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Review Article

Various applications of chlorhexidine as an antimicrobial agent in dentistry: A review

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ABSTRACT

Chlorhexidine is a broad spectrum antimicrobial agent, which has been into used in the dental practice as a major anti plaque agent. Chlorhexidine not only shows the property of substantivity, but due to its broad spectrum of antimicrobial property, it is used in various oral diseases. Different uses of chlorhexidine are, prime most is as a major antiplaque agent, it can be used as a root canal irrigant during the process of root canal treatment, it can be used in the prevention of the dental caries as it results in the suppression of the streptococcus mutans in the oral cavity. It helps in the prevention of the secondary infection from the apthous ulcers as well as from the alveolar osteitis, it can also be prescribed to the patient suffering from denture stomatitis, show promising results also as an anti fungal agent. The use of chlorhexidine mouth wash is not recommended for long term use, as it results in discoloration, so to over come this disadvantage of the chlorhexidine a new formulation with properties of anti discoloration is preferred in case for long term use of the chlorhexidine, and this new system with property of anti discoloration shows promising results in every manner.

1. Introduction

The most common oral diseases affecting the oral cavity are the dental caries and the periodontal disease, dental plaque plays a major role in the progression of these two most common diseases of the oral cavity. Dental plaque started adhering to the tooth surface, when the individual is not maintaining good oral hygiene, in the absence of good oral hygiene, dental plaque started adhering beyond the level that are not compatible with the dental health. The prime step in the prevention of the dental caries as the periodontal diseases is the removal of the dental plaque. Removal of the plaque can be done with the help of the mechanical aids as well as with the help of the chemical aids. There are various antimicrobial agent which are suitable for plaque control, but only few antimicrobial agents found to be clinically affective, because only few antimicrobial agents posses the property of the substantivity. There are various antimicrobial agents like, essential oils, metals which includes zinc, copper and stannous, phenols which includes triclosan, different plants extracts, garlic extract, occimum sanctum, enzymes of aloe vera, triphala. And none of the above antimicrobial agent posses the property of substantivity as good as chlorhexidine. Chlorhexidine can be considered as the gold standard antimicrobial agent against which the efficacy of other antimicrobial agents can be compared.[1,2] The formulation of the chlorhexidine is a bisbiguanide along with the cationic properties. The molecule of the chlorhexidine is symmetric with two chlorophenyle rings and two bigunide groups which are connected with the help of a central hexamethylene chain. Chlorhexidine is a strong base and is most stable in the

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form of the salts. Digluconate salt is the most common preparation because of its water solubility.

As a result for the search of antiviral agents, chlorhexidine was developed in the 1940. At that time it was found that, chlorhexidine does not posses any antiviral property, but instead it posseses strong anti microbial properties. Initially chlorhexidine has been used as a general disinfectant with broad antimicrobial spectrum. The effect on antimicrobial action of chlorhexidine covers most of the gram positive as well as gram negative bacteria's, also including bacterial spores, yeasts and dermatophytes. The use of chlorhexidine is not restricted to dental practice only, but it is also used in the medical practice in various departments like gynecology, ophthalmology, urology in case of burns. The first time use of chlorhexidine in the dental practice was as washing the operation site and as root canal disinfectant material, and ultimately the use or effectiveness of chlorhexidine started appearing on suppression of the dental caries, as an antiplaque agent, helps in restricting the growth of the plaque on the surface of the tooth or the teeth, as a denture disinfectant material, as a choice of treatment modality in the treatment of dry socket and apthous ulcers.

2. Various Applications of Chlorhexidine in Dentistry

2.1. As an antiplaque agent

Chlorhexidine in the concentration of 0.2% works so efficiently as an antiplaque agent. The dose of the chlorhexidine as an antiplaque agent ranges in the concentration of 0.03% to 0.2%. The effect of chlorhexidine as an antiplaque agent is totally dose dependent. The frequency of use of chlorhexidine and the concentration is important in determining the clinical response. The dose of chlorhexidine as a mouth rinse is considered to be 20 mg twice in a day. On mature plaque, the role of chlorhexidine is very much less, because of the matrix of the copolymer, and various enzymes from the bacteria, affects the action of chlorhexidine. According to a recent study, it has been stated that, chlorhexidine in the concentration of the 0.12 % presents the greatest antibacterial activity on organisms which has the tendency to grow over the bio film. On the other hand alcohol is generally added in the formulation of the mouth washes for the reason of stability and to prevent cross contamination. 11.6% is the accepted percentage of the alcohol. According to some studies, chlorhexidine mouth washes that are alcohol free, show less side effects significantly. For the replacement of alcohol in the mouth wash, new formulations have been developed. Cetyl pyridium chloride has been used, investigated and proved that it is as efficient as chlorhexidine is in combination with the alcohol along with, this new formulation reduces the unpleasant side effects of mucosal irritation.[3–9]

