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ORIGINAL ARTICLE

Boosting Gum Health: CoQ10, Beta-Carotene and Neem vs. Chlorhexidine Gel in Periodontal Therapy - A Pilot Study

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Background: Periodontal disease is primarily caused by dental plaque, necessitating effective plaque control to prevent and manage the condition. Chemical plaque control can be used as an adjunct to mechanical methods. Chlorhexidine (CHX) is widely used for its antimicrobial properties, while Coenzyme Q10 (CoQ10) is an antioxidant with potential benefits in periodontal therapy.
Objective: The study aims to evaluate and compare the clinical efficacy of 1% CHX gel and CoQ10 gel in patients with periodontal pockets.
Materials and Methods: A total of 10 patients with Probing Pocket Depth (PPD) of 4-6 mm were selected. Post Scaling and Root Planing (SRP), Group A received 1% CHX gel and Group B received CoQ10 gel, to be applied twice daily. Clinical parameters, including Gingival Index (GI) and PPD, were recorded at baseline, 21 days and 45 days.
Results: Both groups showed a statistically significant reduction in PPD over 45 days. However, intergroup comparison revealed no significant difference between the two treatments.
Conclusion: Coenzyme Q10 demonstrated results comparable to Chlorhexidine in treating periodontal pockets with the added advantage of no known side effects. This suggests that Coenzyme Q10 could serve as a safe and effective alternative for long-term periodontal therapy.

Keywords: *Chlorhexidine, non-surgical periodontal therapy, probing pocket depth, Coenzyme Q10*

INTRODUCTION

Chronic periodontitis is a progressive inflammatory disease marked by the destruction of the tooth-supporting structures, resulting in attachment loss and the formation of periodontal pockets. These pockets emerge due to the combined effects of microbial invasion and the host's inflammatory response, which lead to the degradation of collagenous connective tissue and resorption of alveolar bone. Dental plaque, composed of specific pathogenic microorganisms, is widely recognized as the primary causative factor in the initiation and progression of periodontal disease. Its effective removal and prevention are therefore central to successful periodontal therapy.[11]

Although mechanical debridement remains the foundation of treatment, it often fails to entirely eliminate bacteria, particularly those located in inaccessible areas such as deep periodontal pockets or within gingival tissues. Furthermore, consistent mechanical plaque control requires both time and proper technique, which many patients find difficult to maintain-especially in

interproximal areas. These limitations have led to the increased use of chemical agents as adjuncts to mechanical therapy. Chemical plaque control agents can act at various stages of plaque development and have been shown to reduce bacterial load, inhibit recolonization, and improve clinical outcomes.

Antimicrobial therapies can be administered systemically or locally. However, systemic use is often associated with drawbacks such as hypersensitivity reactions, the development of antibiotic resistance, and disruption of the normal microbiota. Consequently, current research and clinical practice are increasingly focused on localized drug delivery systems that offer targeted antimicrobial action with fewer side effects. Combining mechanical debridement with chemotherapeutic approaches—particularly those involving localized sustained-release agents—offers a promising strategy for managing chronic periodontitis and achieving long-term periodontal health. [1,2]

Chlorhexidine (CHX) is an antiseptic agent belonging to the bisbiguanide class. Structurally, it is a symmetrical molecule composed of two biguanide groups and four chlorinated phenyl rings, which are linked by a central hexamethylene chain. CHX functions as a strong base and typically carries two positive charges—one on each side of the hexamethylene bridge—when the pH is above 3.5. [6]
A number of bisbiguanide antiseptics, such as chlorhexidine, alexidine, and octenidine, have demonstrated effectiveness against dental plaque. Among them, chlorhexidine gluconate is the most extensively researched, particularly in terms of its toxicological profile. Its mode of action involves compromising the integrity of the bacterial cell wall. The compound's notable anti-plaque efficacy is attributed to its strong binding capacity to oral tissues (substantivity) and a mechanism often referred to as the "pin-cushion" effect. [7]
Substantivity refers to a drug's capacity to adhere to and remain on both soft and hard oral tissues, a characteristic first identified in chlorhexidine during the 1970s. This property is influenced by several factors, including the drug's concentration, pH, temperature, and the duration of its contact with oral surfaces. In the case of chlorhexidine, substantivity enables the compound to sustain therapeutic levels over extended periods, making it particularly effective in preventing the accumulation of dental plaque. [2]

Coenzyme Q10 (CoQ10), also known as ubiquinone-10, is a fat-soluble, vitamin-like compound found in mitochondria [3], where it plays a critical role in ATP production through oxidative phosphorylation. It also acts as a powerful antioxidant, existing in two forms—ubiquinone (oxidized) and ubiquinol (reduced)—that help neutralize free radicals and protect cells from oxidative damage. [4]

