Major antiseptic in dentistry

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Abstract

Over the years chlorhexidine has been used in dental practice as an excellent antiplaque agent. Chlorhexidine (CHX) not only shows the special properties of substantivity but, also has a broad spectrum antimicrobial activity that makes its use in various oral disorders. Almost all disciplines of dentistry make use of this material in different formulations such as mouth wash, gel, varnishes and restorative materials etc.

Keywords: Chlorhexidene, Root canal irrigant, Phenols, Aphthous stomatitis.

Introduction

It is an established fact that dental caries and periodontal disease are the two predominant diseases affecting the oral cavity and dental plaque plays a key role in the progression of these two diseases. Dental plaque forms naturally on the teeth and in the absence of adequate oral hygiene, it can accumulate beyond the levels that are compatible with dental health and at susceptible sites dental caries or periodontal disease or both can occur. Effective removal of dental plaque is one of the main strategies for the prevention of these two diseases. Plaque control by mechanical debridement is highly labour intensive whether professionally administered or practiced personally, satisfactory home care further demands a measure of manual dexterity and a high degree of motivation, which many individual do not possess. Not surprisingly, a large number of chemical agents have been tested for their ability to reduce plaque accumulation. Although many antimicrobial agents would appear to be suitable for plaque control, only few have been found to possess clinical efficacy. This is because many of the antimicrobial agents do lack property of substantivity and lacks efficacy against oral microorganisms. Currently formulated antimicrobial agents include essential oils, metals (zinc, stannous, copper), phenols (triclosan), plant extracts, (Terminalia chebula extract, garlic extract, occimum sanctum, triphala, aloe vera enzymes etc.¹⁻⁴

Chlorhexidine is a bisbiguanide formulations with cationic nature. symmetric molecules with two chlorophenyle and two rings linked by a group bigunide central hexamethylene chain. This is a solid foundation and the most stable in salt form. The most common preparation is digluconate salt because of its water solubility. Chlorhexidine was developed in the 1940s as

a result of search for antiviral agents. Chlorhexidine found that does not have antiviral activity but instead it has antibacterial activity. The use of chlorhexidine started as general disinfectant with a broad antimicrobial spectrum. Antimicrobial spectrum, including most of the microbes such as gram-positive and gram-negative organisms including bacteria spores, lipophilic viruses, yeasts and dermatophytes etc.^{5,6} Chlorhexidine is widely used in various medical fields such as gynecology, urology, ophthalmology and treatment of burns etc. The first use of chlorhexidine in the dental practice is the site washing and disinfecting root canal surgery.⁷⁻⁹

Chlorhexidine on plaque

Several studies have proven efficacy in vivo and in vitro 0.2% chlorhexidine as antiplaque agents.⁹⁻¹⁶ Effect from chlorhexidine on plaque inhibition is dose dependent, the dose typically range in concentration from 0.03 to 0.2% volume, frequency and concentration are important in determining clinical response. The optimum dose of chlorhexidine as gargle generally considered to be 20 mg twice daily, the same level of plaque inhibition could be achieved with greater volume lower concentrations. A lower concentration of chlorhexidine has been tested in several studies and proved effective. A persistent bacteriostatic action lasting for 12 hours was observed. There is no significant difference in plaque when 0.2% chlorhexidine mouthwash used for 15,30,60 seconds. There was no difference in plaque inhibiting action of 0.1%, 0.12% and 0.2% of chlorhexidine rinse.¹⁷⁻²² Bonesvoll in his book studies reported that there is a rapid binding of chlorhexidine onmouth during the first 15 seconds of rinsing and almost 75% after 30 seconds of rinsing.²³ However invitro studies recently have

shown a 0.12% chlorhexidine has The antibacterial activity in both planktonic and biofilm organisms.²⁴ The substantivity of chlorhexidine is associated with controlled release system. The presence of β cyclodextrin regulates and controls the amount of CHX released. Greater the amount of β cyclodextrin, more progressive CHX release. The development of controlled release system of cellulose substrates can also be achieved by using microfibrillated cellulose (MFC). A new trial the approach proposed for the development of bio-based controlled release system. β CD and MFC mixed together to create synergies between their ability to control release the active molecule. MFC Association and β CD gives very promising results. The obtained release pattern has a combination of both actions MFC and β CD. MFC mainly act on the effects of the explosion, while β CD controlled and CHX regulated release from time to time. Therefore, complementary measures can be achieved by connecting the two release system. Depending on the needs of end users, CHX system / MFC / β CD will release a higher number of CHX progressive system / β CD.²⁵

