Review Article

Effectiveness of Sodium hypochlorite Chemotherapeutic Agents for Decontamination of Infected Dental Implant Surface: A Review Article

Surbhi Jain, Ruchi Jain, Rashmita Majhi, Priya Muke
Department of Prosthodontics, Crown and Bridges and Implantology, People's College of Dental Sciences & Research Centre, Bhopal (Madhya Pradesh)

ABSTRACT:

Peri-implantitis poses an imminent challenge to the field of implant dentistry. Peri-implant diseases are caused by bacterial biofilm colonizing implant surfaces. Prevention and management of peri-implant mucositis and peri-implantitis rely on effective biofilm removal. Etiological treatment of peri-implantitis aims to reduce the bacterial load within the peri-implant pocket and decontaminate the implant surface in order to promote osseointegration. Considering the promising findings of sodium hypochlorite and periodontal lesions, the aim of the review article is to evaluate the clinical effects of sodium hypochlorite oral rinse on peri-implantitis lesions.

KEY WORDS: Sodium hypochlorite, per-implantitis, chemotherapeutic agents

Address for correspondence : Dr. Surbhi Jain, Department of Prosthodontics, Crown and Bridges and Implantology, People's College Of Dental Sciences & Research Centre, Bhopal (Madhya Pradesh), India, E-mail: surbhijain1211@gmail.com
Submitted: 0000 **Accepted:** 0000, **Published:**0000

INTRODUCTION:

Recently, oral implantology has become a key component of modern dentistry, significantly enhancing the quality of life for many patients. Dental implants are the optimal solution for replicating the appearance, sensation, and function of natural teeth. Not only do they replace missing teeth, but they also help preserve and strengthen the bone structure.

Peri-implantitis, however, is currently regarded as one of the most challenging biological complications related to implants, and if left untreated, it can ultimately result in implant loss.[1]

Peri-implantitis is described as a pathological condition affecting the tissues surrounding dental implants, marked by inflammation in the peri-implant mucosa and gradual loss of the supporting bone. Common features of peri-implantitis include bleeding upon probing, potential pus discharge, increased probing depths, and/or recession of the mucosal margin. The prevalence of peri-implantitis varies between 11.2% and 22%, with contributing risk factors including a history of periodontitis, smoking, diabetes, inadequate plaque control, and insufficient regular maintenance care.[2]

The management of peri-implantitis has proven to be quite challenging, partly due to the difficulty in adequately decontaminating the implant surface. This step is crucial for effectively resolving the bony defects caused by the disease.[3] In response to the increasing prevalence of peri-implantitis, conventional treatments are classified into two main categories: non-surgical (mechanical and chemical) and surgical methods.

Mechanical decontamination is carried out using various techniques, such as curettes, ultrasonic devices, or air-abrasive powder systems. Chemical decontamination methods typically involve agents that target the microbial biofilm in different ways, either by

Access this article online

Quick Response Code:	Website: www.pjsr.org
	DOI:

How to cite this article: Jain S, Jain R, Majhi R, Muke P. Effectiveness of Sodium hypochlorite Chemotherapeutic Agents for Decontamination of Infected Dental Implant Surface: A Review Article. PJSR. 2025;18(1):000

eliminating the bacterial populations, reducing the replication of existing species, and/or modulating the local environment [4].

However, surgical treatment is frequently recommended for the management of peri-implantitis, as it provides the surgeon with enhanced access to the implant surface, facilitating effective decontamination and allowing for the potential repair or recontouring of osseous defects.[5]

Sodium hypochlorite (NaOCl) (1%) exhibits broad-spectrum antimicrobial activity, rapid bactericidal effects, and relative non-toxicity at commonly used concentrations. It has demonstrated substantial bactericidal and fungicidal activity in experimental biofilms, particularly against various endodontic and periodontal pathogens. Subgingival irrigation with 0.5% NaOClresults in a significantly greater and more durable reduction in plaque and gingivitis compared to irrigation with water. Consequently, it has been utilized as an effective decontaminating agent for infected titanium surfaces of implants. Notably, NaOCl (1%) was found to be effective against all three species of microorganisms tested:

Staphylococcus epidermidis, *Candida albicans*, and *Streptococcus sanguinis*. An in vivo randomized controlled trial to assess the clinical efficacy of sodium hypochlorite rinses in periodontitis patients was performed. In this study, patients were instructed to rinse with 0.25% NaOCl twice weekly for 30 seconds over a three-month period. Using a 0.25% sodium hypochlorite oral rinse twice a week significantly reduced dental plaque levels and bleeding on probing, suggesting it may be a promising approach for managing periodontal disease.[6]

SODIUM HYPOCHLORITE:

Sodium hypochlorite is an alkaline inorganic chemical compound with the formula NaOCl (also written as NaClO). It is commonly known in a dilute aqueous solution as bleach or chlorine bleach. It is the sodium salt of hypochlorous acid, consisting of sodium cations (Na^+) and hypochlorite anions ($^-$OCl, also written as OCl^- and ClO^-).[7]

CONCENTRATION OF SODIUM HYPOCHLORITE FOR PERI-IMPLANTITIS:

NaOCl irrigant is used at concentrations varying between 0.5% and 6% with no consensus for the optimal concentration. NaOCl has shown positive results for oral rinse on peri-implantitis lesions regarding the reduction of periodontal probing depth and gingival bleeding index.