In periodontal disease, oxidative stress and inflammation contribute to tissue destruction. CoQ10 levels are often lower in diseased gingiva, and its supplementation has shown promise in reducing inflammation, enhancing tissue repair, and restoring antioxidant balance. Due to its dual role in energy metabolism and antioxidant defense, CoQ10 is gaining recognition as an effective adjunct in non-surgical periodontal therapy. [4,5]

Neem exhibits antibacterial, anti-inflammatory, and plaque-reducing properties, making it beneficial for managing periodontitis. [8]
Carotenoids, as dietary antioxidants, have inhibitory effects on the progression of inflammatory diseases. Carotenoids neutralize the ROS activation that can induce oxidative stress, which results in excessive tissue damages. Carotenoids can protect the damages of tissue cells from several diseases induced by inflammation such as periodontitis or aging. **β-Carotene**, one of the main carotenoids, is a Vitamin A precursor that has antioxidant or anti-cancer effects. Importantly, Ebersole et al., have shown that lower β-carotene levels in blood were found in moderate/severe periodontitis patients. [9]
The purpose of this study was thus, to compare, the effectiveness of anti-inflammatory properties and reduction in Periodontal pockets, of commercially available gels (Cavique gel™) containing a combination of CoQ10, Beta Carotene and Neem and (Hexigel™) containing Chlorhexidine Gluconate, as an adjunct to SRP.

MATERIALS AND METHODS

A total of 10 patients coming to the outpatient department (OPD) of Department of Periodontology, Babu Banarasi Das College of Dental sciences, Lucknow, were selected based on the inclusion and exclusion criteria **[Figure 1].**

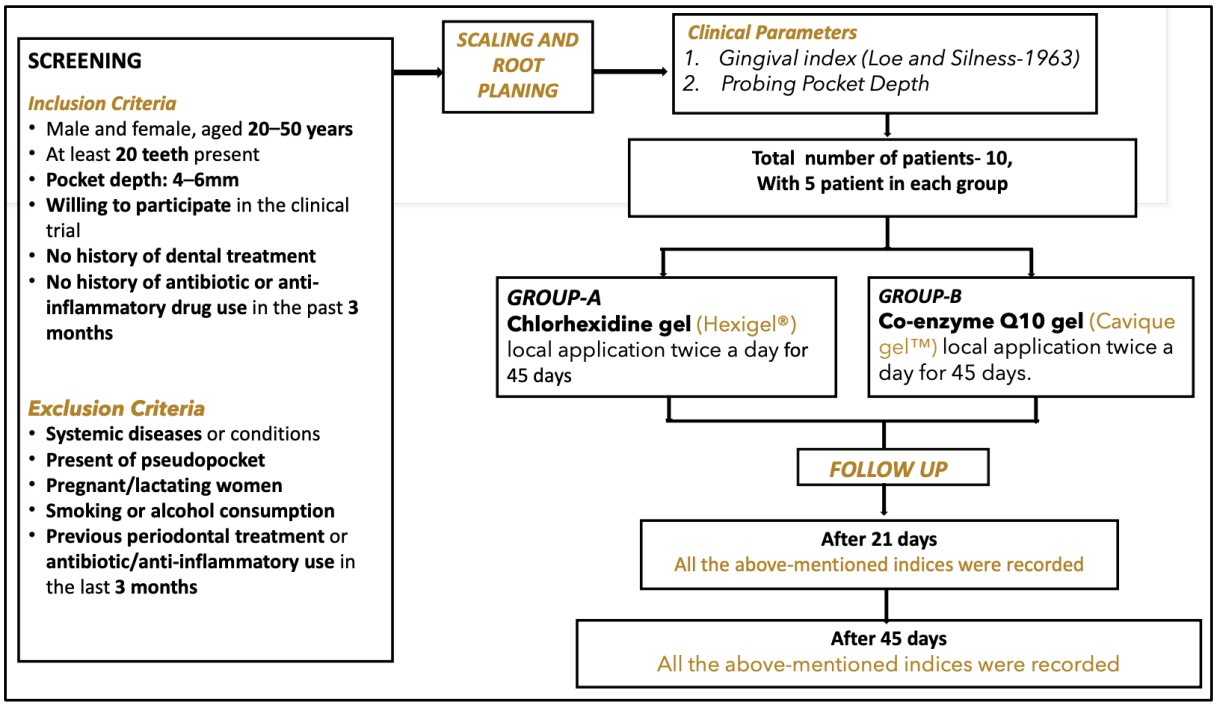


Figure 1. Study Design

Once selected, clinical parameters recorded at baseline were Gingival Index (GI) [10] and Pocket Probing Depth (PPD) using UNC-15 Periodontal Probe. All the patients then received Scaling and Root Planing (SRP). All clinical measurements and SRP were performed by one calibrated periodontist blinded to the study groups. Post the completion of SRP, by coin-toss method, patients were divided into Group A and Group B. Subjects of Group A, consisting of 5 members, received 1% CHX gluconate gel (Hexigel™) and Group B, also consisting of 5 members, received CoQ10, beta carotene and neem gel (Cavique gel™). Patients were instructed to apply the gel, twice daily, using q-tips, after toothbrushing. GI and PPD were again recorded at 21 days and 45 days. Clinical pictures at baseline and 45 days of Group A and Group B are displayed in **Figure 2** and **Figure 3** respectively.

