

Comparative Evaluation of Oxygen-Enriched and Chlorohexidine Mouthwashes as an Adjunct to Non-Surgical Periodontal Therapy and its Efficacy on Gingival Inflammation, Plaque Scores and Patient-Reported Outcomes.

Protocol submitted to

Research committee, School of Dentistry, Newgiza University

By

Azza Mohammed Nasr, Lecturer of Periodontology, School of Dentistry, Newgiza University.
Alia Emad Eldefri, Lecturer of Periodontology, School of Dentistry, Newgiza University.
2025

CODE:

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Group lead signature

Dr. Safa Fathy

Group member signature.

Dr. Azza Nasr

Dr. Alia Emad

Research committee leads signature **Dr. Sherif Elkhodary / Dr. Sherif Elkordy**

Date:**3/03/2025**

I. Introduction:

Effective control of the supragingival plaque biofilm is critical for preventing and treating periodontal disease. Mechanical self-performed plaque control combined with professional debridement can prevent disease initiation and limit its progression [1]. Thus, antiseptic mouthwashes have been widely used in dentistry as an antiplaque and anti-gingivitis adjunctive to professional mechanical plaque control (PMPR) in treating different periodontal diseases [2].

II. Background and Rationale:

Chlorhexidine (CHX) has been suggested as the gold standard of oral antiseptic mouthwashes, as it has a broad anti-bacterial spectrum. According to the 2020 EFP clinical guidelines [1] the adjunctive use of chemical agents especially CHX was recommended in steps 1 and 2 periodontal therapy for patients with different periodontal conditions. Moreover, the American Dental Association Council approved the CHX's superior substantivity and prolonged antiplaque effect by binding tightly to the tooth structure, oral tissues and dental plaque and releasing slowly, resulting in 8 to 12 hours of substantivity [3]. However, CHX showed several disagreeable side effects such as an unpleasant bitter taste, tooth brown staining and temporary loss of taste limiting the prolonged use of these products [4].

The goal of improving the patient's quality of life led to more work on new chemotherapeutic agents with antibacterial and anti-inflammatory properties to overcome the side effects and limitations of chlorhexidine mouthwash. Oxygen is essential for normal cellular functioning and its demand increases during the stages of inflammation, repair, and regeneration. Oxygen improves wound healing by promoting neovascularization, collagen formation, and re-epithelization [5].

Oxygenated mouthwashes can help in the management of periodontal disease by lowering the levels of the reactive oxygen species. Oxygen-enriched mouthwash antimicrobial property is determined by the release of active oxygen that has been claimed to be used for a longer duration without any side effects [6]. The active oxygen particles released from the mouthwash can control bacterial growth and limit its harmful effect in addition to its accelerating effect on wound healing. This type of mouthwash contains a high amount of oxygen, which kills anaerobic bacteria. [5].

Currently, ozonated mouthwash is gaining popularity as a modern noninvasive method of treatment. Accordingly, Ozonated olive oil is a powerful oxidizing agent with a high antimicrobial power against oral pathogens [7]. The antioxidant effects of olive oil can damage the cell walls of microorganisms and destroy them in addition to its effect on altering the bacterial adhesion on the tooth surface [8]. The olive oil is superheated and oxygen gas is superheated to achieve a renaissance phase and combined to form an ozonated olive oil which causes the formation of reactive oxygen molecules (O₂) that influence the cellular metabolism, tissue repair, and antimicrobial effect [9].

Accordingly, this study aims to compare an oxygen-enriched mouthwash to CHX mouthwash with regards to enhancing clinical parameters as bleeding on probing (BoP) and plaque accumulation (PI) and test the possible adverse effects when compared to CHX.

III. Aims and objectives:

The aim of the study is to evaluate the efficiency of oxygen-enriched mouthwash as an adjunct to professional mechanical plaque removal (PMPR) in treating patients with gingival inflammation, by assessing the improvement in bleeding on probing (BOP), plaque index (PI), and patient reported outcomes (teeth and tongue staining, burning sensation, taste alterations, dry mouth). Research question: “Will oxygen-enriched mouthwash be comparable to chlorohexidine mouthwash when used in conjunction with professional mechanical plaque removal in treating patients with gingival inflammation?”

PICO elements:

Population: Adult patients (18-60 years of age) with gingivitis.