2.5% NaOCl for reduction of contamination on used healing abutments and showed significantly greater effectivity than air polishing. 1% NaOClcan be used to disinfect customized abutments. Similarly, 1% NaOClcan be applied for the cleaning of zirconia copings.[6]

CLINICAL USES:

- The Concentration of 3% NaOClcan be used for ultrasonication of titanium specimens NaOCl
- shows maximum significant effect on all three test microbes (C. albicans, S. sanguinis, and S. epidermidis).[8]
- NaOCl its active agent is undissociated hypochlorous acid (HOCl)– shows broad antimicrobial activity, rapid bactericidal action, and relative non-toxicity at common concentrations.
- NaOCl helps in reduction of periodontal probing depth and gingival bleeding index.
- 2.5% NaOCl for reduction of contamination on used healing abutments and showed significantly greater effectivity than air polishing.
- Also, 0.125%, 0.25%, and 0.5% NaOCl can be used for wound irrigation after surgical debridement for orthopaedic infections.
- Oral rinsing with 0.1%–0.25% NaOCl was used to improve periodontal health.[6]
- It has chemotherapeutic effect on reosseointegration after treatment of peri-implantitis.[9]
- Biofilms grown on sandblasted, large-grit, acid-etched titanium discs can be treated with a titanium brush with 1.0% NaOCl and 0.2% chlorhexidine.[8]

Limitations:

NaOCl may cause chemical burn, tissue necrosis, upper airway obstruction and can corrode titanium surface.[10]

EFFECT ON PERI-IMPLANTITIS:

- 0.95 % NaOCl and 1mg minocycline in conjunction with ultrasonic debridement and soft tissue curettage synergistically reduces probing depth and bleeding on probing.
- NaOCl and hydrogen peroxide represent traditional dental disinfectants that are widely used for reducing biofilm accumulation on removable prostheses.

- For regeneration of peri-implantitis defects, autografts are used.However, use of 1.5% NaOCl leads to most favourable results in terms of changes in defect depth and percentage of reosseointegration.
- 0.1% NaOCl with titanium brush and chlorhexidine is used for decontamination during peri-implantitis treatment.[6]

ZINC OXIDE NANOPARTICLES ENHANCES THE EFFICIENCY OF SODIUM HYPOCHLORITE:

The use of nanoparticles based on metals and their oxides are seen as a potential next-generation agent with antibacterial activity. There is a growing interest towards Zinc oxide nanoparticles (ZnO NPs) because of its unique physical and chemical properties e.g., antimicrobial, high catalytic, large excitation binding energy, UV filtering properties, photochemical activity, low toxicity, biocompatibility, and high photostability.

NaOCl disinfectant and ZnO nanoparticles exhibit significant antibacterial activity against bacteria *Escherichia coli*, *Salmonella* Typhimurium, *Staphylococcus aureus* and *Listeria monocytogenes*, with a synergistic effect achieved in their combination. Outcomes have revealed that the doping of manganese and cobalt in ZnO nanoparticles played a noteworthy part in inhibiting the growth of both gram-positive bacteria.[11]

The increasing number of dental implants used for tooth replacement and the extension of implant indications for high-risk patients, such as smokers and patients after irradiation, have resulted in increased number of patients with peri-implant mucositis and peri-implantitis requiring adequate therapeutic strategies. Unfortunately, treatment recommendations for peri-implant infections remain unclear. The key to success in the treatment of peri-implantitis is the decontamination and disinfection of implant surfaces.

Antimicrobial mouth-rinses and rinsing solutions are a common adjunct to mechanical debridement to facilitate the control of supragingival and subgingival plaque. Several of these traditional antiseptics have been proposed for the non-surgical therapy of mucositis and periodontitis as well as peri-implant mucositis and peri-implantitis. NaOCl with its active agent undissociated hypochlorous acid (HOCl) is a traditional disinfectant in dentistry because of its bactericidal, fungicidal, and tissue dissolving properties' is mainly used in endodontic therapy, and its proposed concentrations range from 0.5% to 5.25%. HOCI is effective against bacteria because of its oxidizing action and has been successfully used as a supportive antimicrobial agent in surgical peri-implantitis therapy.[8]

NaOCl was applied against three peri-implantitis-associated microbiota strains (Staphylococcus aureus, Staphylococcus epidermidis, and Candida albicans). Moreover, NaOCl has been used for recycling of implant healing abutments and this results in no bacterial contamination. Oral rinsing with NaOCl twice weekly is used as an available adjunct to conventional anti-plaque and anti-gingivitis treatments. NaOCl and minocycline in conjunction with ultrasonic debridement and soft tissue curettage leads to synergistic effect on reduction of probing depth and bleeding on probing.