Effect of chlorhexidine on oral tissues

Some studies support the view that the use of prolonged chlorhexidine is not associated with the development of resistant strains of microorganisms. With Long-term use of chlorhexidine, staining of teeth, the emergence of opportunistic pathogens or steady shift in oral flora has been reported.¹ Clinical studies indicate that the use of 0.2% chlorhexidine mouth wash causes a reduction in the number of oral bacteria without overgrowth by candida albicans or E. coli. A number of studies have examined the ability to produce oral bacteria resistant to chlorhexidine in the laboratory.

Chlorhexidine and Its Use in HIV Infection

Common oral disease such as gingivitis and periodontitis are usual in HIV patients. Palliative therapy for these conditions can prevent the more serious complications. Chlorhexidine plays an important adjunctive role in the treatment of HIV associated gingivitis and periodontitis. aphthous stomatitis, candidiasis, herpes virus and HIV associated neoplastic lesions. Chlorhexidine found to be effective in reducing candida species in HIV affected individuals and children.^{26,27}

In Patients with Drug Induced Gingival Enlargement

Chlorhexidine has an adjunctive role in the treatment of drug induced gingival enlargement.²⁸ The overall effect

is not known as the research is inadequate and consist of mixed reports. More research is needed to evaluate the effect of chlorhexidine on the inflammation associated with gingival enlargement.

Use of Chlorhexidine in Recurrent Aphthous Stomatitis

Chlorhexidine can be used in patients suffering from recurrent aphthous ulceration on the basis that natural course of recurrent oral ulcers can be extended due to bacterial contamination. Several studies support the benefits of this therapy but chlorhexidine mouth rinse is of limited or no effect on established major aphthous ulceration.²⁹ Studies have shown that chlorhexidine mouth rinse can reduce the incidence, severity and duration of aphthous ulceration whereas chlorhexidine gel significantly reduced severity and duration but not incidence.³⁰

Chlorhexidine in dry socket

A significant reduction in the incidence of dry socket is observed in studies Larsen et al.³¹ Hedstrom L 2007, found no effects on alveolar osteitis reduction.³² More recently, a 0.2% bioadhesive gel form has become available and is more effective than the mouth wash. Its main advantage is that it extend the bioavailability of chlorhexidine in the application area. The topical application of chlorhexidine gel bioadhesive for surgical wound for a week after surgery possibly decreases the incidence of alveolar osteitis after extraction of mandibular third molar.³³ Babar A reported that one application of chlorhexidine gel effectively reduce the frequency of alveolar osteitis.³⁴ It is seen that increased concentration from 0.2% to 1.2% gel is not possible as it doesn't show much affect.³⁵

As a root canal irrigant

Intracanal tissue treated with chlorhexidine really inhibits the growth of E. feacalis. Martin and Nind investigating the efficacy of chlorhexidine as a disinfectant in presurgical apicectomy site observed the beneficial effects.³⁶ Numerous studies have prove that 2% chlorhexidine as effective as 5.25% sodium hypochlorite in reducing the growth of E.feacalis.³⁷⁻⁴⁵ With a high concentration of substantivity of chlorhexidine was found for 12 weeks. The antimicrobial activity of CHX is reduced when combined with other substances, including CH, CH plus zinc oxide, among others.⁴⁶⁻⁵⁰ However, CHX alone does not act as a physical barrier and does not present radiopacity. The use of CHX gel as intracanal medicament is recommended for a short period of time (3-5 days), particularly in those cases where the canals

were fully instrumented but could not be root-filled due to the lack of time. It is also recommended in cases of exudation, as it retains its antimicrobial activity in the presence of blood and other organic matters.^{51,52} CHX gel is delivered into the canals with a syringe with 24-gauge needle, being easily introduced and removed from the root canals.⁵³⁻⁵⁷ Dornellis-morgental study observed that chlorhexidine irrigation solution can prevent the activity but did not eradicate *E. faecalis* in the root canal system.⁵⁸⁻⁶⁰

