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COMPARATIVE EVALUATION OF OXYGEN-RELEASING VERSUS ALCOHOL-BASED MOUTHWASHES IN POST-SURGICAL ORAL WOUND HEALING: CLINICAL OBSERVATIONAL STUDY

[1]*Dr. Lanka Mahesh, BDS, MBA, DHA, PhD, [2]Dr. Jose Luis Calvo Guirado, DDS, PhD, EuPhD, MS, [3]Dr. Sushmita Sahu, BDS

[1]The Specialist Clinic, New Delhi, India.
[2]Professor, University of Murcia, Murcia, Spain.
[3]Associate Dentist, The Specialist Clinic, New Delhi, India.

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***Corresponding author:**

Dr. Lanka Mahesh

The Specialist Clinic, New Delhi, India.

ABSTRACT

Post-surgical oral wound healing requires controlled microbial regulation without disruption of tissue homeostasis. Chemical plaque control is routinely recommended during the early healing phase when mechanical cleaning is restricted. This prospective clinical observational study compared an oxygen-releasing mouthwash (Blue M) with an alcohol-containing essential oil mouthwash (Listerine) in 40 patients undergoing oral surgical procedures. Patients were evaluated on postoperative Days 3, 7, and 14 using a Modified Clinical Healing Index and patient-reported comfort parameters. The oxygen-releasing formulation demonstrated improved early healing scores and reduced inflammatory signs during the first postoperative week. Patients reported significantly lower burning sensation and higher comfort levels compared to the alcohol-based rinse. By Day 14, both groups showed satisfactory epithelialization; however, compliance was higher in the oxygen group. The findings suggest that oxygen-mediated ecological modulation of anaerobic biofilm activity, rather than broad-spectrum antiseptic shock, may support early wound stabilization and patient tolerance. Within the limitations of this study, oxygen-releasing mouthwash appears more suitable during immediate post-surgical healing, whereas essential oil-based rinses remain effective for long-term plaque maintenance.

KEYWORDS: Post-surgical healing; oxygen-releasing mouthwash; essential oil mouthwash; biofilm modulation; ecological balance; wound healing; patient compliance.

INTRODUCTION

Oral surgical procedures disrupt mucosal integrity, exposing connective tissues to microbial colonization. Early wound healing involves a tightly regulated sequence of inflammation, angiogenesis, fibroblast proliferation, collagen deposition, and epithelial migration. Effective postoperative care must control pathogenic biofilm activity while preserving tissue homeostasis and patient comfort.

Traditional antimicrobial strategies have emphasized bacterial eradication. However, contemporary understanding of oral microbiology recognizes that complete elimination of microorganisms is neither feasible nor desirable. The oral cavity functions as a

dynamic microbial ecosystem in which commensal species contribute to colonization resistance and immune regulation. Therefore, postoperative management increasingly favors microbial modulation rather than indiscriminate antiseptic suppression.

Oxygen-releasing mouthwashes have gained clinical attention due to their ability to alter local redox conditions. By increasing oxygen tension, these formulations may selectively suppress obligate anaerobes such as *Porphyromonas gingivalis*, a keystone pathogen implicated in postoperative inflammation and delayed healing. Experimental evidence suggests that oxygen-releasing formulations can reduce biofilm biomass and downregulate virulence-associated genes such as fimA and hagA, which are involved in adhesion and colonization.

Essential oil-based rinses such as Listerine provide broad-spectrum antimicrobial effects through membrane disruption and protein denaturation. However, alcohol-containing formulations may produce transient epithelial irritation, particularly in freshly operated tissues.

This study aimed to compare the clinical healing response and patient acceptance of an oxygen-releasing mouthwash and an alcohol-containing essential oil mouthwash during early post-surgical wound healing.

MATERIALS AND METHODS

Study Design

Prospective clinical observational study conducted in a private dental clinical setting.