Application time varries among studies. For wound irrigation after surgical debridement for orthopedic infections, NaOCl is applied for different time intervals 1-, 5-, and 10-min. NaOCl is applied for 5 min to disinfect customized abutments. To evaluate the efficacy of antibacterial sealing gel, 2% NaOCl solution is applied for 30 min. NaOCl is applied for 1 min to clean the retentive attachments in dentures. NaOCl is applied for 1 min for antibacterial effects on a titanium surface.[6]

CONCLUSION:

The concentration of 0.25% can be used for treatment of peri-implantitis. Also, Regeneration of peri-implantitis defects using autograft with or without resorbable membrane can achieve some reosseointegration, Additional chemical treatment with 1.5% NaOCl leads to the most favorable results in terms of changes in defect depth and percentage of reosseointegration.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

There are no conflicts of interest.

REFERENCES:

1. Patil C, Agrawal A, Abullais SS, Arora S, Khateeb SU, Fadul A Elagib M. Effectiveness of Different Chemotherapeutic Agents for Decontamination of Infected Dental Implant Surface: A Systematic Review. Antibiotics (Basel). 2022 Apr 28;11(5):593. doi: 10.3390/antibiotics11050593. PMID: 35625237;

PMCID: PMC9137954.

2. Cheng, J, Chen L., Tao X. et al. Efficacy of surgical methods for peri-implantitis: a systematic review and network meta-analysis. BMC Oral Health 23, 227 (2023). https://doi.org/10.1186/s12903-023-02956-6
3. Persson L G , Araújo M G, Berglundh T, Gröndahl K, Lindhe J. Resolution of periimplantitis following treatment. An experimental study in the dog. Clinical Oral Implants Research. 1999; 10(3), 195–203. 10.1034/j.1600-0501.1999.100302.
4. Monje A, Amerio E, Cha JK, Kotsakis G, Pons R, Renvert S, et al. Strategies for implant surface decontamination in periimplantitis therapy. International journal of oral implantology (Berlin, Germany),2022;15(3), 213–248. https://www.ncbi.nlm.nih.gov/pubmed/36082658 [PubMed] [Google
5. Hart I, Wells C, Tsigarida A, Bezerra B. Effectiveness of mechanical and chemical decontamination methods for the treatment of dental implant surfaces affected by peri-implantitis: A systematic review and meta-analysis. Clin Exp Dent Res. 2024 Feb;10(1): e839. doi: 10.1002/cre2.839. PMID: 38345466; PMCID: PMC10847712.
6. Lee W, Park JB. The clinical effect of sodium hypochlorite oral rinse on peri-implantitis lesion: A pilot study. Heliyon. 2023 May 2;9(5): e15859. doi: 10.1016/j.heliyon. 2023.e15859. PMID: 37305462; PMCID: PMC10256906.
7. National Center for Biotechnology Information. PubChem Compound Summary for CID 23665760, SodiumHypochlorite. https://pubchem.ncbi.nlm.nih.gov/compound /Sodium-Hypochlorite. Accessed Mar. 20, 2025
8. Bürgers R, Witecy C, Hahnel S, Gosau M. The effect of various topical peri-implantitis antiseptics on Staphylococcus epidermidis, Candida albicans, and Streptococcus sanguinis. Arch Oral Biol. 2012 Jul;57(7):940-7. doi: 10.1016/j.archoralbio. 2012.01.015. Epub 2012 Feb 22. PMID: 22365324.
9. Qian SJ, Tsai YW, Koutouzis T, Lai HC, Chong SQ, Kotsakis GA. Impact of surface chemical treatment in surgical regenerative treatment of ligature-induced peri-implantitis: A canine study. Journal of periodontology vol. 95,10 (2024): 991-1001. doi:10.1002/JPER.23-0634
10. Cai C, Chen X, Li Y, Jiang Q. Advances in the Role of Sodium Hypochlorite Irrigant in Chemical Preparation of Root Canal Treatment. Biomed Res Int. 2023 Jan 13;2023:8858283. doi: 10.1155/2023/8858283. PMID: 36685672; PMCID: PMC9859704.
11. 11.Tomičić R, Čebela M, Tomičić Z, Čabarkapa I, Kocić-Tanackov S, Raspor P. ZnO nanoparticles enhance the efficiency of sodium hypochlorite disinfectant in reducing the adhesion of pathogenic bacteria to stainless steel surfaces. Food Microbiol. 2025 Aug;129:104760. doi: 10.1016/j.fm.2025.104760. Epub 2025 Feb 20. PMID: 40086982.