Conclusion

Chlorhexidine is not only an excellent antiplaque agent but also has excellent antimicrobial properties. Its extensive antimicrobial spectrum can be regarded as a benefit for maintaining overall oral health. A wealth of research supports its use in a variety of forms and in a variety of oral disorders. Although its use is limited because of side effect, new formulations with anti discoloration system has shown promising results. More importantly chlorhexidine has shown promising results in controlling dental caries.

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None.

Conflict of Interest

None.

References

- Walker CB. Microbiological effects of mouth-rinses containing antimicrobials. *J Clin Periodontol* 1988;15:449-505.
- Mandel ID. Antimicrobial mouthrinses: Overview and update. *J Am Dent Assoc* 1994;125(2):2S-10S.
- Pitten FA, Splieth C, Kramer A. Prophylactic and therapeutic application of antimicrobial agents in the oral cavity. *Pharmazie* 2000;55:635-9.
- Gupta D, Guptab RK, Dara John Bhaskar. Vipul Guptad:Comparative Evaluation of Terminalia chebula Extract Mouthwash and Chlorhexidine Mouthwash on Plaque and Gingival Inflammation – 4-week Randomised Control Trial. *Oral Health Prev Dent* 2015;13:5-12.
- Jone C G. Chlorhexidine is it still a gold standard. *Periodontol* 2000;15:55-62.
- Denton G W. Disinfection, sterilization and preservation. 1991, 4th edn. 274-289.
- Lim KS. Chlorhexidine pharmacology and clinical applications anaesthetic intensive care. 2008;36:50-12.
- Fardal O, Turnbull RS: A review of the literature on use of chlorhexidine in dentistry. *J Am Dent Assoc* 1986;18:863-9.
- Johnson BT. Uses of chlorhexidine in dentistry. *General Dent* 1995;43:126-32.
- Hull P S. Chemical inhibition of plaque. *J Clin Periodontol* 1980;7:431-42.
- Davies RM. The effect of topical application of chlorhexidine on the bacterial colonization of the teeth and gingiva. *Period Res* 1970;5:96-101.
- Flotra, L, Gjenno P, Rolla G. A 4-month study on the effect of chlorhexidine mouth washes on 50 soldiers. *Scand J Dent Res* 1972;80:10-7.
- Gjerme P, Rolla G. Plaque inhibition by antibacterial dentifrices. *Scand J Dent Res* 1970;78:464-70.
- Bonesvoll P, Lokken P, Rolla, G. Influence of concentration, time, temperature and pH on the retention of chlorhexidine in the human oral cavity after mouth rinses. *Arch Oral Biol* 1974;19:1025-9.
- Flotra L, Gjenno P, Rolla G. & Waerhaug J. A 4-month study on the effect of chlorhexidine mouth washes on 50 soldiers. *Scand J Dent Res* 1972;80:10-7.
- Loe H, Schiott CR. The effect of mouth rinses and topical application of chlorhexidine on the development of dental plaque and gingivitis in man. *J Period Res* 1970;5:79-83.
- Segreto VA, Collins E. IVI, Beiswanger BB. A comparison of mouthrinses containing two concentrations of chlorhexidine. *J Period Res* 1986;21:23-32.
- J Ernst C. P, Prockl K, Wil Jershausen B. The effectiveness and side effects of 0.1% and 0.2% chlorhexidine mouthrinses: a clinical study. *Quintessence Int* 1998;29:443-8.
- Berchier CE, Slot DE, Van der Weijden GA. The efficacy of 0.12% chlorhexidine mouthrinse compared with 0.2% on plaque accumulation and periodontal parameters: a systematic review. *J Clin Period* 2006;33: 561-7.
- Keijser JA, verkede H, Timmerman MF. Comparison of two commercially available chlorhexidine mouth rinses. *J Clin Period* 2003;74:214-8.
- Van Strydonck DA, Timmerman MF, van der Velden U, van der Weijden GA. Plaque inhibition of two commercially available chlorhexidine mouthrinses. *J Clin Period* 2005;32:305-9.
- Rath SK, Singh M. Comparative clinical and microbiological efficacy of mouthwashes containing 0.2% and 0.12% chlorhexidine. *Dent Res J* 2013;10:364-9.
- Sbordone L, Bortotalia C. Oral microbial biofilms and plaque related disease, microbial Communities and their role in the shift from oral to disease. *Clin Oral Investig* 2003;7:181-8.
- Babu JP, Garcia-Godoy F. In vitro comparison of commercial oral rinses on bacterial adhesion and their detachment from biofilm formed on hydroxyapatite disks. *Oral Health Prev Dent* 2014;12:365-71.
- Lavoine N, Tabary N, Desloges I, Martel B, Bras J. Controlled release of chlorhexidine digluconate using β -cyclodextrin and microfibrillated cellulose. *Colloids Surfaces B: Biointerfaces* 2014;121:196-205.
- Barasch A, Safford MM, Dapkute-Marcus I. Efficacy of chlorhexidine gluconate rinse for treatment and prevention of oral candidiasis in HIV-infected children: a pilot study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2004;97:204-7.
- Ellepola AN, Samaranyake LP. Adjunctive use of chlorhexidine in oral candidoses: a review. *Oral Dis* 2001;7:11-7.
- Pilatti GL, Sampaio JE. The influence of chlorhexidine on the severity of cyclosporin A-induced gingival overgrowth. *J Periodontol* 1997;68:900-4.
- Addy M, Hunter L. The effects of a 0.2% chlorhexidine gluconate mouthrinse on plaque, toothstaining and candida in aphthous ulcer patients. A double-blind placebo-controlled crossover study. *J Clin Period* 1987;14:267-73.