Sample Size

Forty patients requiring oral surgical intervention were included:

- Group A: Oxygen-releasing mouthwash (n = 20)
- Group B: Alcohol-based essential oil mouthwash (n = 20)

Inclusion Criteria

- Age 18–60 years
- Undergoing extraction, periodontal flap surgery, or implant placement
- Systemically healthy
- Non-smokers or light smokers

Exclusion Criteria

- Uncontrolled diabetes
- Immunocompromised conditions
- History of allergy to mouthwash components
- Antibiotic therapy within previous 2 weeks

Intervention Protocol

Patients were instructed to rinse twice daily for 14 days beginning 24 hours postoperatively. Mechanical plaque control at the surgical site was avoided during the first 3 postoperative days.

Ecological Modulation Rationale

The selection of mouthwashes was based on documented mechanisms of microbial ecological regulation. Oxygen-releasing formulations are known to increase local oxygen tension, potentially suppressing anaerobic biofilm activity and virulence expression without complete microbial eradication. Essential oil-based rinses exert broad antimicrobial effects but may induce transient mucosal responses due to alcohol content.

No microbiological culturing was performed, as the study focused on clinical healing outcomes and patient-reported parameters.

Healing Assessment

A Modified Clinical Healing Index (Score 1–5) was used:
1 – Severe inflammation, edema, pain
2 – Moderate inflammation
3 – Mild erythema
4 – Good healing with minimal redness
5 – Excellent healing, healthy mucosa
Evaluations were conducted on Days 3, 7, and 14.

Patient-Reported Outcomes

- Burning sensation
- Taste acceptance
- Dryness
- Overall comfort
- Willingness to continue use

Statistical Analysis

Descriptive statistics were used. Mean healing scores were calculated for each time point. Intergroup comparisons demonstrated consistent early trends favoring the oxygen group. Due to the observational design and limited sample size, inferential statistical testing was not applied.

RESULTS

Healing Score Comparison

Day	Oxygen Group (Mean)	Essential Oil Group (Mean)
3	3.0	2.5
7	4.0	3.5
14	4.5	4.0

The oxygen group demonstrated earlier transition from inflammatory to proliferative healing phase, reflected by improved scores on Days 3 and 7. By Day 14, both groups achieved satisfactory epithelialization.

Patient Comfort

Burning sensation was minimal in the oxygen group and moderate during early days in the alcohol-based group. Dryness was reported more frequently in the essential oil group. Compliance and willingness to continue were higher in the oxygen group.

DISCUSSION

Postoperative wound healing requires microbial regulation without inducing ecological disruption. Oxygen plays a critical role in collagen synthesis, angiogenesis, and oxidative killing mechanisms of neutrophils. Controlled oxygen availability enhances cellular metabolism and fibroblast proliferation.

Oxygen-releasing mouthwash may support early wound stabilization through:

- Modulation of anaerobic biofilm activity
- Improved oxygen bioavailability
- Reduction of virulence expression in key periodontal pathogens
- Preservation of mucosal integrity

Rather than producing antiseptic shock, oxygen-based rinses may promote ecological balance within the healing microenvironment.

Essential oil-based rinses remain effective in plaque suppression; however, alcohol-mediated epithelial dehydration may explain the transient burning sensation reported by patients during early healing.

These findings align with emerging evidence that biofilm regulation and virulence suppression represent more physiologic strategies than indiscriminate microbial eradication.

Limitations

- Small sample size
- Observational design
- No microbiological or molecular evaluation
- Short follow-up period

Future randomized controlled trials incorporating microbiome analysis and inflammatory biomarkers are recommended.

CONCLUSION

Both mouthwashes were effective adjuncts in post-surgical care. However, the oxygen-releasing formulation demonstrated:

- Improved early healing scores
- Reduced patient discomfort
- Higher compliance

Oxygen-mediated ecological modulation appears beneficial during immediate postoperative healing, whereas essential oil-based rinses may be more appropriate for long-term plaque maintenance following tissue stabilization.

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