The most common side effect by the use of the chlorhexidine mouthwash is brownish discoloration of the teeth, brownish discoloration of restoration if present in the oral cavity, and discoloration of the tongue. Staining which has been done by the use of chlorhexidine mouth wash, can not be easily removed with the help of tooth brushing. The mechanism behind this could be the breakdown of the molecule of chlorhexidine in to parachloraanaline, denaturation of proteins with chromogens, formation of metal sulphide ions, precipitation of anionic compounds from the diet. The more conclusive evidence to date is in favor of precipitation of dietary compounds onto adsorbed chlorhexidine molecule. Studies stated that, if the large amount of chlorhexidine is used, than the concentration of the chlorhexidine should be less. It has been stated that staining of the teeth are less with larger amount of the mouth rinse with lesser concentration. It has also been stated that frequent use of chlorhexidine mouth was results in the alteration of the taste sensation temporarily.[2–5,10,11]

2.2. Use in Periodontal Therapy

Chlorhexidine can be used as a treatment modality in periodontal conditions. Chlorhexidine mouth rinse is ineffective in the eliminating the microorganisms which are present beneath the gingival margin. For the sub gingival procedure, irrigation sub gingivally with chlorhexidine in the form of solution or in the form of the gel, provides promising results in the treatment of periodontitis, due to the ability of chlorhexidine to retain the concentration in to the periodontal pocket for some time. Some studies also shows reduction in the periodontal pocket, when irrigation of the periodontal pocket is done with chlorhexidine after the procedure of scaling and root planning, it also shows reduction in the microbial load in the periodontal pocket. No clinical difference is found between two different concentration i.e. between 0.1 % and 0.2 % when used sub gingivally. Alternative to this, use of chlorhexidine chip, containing 2.5 mg of chlorhexidine which is present in cross linked matrix of gelatin is placed in to the periodontal pocket, results in inhibition of the bacteria up to 99 %.[1–18]

Chlorhexidine also helps in the treatment of oral malodor. The use of chlorhexidine after any periodontal surgery, results in enhancing the wound healing. Some of the studies stated that, excessive rinsing with chlorhexidine in high concentration after periodontal surgery in which the bone has been exposed, results in delayed and disturbed healing of the wound.

Any patient who is suffering from HIV usually develop gingivitis and periodontitis. Chlorhexidine plays an adjunctive role in the treatment of the gingivitis, periodontitis, apthous stomatitis, candidiasis associated with HIV. Chlorhexidine was found really effective in reducing candidia species in HIV patient and also inhibit the cross contamination. Chlorhexidine also plays an

adjunctive role in reducing the inflammation of the gingiva. Chlorhexidine can be used in the treatment of recurrent apthous ulcers, to inhibit or restrict the growth of the bacteria, studies have revealed that with the use of chlorhexidine mouth rinse the duration, incidence and severity of the apthous ulceration can be reduced. On the other hand chlorhexidine in the form of gel can also reduce the severity and duration of the apthous ulcers, but not able to reduce the incidence of the apthous ulcers. A study revealed that, there is decreased in the incidence of dry socket when chlorhexidine is used. A recent modification in terms of bioadhesive gel is formed which is much effective than 0.2% of mouth wash. It has also been stated that the application of bio adhesive chlorhexidine gel over the surgical wound in the post operative week results in less incidence of alveolar osteitis. [12–16]

The gingival health was found to be improved in patients who are using fixed prosthesis, when they use chlorhexidine as mouth wash. Reduction in the periodontal pathogens are seen with the usage of chlorhexidine. Chlorhexidine results in reduction in the fungal activity as well as reduction in the inflammation, when applied on the surface which is covered by the denture. It is also stated that complete denture can be soaked in chlorhexidine solution for short term, longer duration will result in the staining of the denture. Rinsing the mouth with 0.12% concentration of chlorehexidine solution along with soaking the denture in chlorhexidine solution results in elimination of candida albicans from the denture surface.

It has been stated that, when intra canal tissues are irrigated with chlorhexidine solution it results in inhibition of the growth of E. feacalis. Different studies stated that, concentration of 2 % chlorhexidine solution is equally effective to the concentration of 5.25% sodium hypochlorite in inhibiting the growth of E. feacalis. It also shows promising effects as pre surgical disinfectant, when used in case of apicectomy.

3. Conclusion

Chlorhexidine is not only an excellent antiplaque agent, but along with this, it is excellent antimicrobial agent and has a wide variety of application in dentistry and shows promising excellent results. one should know the thorough knowledge of the application of chlorhexidine solution,i.e. where it can be used and in how much concentration is required and necessary as it is having concentration related as well as time related some of the adverse effects.

4. Conflict of Interest

None.

5. Source of Funding

None.

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