30. dy. Journal of Clinical Periodontology. 1987; 14: 267-73.
31. Addy M. Hibitane in the treatment of aphthous ulceration. *J Clin Period* 1977;4:108-16.
32. Larsen PE. The effect of a chlorhexidine rinse on the incidence of alveolar osteitis following the surgical removal of impacted mandibular third molar. *J Oral Maxillofac Surg* 1991;49:932-7.
33. Hedstrom L, Sjogren P. Effect estimates and methodological quality of randomized controlled trials about prevention of alveolar osteitis following tooth extraction. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007;103:8-15.
34. Hita-Iglesias P, Torres-Lagares D, Flores-Ruiz R. Effectiveness of chlorhexidine gel versus chlorhexidine rinse in reducing alveolar osteitis in mandibular third molar surgery. *J Am Dent Assoc* 1994;125(2):2S-10S.
35. Babar A, Ibrahim MW, Baig NJ. Efficacy of intraalveolar chlorhexidine gel in reducing frequency of alveolar osteitis in mandibular third molar surgery. *J Coll Physicians Sur Pak* 2012;22:91.
36. Rodriguez – Perez M. Effectiveness of 1% versus 0.2% gels in reducing alveolar osteitis from mandibular third molar surgery. *Med Oral Patologia Oral y Cirugia Bucal* 2013;18:693-700.
37. Martin MV, Nind D. Use of chlorhexidine gluconate for preoperative disinfection of apicectomy sites. *Braz Dent J* 1987;162:459-61.
38. Dornelles-Morgental R, Guerreiro-Tanomaru JM. Antibacterial efficacy of endodontic irrigating solutions and their combinations in root canals contaminated with *Enterococcus faecalis*. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2011;112:396-400.
39. Kuruvilla JR, Kamath MP. Antimicrobial activity of 2.5% sodium hypochlorite and 0.2% chlorhexidine gluconate separately and combined, as endodontic irrigants. *J Endod* 1998;24:472-6.
40. Mohammadi Z, Abbott PV. Antimicrobial substantivity of root canal irrigants and medicaments: a review. *Aus Endod J* 2009;35:131-9.
41. White RR, Hays GL, Janer LR. Residual antimicrobial activity after canal irrigation with chlorhexidine. *J Endod* 1997;23:229-31.
42. White RR, Janer LR, Hays GL. Residual antimicrobial activity associated with a chlorhexidine endodontic irrigant used with sodium hypochlorite. *Am J Dent* 1999;12:148-50.
43. Zehnder M. Review Root canal irrigants. *J Endod* 2006;32:389-98.
44. El Karim I, Kennedy J, Hussey D. The antimicrobial effects of root canal irrigation and medication. *J Oral Maxillofac Surg* 2008;66:441-5.
45. Silva AR, Pinto SC, Santos EB, Santos FA, Farago PV, Gomes JC et al, Pina-Vaz I, Carvalho MF. New intracanal formulations containing doxycycline or chlorhexidine against *Enterococcus faecalis*. *J Contemp Dent Prac* 2014;15:61-5.