Intervention 1: Professional mechanical plaque removal (PMPR) + 0.2% Chlorohexidine (Hexitol) mouthwash (Group A)

Intervention 2:- Professional mechanical plaque removal (PMPR)+ Oxygen-enriched (Q sanihex) mouthwash (Group B)

Control: Professional mechanical plaque removal (PMPR) only (Group C)

Outcomes:

1. Clinical parameters:
 - BOP
 - PI
2. Patient-reported outcomes (teeth and tongue staining, burning sensation, altered taste sensation, dry mouth)

IV. Methods:

a. Sample size calculation:

According to Akash and Rajasekar et al (2021) [6] The mean post treatment GI ranged from 1.409 ± 1.225 , 1.476 ± 1.081 and 2.343 ± 1.1154 . Using G power statistical power Analysis program (version 3.1.9.4) for sample size determination [11], A sample size ($n=66$; subdivided to 22 in each group) will be sufficient to detect a medium effect size (f) = 0.39, with an actual power ($1-\beta$ error) of 0.8 (80%) and a significance level (α error) 0.05 (5%) for two-sided hypothesis test [6]. The calculated sample size will increase by 10% to compensate for any dropouts during the study (total sample size will be $n=72$ subjects; subdivided to 24 in each group).

b. Description of the study sample:

Inclusion criteria:

Adult patients (age between 18-60 years) with gingivitis. (patients from 18-21 years need a verbal assent and written consent from their legal guardian)

Exclusion criteria:

- Less than 20 teeth remaining.
- Patients who had undergone any periodontal therapy in the last 6 months
- Tobacco smokers
- Known systemic disease.
- Pregnant or lactating females

- Use of antibiotic or anti-inflammatory medications in the last 3 months

c. Intervention for each group:

All subjects will be clinically assessed before starting treatment with clinical parameters – bleeding on probing (BoP) using the gingival index (GI) by Löe and Sillness, 1963 [10], and plaque index (PI) by Löe and Sillness, 1964. [10]

All subjects will receive Step 1 periodontal therapy which includes patient education and oral hygiene instructions. Then patients will receive professional mechanical plaque removal (supragingival scaling and subgingival instrumentation) using ultrasonic scalers, manual scalers, universal and Gracey curettes.

Subjects from Groups A and B will be given their designated mouthwash (0.2% Chlorohexidine for Group A and oxygen-enriched mouthwash for Group B) and instructed to use it twice daily 30 minutes after tooth brushing (rinsing with 10 ml. of undiluted mouthwash for one minute). Intervention subjects will use mouthwash regularly for 2 weeks.

All subjects will be recalled weekly for follow-up of oral hygiene measures compliance until the end of the study.

d. Outcomes:

	Outcome	Measuring method	Measuring unit
Primary outcomes	Plaque index (PI) by Löe and Sillness, 1964	Visual examination	score
Secondary outcomes	Bleeding on probing (BOP) using the gingival index by Löe and Sillness, 1963	Periodontal probe	score
	Patient-reported outcomes	VAS score	1-10

Clinical parameters include plaque index (PI) by Löe and Sillness, 1964, and bleeding on probing (BOP) using the gingival index (GI) by Löe and Sillness, 1963. The sites with BOP will be checked by noting the presence and absence of bleeding on all four surfaces (buccal,

lingual, mesial, and distal) for all the teeth. The percentage of sites with BOP will be calculated by the percentage of the teeth with BOP to the total teeth present.

Clinical parameters (GI and PI) will be measured twice, once before starting Step 1 periodontal therapy, and after two weeks of mouthwash use.

Patient-reported outcomes will be recorded at the end of the study (after two weeks of mouthwash use) using a visual analogue scale (VAS) score (1-10) to examine the unwanted side effects, such as teeth and tongue staining, burning sensation, taste alterations and oral dryness.

e. Time plan of the study:

Study subjects will be recruited from the outpatient periodontology clinic at the School of Dentistry, Newgiza University.

All study subjects will be randomly assigned to the intervention and control groups using the numbered opaque sealed envelopes technique.

The study duration will be four weeks from recruiting patients until the final assessment.

f. Statistical methods:

Statistical analysis will be performed using a commercially available software program (SPSS Chicago, IL, USA).

Numerical data will be described as mean and standard deviation or as median and range as appropriate according to the normality of the data. Data will be compared using Kruskal Wallis test or ANOVA test depending on normality. The level of significance will be set at $P \leq 0.05$.

All tests will be two tailed.

V- Ethics:

Research ethics approval.

VI- References:

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