Figure 2. Group A (Chlorhexidine Gluconate 1% gel)

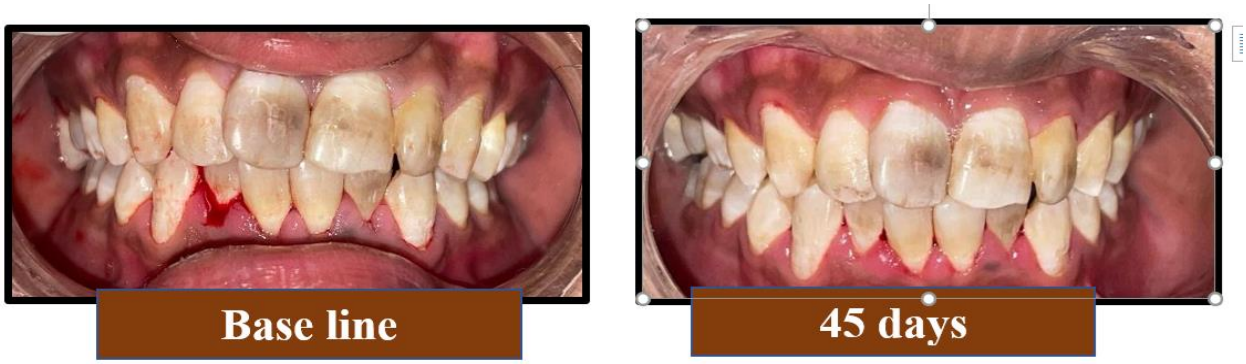


Figure 3. Group B (Coenzyme Q10, Beta carotene, Neem gel)

INCLUSION CRITERIA

Male and female subjects aged between 20 and 40 years were included in the study. Subjects having at least 20 teeth and a pocket probing depth of 4–6 mm were included. Only those who were willing to participate in the clinical trial were enrolled. Additionally, subjects with no history of dental treatment and no use of antibiotics or anti-inflammatory medications in the past three months were selected.

EXCLUSION CRITERIA

Participants with systemic diseases, fibrotic gingival enlargement, women who are pregnant or lactating mothers, individuals with a history of smoking or alcohol consumption, and those who have undergone periodontal treatment and/or used antibiotics/anti-inflammatory drugs within the past three months were excluded from the study.

STATISTICAL ANALYSIS

Data was analyzed using Microsoft Excel 2007 and IBM SPSS 20.0. The t-test compared test and control sites at baseline, 21 days, and 45 days, with Mean and Standard Deviation (SD) calculated. A p-value ≤ 0.05 was considered statistically significant.

RESULT

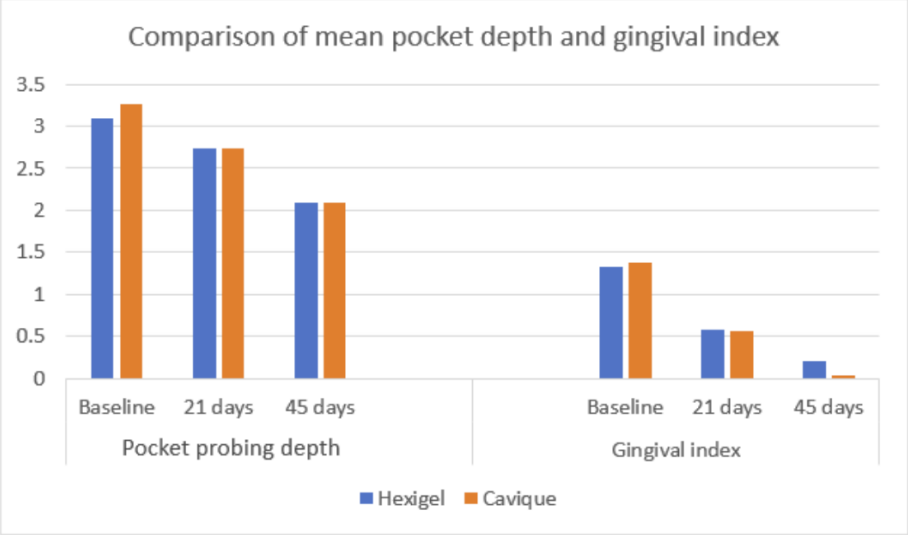
The study consisted of 10 subjects (6 females and 4 males). Age groups varied from 20 to 40 years. Significant reduction in GI was observed at 21 days and 45 days from baseline in Group A and B, individually. On intercomparison of the two groups, no statistically significant difference was observed in the GI scores **[Table 1]**.