46. Van der Vyver PJ, Botha FS, de Wet FA. Antimicrobial efficacy of nine different root canal irrigation solutions. *J South Afr Dent Assoc* 2014;69:158-60, 162-5.
47. Emilson CG. Potential efficacy of chlorhexidine against mutans streptococci and human dental caries. *J Dent Res* 1994;73:682-9.
48. K raal, J.H., and W ong, P.H. C hlorhexidine feeding and its effect on grow th a n d intestinal microflora in rats. *Pharm Scol Ther Dent* 1978;3(2-4):111-5.
49. Luostarinen V, Effect of chlo rhexidine on the hamster cheek pouch. *J Periodontol* 1977;48(4):212-5.
50. Harvey BV, Squier CA, Hall BK. Effects of chlorhexidine on the structure and perm eability of hamster cheek pouch mucosa. *J P Eriodontol* 1984;55(10):608-14.
51. Osmundsen PE. Contact dermatitis to chlorhexidine. *Contact Dermatitis* 1982;8(2):81-3.
52. Case DE. Safety of Hibitane. Laboratory experiments. *J Clin Period* 1977;4(5):66-72.
53. G oldschmidt P, Cogen R, Taubman S. Cytopathologic effects of chlorhexidine on hum an cells. *J Periodontol* 1977;48(4):212-5.
54. K nuuttila, M., and S oderling, E. E ffect o f chlorhexidine on the release o f lysosom al enzym es from c u ltu re d m acrophages. *Acta Odontol Scand* 1981;39(5):285-9.
55. Oydna J, Gjermo P. Effect of chlorhexidine mouthrinses on concentration of IgA in expectorates. *Scand J Dent Res* 1982;90(3):189-92.
56. Prasad, I. M utagenic effects of the herbicide 3', 4' dichloro propionanilide and its degradation products. *Canad J Microbiol* 1970;16:369-72.
57. National Cancer Institute, Carcinogenesis. T echnical Support Series no 189, 1979.
58. Kakehashi S, and Parakkal P.I, eds. P roceedings from state of the art workshop of surgical therapy for periodontitis. *J Periodontol* 1982;53(8):482.
59. Cabral CT, Fernandes MH. In vitro comparison of chlorhexidine and povidone-iodine on the long-term proliferation and functional activity of human alveolar bone cells. *Clin Oral Investig* 2007;11:155-64.
60. Lee TH, Hu CC, Lee SS, Chou MY, Chang YC. Cytotoxicity of chlorhexidine on human osteoblastic cells is related to intracellular glutathione levels. *Int Endod J* 2010;43:430-5.
61. Ribeiro DA, Scolastici C, de Almeida PLA, Marques PLA, Marques MEA, Salvadori MF et al. Genotoxicity of antimicrobial endodontic compounds by single cell gel (comet) assay in Chinese hamster ovary (CHO) cells. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2005;99:637-40.

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