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# Low-Cost Antiseptics in Periodontal Therapy- A Review Article

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Review Article

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## ABSTRACT

Periodontitis is a major health problem in low-income populations. Low-income individuals in developing countries tend to demonstrate a high level of risk factors for periodontal disease and are at increased risk of developing severe periodontitis and even potentially fatal oral infections such as noma (cancrum oris). Successful periodontal healthcare of low-income populations must be based upon affordable professional therapy and self-care techniques with proven efficacy and safety. Antiseptics are broad-spectrum microbicidal agents that are applied topically onto living tissue to prevent or treat clinical infections caused by bacteria and viruses.[1] The high degree of safety allows frequent and broad use of antiseptics in periodontal treatment. Antiseptics when used together with subgingival scaling are more effective than scaling alone in reducing periodontal pathogens and in improving clinical attachment and alveolar bone mass.

**Keywords:** Antiseptics, Iodine, Sodium Hypochlorite, Chlorhexidine.

## Introduction

Periodontal diseases are most commonly associated with characteristic pathogenic bacteria located in the oral biofilms. Successful therapy of this is based on effective control of the biofilms. The ultimate goal of any periodontal therapy was to disrupt the biofilm. Scaling and root planning are considered the gold standard therapy for the non-surgical management of periodontal diseases. Recently extensive research has been carried out to evolve cost-effective antiseptics for plaque control. Antiseptics are broad-spectrum microbicidal agents that are applied topically onto living tissue to prevent or treat clinical infections caused by bacteria and viruses.[1]

Periodontitis is a major health problem in low-income populations. Classical risk factors for periodontitis, such as immunocompromising diseases/conditions and tobacco use, are prevalent in developing countries. Other risk factors for periodontitis are obesity and diabetes, which have assumed almost epidemic proportions in many countries of the world, including regions of Asia. Taken together, low-income individuals in developing countries tend to demonstrate a high level of risk factors for periodontal disease and are at

increased risk of developing severe periodontitis and even potentially fatal oral infections such as noma (cancrum oris).[2]

Successful periodontal healthcare of low-income populations must be based upon affordable professional therapy and self-care techniques with proven efficacy and safety. Scalers of even the slim type cannot access the most apical part of periodontal lesions, which harbors high loads of pathogens, and thus may not eliminate periodontopathic bacteria in deep probing sites and in furcation defects. In contrast, microbicidal antimicrobials applied through the orifice of the periodontal pocket, or antibiotics delivered systemically, can penetrate throughout the subgingival area and represent an important adjunct to mechanical periodontal therapy.[3]

Cost concerns and the worldwide increase of antibiotic-resistant bacteria have created interest in using inexpensive, safe, and highly bactericidal/virucidal antiseptics in periodontal therapy. Antiseptics attack multiple components of infectious agents, practically eliminating the risk of resistance development, and do not interact with prescription medications. Antiseptics are especially important in the treatment of biofilm infections, which may be unresponsive to even high concentrations of antibiotics. Also, as relatively small amounts of antimicrobial agents are applied subgingivally, and the content of inflamed periodontal pockets is emptied into the oral cavity every 90 seconds, the risk of antiseptics entering the gingival tissue and causing systemic damage is virtually nonexistent. The high degree of safety allows frequent and broad use of antiseptics in periodontal treatment. Antiseptics when used together with subgingival scaling are more effective than scaling alone in reducing periodontal pathogens and in improving clinical attachment and alveolar bone mass.[4]

**Low cost antiseptics that are used in periodontal therapy are as follows:**

**Iodine**

Iodine is a bactericidal, fungicidal, trichomonacidal and virucidal agent. The antimicrobial activity occurs through the oxidation of amino (NH)), thiol (SH)) and phenolic hydroxyl (OH)) groups in amino acids and nucleotides. The most common commercial form of povidone-iodine is a 10% solution in water yielding 1% (10,000 ppm) available iodine. Povidone-iodine is generally nontoxic and nonirritating to mucous membranes, can easily be washed off with soap and water with no residual staining, and is available globally at low cost, making it an excellent choice for oral antiseptic use. Povidone-iodine is a valuable antiseptic in the treatment of periodontal disease and a variety of other oral infections. Povidone-iodine kills all major periodontopathic bacteria in vitro within 15–30 s, and exhibits a wide virucidal spectrum, covering both non enveloped and enveloped viruses, including the periodontopathic cytomegalovirus.[5]

