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Chlorhexidine - An Antiplaque Agent

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ABSTRACT

Chlorhexidine is one of the most commonly used antiplaque agent. Chlorhexidine has a property of substantivity and it can be bacteriostatic or bactericidal depending on the concentration. Its antibacterial action is due to the disruption of the bacterial cell membrane resulting in cell lysis. It is available in various different formulations..

Keywords: Chlorhexidine, Plaque control agent.

INTODUCTION

Dental plaque

Dental plaque is defined clinically as a structured resilient, grayish yellow substances that adheres tenaciously to the intraoral hard surfaces including removable and fixed restorations.[1]

Dental plaque has major etiological role in the initiation of gingivitis.[2] If left untreated it can progress to periodontis.[3] Dental plaque is associated with different proportions of bacteria such as Porphyromonas gingivalis, Treponema denticola, Prevotella intermedia, and Aggregatibacter actinomycetemcomitans. These bacterias are responsible for periodontal destruction.

Plaque control can be done by mechanical and chemical methods. Mechanical plaque control can be done by various methods such as toothbrushes, Interdental cleaning aids and Dentifrices. Disadvantage of mechanical plaque control is that it is done only on the non shielding surface of teeth[4], Whereas periodontal pathogens accumulate in the tissue surfaces. Therefore, The antimicrobial formulations is needed for daily self care oral hygiene[5].

Principles of Chemical Plaque Control

- Inhibition of plaque development
- Elimination & dissolution of already existing plaque
- Inhibition of calcification of plaque
- Inhibition of microbial colonization of tooth surface
- Alteration of pathogenic plaque into a lesser or non pathogenic one

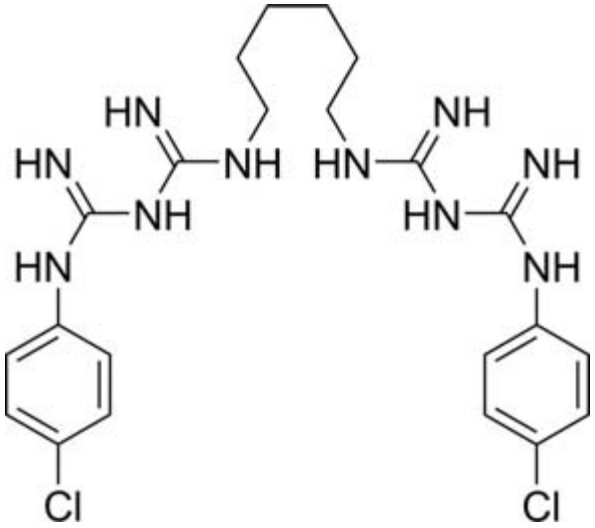
Various different chemical plaque control agents are available but Chlorhexidine is found to very effective among the available agents. Chlorhexidine has substantivity for a period of 10-12 hours and is considered as a gold standard.[6]

HISTORY OF CHLORHEXIDINE

Chlorhexidine was developed in 1940s by Imperial chemical industries, England and marketed in 1954 as an antiseptic for skin wounds. Later widely used in medicine & surgery. In dentistry it was used presurgical disinfection of the mouth and in endodontics. Plaque inhibition activity was shown by Schroeder in1969.[7] Till date ADA recognizes that only mouthrinses containing Chlorhexidine & Listerine formula are effective in controlling plaque & gingivitis.

STRUCTURE

Chlorhexidine is a molecule consisting of two biguanide groups and four chlorophenyl rings and are connected by a central hexamethylene bridge.[8]



PROPERTIES

It is a strong base and dicationic at pH >3.5. It is extremely interactive with anions which is relevant to its efficacy, safety, local side effects & different with formulation in products. It has broad antibacterial activity against gram+ve, gram-ve bacteria, yeast, dermatophytes & lipophilic viruses. It is having low toxicity and strong affinity for binding to skin & mucous membrane. It is an antiplaque and antigingivitis agent as it prevents accumulation of plaque.[9]
It can be bacteriostatic or bactericidal depending on the concentration.

MECHANISM OF ACTION OF CHLORHEXIDINE

Antimicrobial activity:

Chlorhexidine shows different effects at different concentrations.
Chlorhexidine is bacteriostatic at low and bactericidal at higher concentration.