Table 1 Intergroup and Intragroup statistical comparison of gingival index (GI)

Time interval	Gel	Mean	Std. Deviation	P-value
Base line	Hexigel	3.1040	0.6025	0.66
	Cavique	3.2600	0.4827	
21 days	Hexigel	2.7480	0.2766	0.969
	Cavique	2.7360	0.6094	
45 days	Hexigel	2.1060	0.2125	0.956
	Cavique	2.0960	0.3273	

Similarly, there was a significant reduction in the PPD scores of Group A and Group B individually, but no statistically significant difference in PPD scores was observed on intergroup comparison (p>0.05) **[Table 2]**. The statistical comparison of mean pocket depth and gingival index also showed no statistically significant difference **[Graph 1]. Table 2. Intergroup and Intragroup statistical comparison of pocket probing depth (PPD)**

Time interval	Gel	Mean	Std. Deviation	P-value
Base line	Hexigel	1.332	0.1101	0.704
	Cavique	1.370	0.1850	
21 days	Hexigel	0.5800	0.0237	0.911
	Cavique	0.5660	0.1312	
45 days	Hexigel	0.2100	0.0612	0.485
	Cavique	0.0172	0.0985	



Graph 1. Intergroup statistical comparison of mean pocket depth and gingival index.

DISCUSSION

This study aimed to evaluate and compare the effectiveness of two distinct treatment strategies for managing periodontal disease. One group was administered a combination therapy consisting of Co-enzyme Q10, Beta-carotene, and Neem, while the other group received Hexigel, a gel formulation containing chlorhexidine gluconate in the concentration of 1%. Both interventions focused on reducing periodontal pocket depth and controlling inflammation, though they operate through different mechanisms of action.

In a systematic review conducted by *Salman et al* [2], stated that co-enzyme serves as a cofactor for the oxidative phosphorylation that produces adenosine triphosphate (ATP). Co-enzyme Q10 plays a crucial role in cellular energy production and has been shown to reduce oxidative stress in periodontal tissues.

In a review article by *Tufail et al* [11], stated that beta carotene is the precursor of vitamin A and is vital for antioxidant defense against peroxides in cells and tissues. Vitamin A, derived from beta-carotene, supports epithelial tissue repair and maintenance, which is crucial for gum health. [9]

According to *Abdollahzdeh S.H et al* [12], Azadirachta indica extract is a potent inhibitor of microorganisms that cause infectious diseases in the mouth. It also aids in the reduction of dental plaque index neem is said to remove toxins, purify the blood, and prevent free radical damage in the human body and it also has anti-inflammatory, astringent, antiviral and antiseptic properties.

In a systematic review and meta-analysis, *Han Zhao et al* [13], chlorhexidine (CHX) remains one of the most effective local antimicrobial agents and is widely used for the local treatment of periodontitis. Through the rapid attraction of the negatively charged bacterial cell surface to the cationic CHX molecule, CHX shows strong antibacterial activity in the periodontal pocket, along with a lack of toxicity, noncompliance from patients and an emergence of resistance microorganisms.

The findings indicate that both treatment modalities resulted in significant improvements in clinical parameters such as gingival index (GI) and probing pocket depth (PPD). The reduction in inflammation and pocket depth was observed in both groups, highlighting their efficacy in periodontal therapy. However, intergroup comparisons revealed non-significant differences, suggesting that the natural combination therapy (Co-enzyme Q10, Beta-carotene, and Neem) produced results comparable to the gold-standard chlorhexidine-based treatment.

The results of this study reinforce the potential of natural adjuncts in periodontal therapy. Given their safety profile and comparable efficacy, Co-enzyme Q10, Beta-carotene, and Neem-based formulations could serve as a viable long-term alternative or adjunct to conventional chlorhexidine therapy, particularly for patients seeking natural treatment options.

CONCLUSION

Co-enzyme Q10 has demonstrated promising results, effectively rivalling conventional chemical agents through its natural therapeutic properties. The findings of this study indicate that Co-enzyme Q10 delivered outcomes comparable to those of chlorhexidine, the established standard in periodontal care. Co-enzyme Q10 is associated with no known side effects, making it a safe option for long-term use. Its performance also suggests a positive shift in the periodontal treatment phase, highlighting its potential to expand current treatment strategies and offer a viable alternative in managing periodontal conditions.

DECLARATIONS

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Conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Statement on the accessibility of data

The corresponding author can provide the data supporting this study upon reasonable request.

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