Studies have shown a measurable improvement in the periodontal status after treatment with povidone-iodine. Huong et al. studied the effect of subgingival irrigation with povidone-iodine in deep periodontal pockets with radiographic evidence of subgingival calculus. At 5 weeks post-treatment, a 95–100% reduction in total subgingival pathogen counts was observed in 44% of pockets after irrigation with povidone-iodine plus scaling and root planing, but in only 6–13% of pockets after povidone-iodine irrigation alone, scaling and root planing alone, or water irrigation alone. The average decrease in pocket depth was 1.8 mm at 5 weeks after povidone-iodine irrigation plus scaling and root planing.[6] Von Ohler et al. found that single subgingival irrigation with povidone-iodine led to a 12–90% decrease in total subgingival microbial counts at 1-month post-treatment. Rosling et al. reported that patients who received a whole-mouth application of povidone-iodine at the time of initial therapy exhibited less periodontitis for up to 13 years post-treatment.[7]

The American Heart Association and the American Dental Association and others have recommended rinsing periodontal sites with povidone-iodine before dental invasive procedures to reduce the risk of bacteremia. Povidone-iodine may be applied subgingivally using a thin syringe capable of reaching close to the base of periodontal pockets.[8] Thus Periodontal therapy can be benifited from the use of iodine as subgingival irrigation and oral rinse.

**Sodium Hypochlorite**

Sodium hypochlorite (NaOCl) is recognized to be one of the most potent antiseptics and disinfectant agents against bacteria, fungi, and viruses. Experimentally, it was found to oxidize polysaccharide matrix in oral biofilms and thus rendering biofilms non-pathogenic. Sodium hypochlorite is highly bactericidal, nontoxic, does not stain, and is low in cost. Professional chemotherapeutic use of sodium hypochlorite will provide treatment needs of low-income individuals with affordable patient self-care. High efficacy and tolerability of sodium hypochlorite can be implemented in virtually all parts of the world using low-cost local resources.[9]

Sodium hypochlorite is hydrolyzed in water to form hypochlorous acid (HOCl) and the less active hypochlorite ion (OCl). The equilibrium between hypochlorous acid and the hypochlorite ion permits the neutral charged and small-sized hypochlorous acid molecule to diffuse through the microbial cell wall and change the oxidation-reduction potential of the cell. Sodium hypochlorite reacts with proteins, nucleic acids, and lipids, and inactivates enzymes essential in the energy-yielding metabolism of microorganisms.[10]

The American Dental Association Council on Dental Therapeutics has designated dilute sodium hypochlorite as a mild antiseptic mouthrinse and suggested its use for direct application to mucous membranes.[11] Dilute sodium hypochlorite (household bleach) has a basic pH and does not pose a risk of tooth erosion and does not corrode titanium implant surfaces. A histological study found that concentrated sodium hypochlorite solution applied subgingivally exhibited no detrimental effect on periodontal healing.[12]

Dilute sodium hypochlorite has no contraindications. The lowest concentration of sodium hypochlorite solution that reliably inactivates bacteria in vitro is 0.01%.[13] A suitable concentration of sodium hypochlorite for periodontal pocket irrigation is less than 0.5%, dependent on the taste tolerance of the patient. This is equivalent to 10 ml (two teaspoonfuls = two-thirds of a tablespoon) of 6.0% household bleach in 125 ml (one half-glass) of water. Special measuring spoons are available that hold exactly 5 ml. Patients are advised to rinse orally for 30 s, two or three times a week, with 8 ml (two reduced teaspoonfuls) of 6% chlorine (household) bleach diluted in 250 ml of water (full glass), to yield a sodium hypochlorite concentration of 0.2%. Thus Periodontal therapy can be profited from the use of sodium hypochlorite as subgingival irrigation and oral rinse.

**Fluorine**

Fluorine compounds exhibit little ability to prevent or reduce dental plaque formation or periodontal disease. However, as periodontal therapy promotes a shift towards gram-positive dental plaque microorganisms, including cariogenic bacteria, patients with newly exposed low-fluoride root surfaces should receive intensive fluoride treatment. Recommended treatments include 0.05% sodium fluoride rinses, 1.1% sodium fluoride gel, or 0.4% stannous fluoride gel applied with a toothbrush or via a delivery tray.[14]

**Chlorhexidine**

Chlorhexidine exerts broad activity against bacteria, yeasts, fungi, and enveloped viruses, although some periodontal bacteria are only moderately susceptible.[15] The positively charged chlorhexidine molecule reacts

with the negatively charged cell surface of microorganisms and damages the microbial cell envelope. Chlorhexidine gluconate is used in dentistry as a 0.12–0.2% mouthwash applied in a volume of 15 ml for 30 seconds twice a day. Rather than purchasing expensive chlorhexidine oral rinse products, patients may acquire low-cost generic chlorhexidine at concentrations of greater than 2% and dilute with water to the concentration desired for oral use.

