects, which restricts their use. India has a rich source of herbal plant products with medicinal value. Products based on herbal derivatives such as hyaluronan, myrrh, aloe vera can be used as adjuvant to oral hygiene maintenance with a goal of prevention of periodontal diseases due to its antibacterial and antioxidant properties.

Due to presence of natural ingredients, herbal mouthwashes have a more palatable taste and almost none known significant side-effects. Thus they can be used on a daily basis as an alternative to chemical based mouthwashes as antiplaque agents, in addition to mechanical means of plaque control. Their role should be further explored and evaluated on long term basis as antiplaque agents with prophylactic benefits.

6. Source of Funding

Purexa Global Pvt Ltd.

7. Conflict of Interest

None.

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