⬇

Cationic Chlorhexidine molecule+ negatively charged bacterial cell wall

⬇

Adsorption of Chlorhexidine to Phosphate containing compounds

⬇

Chlorhexidine binds to inner cell membrane phospholipids

⬇

Causing Leakage of cell wall integrity of the lesser molecular weight components viz. potassium ions
[This is the sub lethal stage of CHX. The action can be reversed. This marks the bacteriostatic property of Chlorhexidine, If the concentration is increased and the action continues, the Chlorhexidine becomes bactericidal in nature]

⬇

Intracellular coagulation

⬇

Slows down leakage of intracellular components

⬇

Cytoplasmic coagulation

⬇

Irreversible cell damage [bactericidal][10]

Antiplaque action

For antiplaque activity following various mechanisms may be suggested.[11,12]

1. Protein adsorption to tooth surfaces reduces by blocking of acidic groups on the salivary glycoproteins.
2. Significantly reduced in the number of bacteria available in saliva for adsorption to the teeth.
3. Chlorhexidine bind to the surface of the salivary bacteria including the polysaccharides coats.
4. By displacement of calcium, which involved in the gluing the plaque together and by precipitation of the acidic agglutination factors in saliva.

SIDE EFFECTS

Staining is the most common side effect. Yellow-brown stain that develops in the gingival third and interproximal of affected teeth. Staining of the tongue has also been reported. The mechanisms for staining can be the degradation of chlorhexidine molecule to parachloraanaline, protein denaturation with chromogens, catalysis of mailard rections, metal sulphide formation[13].

Other side effects - Enhanced supragingival calculus formation, Precipitation of salivary proteins onto the tooth surface increases pellicle thickness, occasionally dulling of taste sensation and rarely unilateral or bilateral parotid swellings occur.

FORMULATIONS OF CHLORHEXIDINE

Chlorhexidine is available in various forms such as Mouthrinses, Sprays, Gel, Tooth paste, Varnishes, Chewing gum.

USES OF CHLORHEXIDINE

Mouthwash Chlorhexidine mouthwash is available in the form of 0.2% and 0.12%. There is equal efficacy for 0.2% and 0.12% rinses when used at appropriate doses.[14] Löe and Schiott demonstrated that twice daily rinsing with 10 ml of 0.2% chlorhexidine solution for 1 minute resulted in almost complete plaque elimination.[15,16] It has substantivity of 12 hours so advice to use twice a day(morning and night). The anti plaque effect of a 0.2% chlorhexidine with rinsing time of 15,30,60 seconds showed great difference.[17]

Oral Irrigators Lang and Räber showed antimicrobial agents would be more effectively distributed with irrigating devices resulting in a reduced plaque index.[18] The difference was most pronounced interproximally, an area often missed during toothbrushing. However, their oral rinse consisted of 30 ml of 0.1% solution (30 mg of CH) whereas 600 ml of 0.05% solution was used for irrigation (300 mg CH). Thus, while the concentration during irrigation was decreased, the dosage of CH was increased tenfold.

Gels Available as 1% , 0.2% and 0.12% gels. Delivered in tooth brushes and trays.

Sprays 0.1% and0.2% sprays have similar plaque inhibition properties of 0.2% mouthwash. It is well received by physically and mentally handicapped patients.[19]

Toothpastes

0.12% of chlorhexidine with 1 parts per million of fluoride has antiplaque effects. Jenkins S proved the antiplaque actions of chlorhexidine containing toothpaste and determined by a micro- bioiogicai assay that chorhexidine in paste was lower than that from the 0.2% rinse.[20] In dentifrices Chlorhexidine has gained little attention due to its interaction with anionic ingredients contained in toothpaste and competition for oral retention sites.

PRECAUTIONS

Chlorhexidine molecule being dicationic tends to bind with the anionic agents which are present in toothpaste detergents leading to a reduction in the substantivity of chlorhexidine mouthrinse. So,Time lapse of 30 minute should be there between the usage of chlorhexidine mouth wash.[19]

CONCLUSION

Dental plaque leads to gingivitis and chronic periodontitis, therefore plaque removal is very necessary for oral health, more so in orthodontic treatment regimen. Plaque removal is one mechanical and chemical method. Chemical plaque inhibitors help in prevention and management of periodontal disease in some individuals. Therefore, chemical plaque-inhibitory agents use as an adjunct to tooth brushing to improving the oral health of the individual. Chlorhexidine is bacteristatic as well as bactericidal depending on the concentration. Chlorhexidine having various formulations with substantivity so it is called as gold standard chemical plaque control agent.

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