Chlorhexidine is an efficient antiseptic in combating halitosis. Severe halitosis can be socially unacceptable and numerous remedies for oral malodor have been proposed throughout history. Persistent halitosis is caused by the volatile sulfur compounds produced by anaerobic bacteria that mainly reside on the dorsum of the tongue. Halitosis can be markedly reduced by applying 4% chlorhexidine to the most posterior part of the tongue dorsum using a toothbrush or a cotton swab tip (own unpublished data). The ability of chlorhexidine to bind to and be slowly released from the mucosal surface of the tongue makes it the preferred antiseptic agent against halitosis bacteria.[16]

**Miscellaneous antiseptics**

Hydrogen peroxide in concentrations up to 1.5% induces no adverse effects, even with daily use over an extended period of time,[17] but exhibits only a modest effect on subgingival bacteria and clinical periodontal disease. Prolonged subgingival application of 3% hydrogen peroxide may suppress periodontopathic bacteria. Hexetidine, a methyl Hexahydropyrimidine, is used in mouthwashes and may show antiplaque activity, Phenolic agents, in concentrations of 1–5%, quaternary ammonium compounds, in concentrations of 0.1–2%, and ethyl and isopropyl alcohol in concentrations of 50–70%, exert moderate bactericidal activity in vivo. Botanical extracts and naturally occurring cationic peptides that protect various animals from infection are used in periodontal healthcare but limited scientific data exist on the clinical efficacy and safety of natural products for oral use.[18]

A combination of microbicidal agents with different mechanisms of action may be more effective than single antiseptics. A hydrogen peroxide-sodium hypochlorite combined solution potentiated the killing and removal of Pseudomonas aeruginosa cells and experimental biofilm.[19] A mixture of sodium chloride, sodium bicarbonate (baking soda), and hydrogen peroxide (NaCl-NaHCO3-H2O2) applied subgingivally during scaling followed by subgingival irrigation with povidine-iodine significantly enhanced the microbiological and clinical effects of mechanical debridement[20] but did not result in clinical improvement in unscaled sites.

Chlorhexidine and sodium hypochlorite may not be combined as such a combination can lead to the formation of the carcinogenic products para-chloroaniline and 1-chloro-4-nitrobenzene.[21,22]

**Patient self-care**

Patient self-care constitutes the most cost-effective approach to the management of the periodontal disease. Periodontal self-care aims to preserve a healthy periodontium or at least to minimize disease activity through the chemotherapeutic removal of dental biofilms. Self-administered supragingival and subgingival application of antimicrobial agents offers a valuable supplement to mechanical plaque removal. The periodontal diagnosis, the health-seeking behaviour, and the socioeconomic status of the patient are key factors in therapeutic decision-making. Basic components of periodontal therapy include oral hygiene instruction, mechanical depuration, and topical application of antiseptics. Patients with severe periodontitis may receive additional systemic antibiotic therapy and perhaps surgical intervention.

Periodontal mechanical debridement combined with antiseptics gives rise to greater gains of clinical attachment than mechanical debridement alone. A lack of oral health motivation by patients can complicate periodontal treatment decisions. In individuals who are unwilling or unable to make major changes in their oral hygiene habits, periodic scaling and subgingival irrigation with a potent antiseptic may be able to retard periodontal disease progression.

**Conclusion:** The underlying concept of the low-cost antiseptic therapy proposed here reduces or eradicates specific pathogenic bacteria caused by periodontitis. Several new antimicrobial devices in periodontal healthcare carry considerable acquisition costs and may not be a realistic option in low-income communities. A truly low-cost treatment is a prerequisite for improving the periodontal disease status among poor people of the world. This article presents an efficacious, highly safe, minimally invasive, practical, and inexpensive therapy for the prevention and treatment of periodontitis. Studies are still needed to identify the most cost-effective method of managing periodontitis and the long-term therapeutic outcome. Implementation of efficacious and low-cost periodontal healthcare is urgently needed in many parts of the world.

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