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Chlorhexidine as an Irrigant in Endodontics -A Review

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Abstract:

Micro-organisms and their by-products are considered to be the major cause of pulp and periradicular pathosis. So, the major objective in the root canal treatment is to disinfect the entire root canal system, which requires the elimination of all possible sources of infection. This goal can be accomplished by the use of a gold standard antiplaque agent called Chlorhexidine which possess antimicrobial property. It can be applied clinically as a root canal irrigant in all phases of root canal preparation including the disinfection of operating field, during the enlargement of canal orifices, removal of necrotic tissues, as an intracanal medicament for the modeling of gutta percha cone and in the disinfection of prosthetic space. Therefore, chlorhexidine application as a irrigant in endodontic treatment not only eliminates the infection, but also results in increased resistance to microbial colonization preventing reinfection of the cleansed space.

Key words:
Chlorhexide, irrigant, intracanal medicament, endotoxin, coronal microleakage, obturation, antimicrobial agent.

INTRODUCTION:

One of the most commonly preferred antiseptic in recent days in dental field is chlorhexidine. It possess antimicrobial action which reduces plaque, gingival inflammation and bleeding[1]. It is generally known for its bio-compatibility and substantivity , which is available as mouthwash, gel, aerosol,sprays and disks [2,3]. Chlorhexidine is considered to be safe compound with minimal and transitory local and systemic effects. Chlorhexidine is a chemical auxillary substance which is used for successful disinfection and to clean the root canal during endodontic treatment procedure[4]. Chlorhexidine has been used in endodontics as an irrigating substance or an intracanal medicament due to its bio-compatiblity, substantivity, lubricating property and rheological actions. The aim of this paper is to review the general use of chlorhexidine as an irrigant in the field of endodontics in times of root canal procedures such as access opening , root resorption , foramen enlargement and root perforation[5].In addition, studies suggest that 0.12% chlorhexidine used in mouthwash are able to reduce the signs of gingival inflammation, and that's why it is still considered to be the gold standard antiplaque and antigingivitis agent[6,7] and also a bisbiguanide antiseptic which controls chemical plaque[8].

HISTORY:

Chlorhexidine was developed by imperial chemical industries in England during 1940's .It was marketed as a general antiseptic in 1950. In 1957, Chlorhexidine was introduced for human use in Britain as a skin antiseptic. The property of plaque inhibition of chlorhexidine was first investigated by Schroeder in 1969[9]. A definitive study for caries inhibition of dental plaque was done by Loe and Schiott in 1972 [10].

CHARACTERISTICS:

Chlorhexidine is a symmetrical molecule which has 4 chlorophenyl rings and two biguanide groups connected by a central hexamethylene bridge [11]. The International Union of Pure and Applied Chemistry (IUPAC) defines chlorhexidine as 1,1 hexamethylene bis (5-(4-chlorophenyl)bisbiguanide[12].It is dicationic at pH levels above 3.5. In general , chlorhexidine is a antiplaque and antigingivitis agent. It acts against virus, fungi and other pathogens . The most unique character of Chlorhexidine is its substantivity which refers to oral retentiveness. It depends on various factors such as concentration, pH , temperature and time of contact of solutions with oral structures[13]. Thus, it is safe to be used as an irrigant as the canals medicated with chlorhexidine do not affect negatively the ability of root fillings to prevent the fluid penetration into the root canal system through the apical foramen[14,15].

MECHANISM OF ACTION :

i. As an antimicrobial agent:

The mechanism of action is found to take place through the cationic ions that are negatively charged. They rapidly gets attracted to the inner cell membrane of the bacteria and other microbes and exerts bactericidal effect to eliminate them thus serving as an antiplaque and antimicrobial agent[16].

ii. Substantivity of chlorhexidine :

Chlorhexidine offers oral retentivity as its capable to absorb the negativity charged surfaces in tooth , mucosa, pellicle, restorative materials and other oral structures [17].Recent studies on the substantive nature of chlorhexidine has reported on the inhibition of dentinal proteases thereby prolonging the durability of resin dentin bonds, especially in the absence of collagen[18,19,20].

Due to all above mentioned actions and properties , chlorhexidine can widely be accepted for the purpose of irrigation during root canal treatment. It ensures a microbe and infection free canal on proper application.

CHLORHEXIDINE- AN AGENT OF IRRIGATION IN ENDODONTICS:

i. Role in endodoxin reduction:

Lipopolysaccharide an outer membrane component of gram negative bacteria which is predominantly involved in root canal infection is an important mediator in the pathogenesis of apical periodontitis and enhancing the sensation of pain in endodontic infections[21]. Concerning the detoxifying activity of Chlorhexidine, Buck et al.[22] reported little or no efficacy on inactivating the biologically active portion of the endotoxin lipid A. Signoretti et al.[23] showed that Chlorhexidine improved the properties of reducing the endotoxin content in root canals in vitro. Vianna et al. [24] evaluated clinically the effect of root canal procedures on endotoxins and endodontic pathogens.

ii. Resistance to microleakage:

Many studies on role of irrigants in microleakage have concluded that, characteristics of chlorhexidine treated dentin might also explain the greater resistance to microbial leakage[25]. Different irrigation regimens may alter the chemical and structural composition of dentin, thereby affecting the adhesion of bonded materials to the dentin surface. The presence of surface surfactant in Chlorhexidine increases the surface energy and wetting ability of dentin. This may positively

affect the adhesion of hydrophilic bonded materials lik e Active GP and thereby prevents microleakage[26].

iii. Apical fluid penetration:

Canals irrigated or medicated with Chlorhexidine do not affect negatively the ability of root fillings to prevent fluid penetration into the root canal system through the apical foramen [27,28].

iv. Tissue dissolution capacity:

The tissue dissolution capacity of a substance depends mainly on three factors: the frequency of shaking, the amount of organic matter in relation to the amount of irrigant in the canal system and the surface area of tissue that is available for contact with the irrigant [29]. Chlorhexidine gluconate has been recommended as a root canal irrigant because of its broad spectrum antimicrobial action, substantivity and low toxicity[30,31]. Bleeding in case of vital pulp will stop only with the complete removal of the pulp tissue by a full instrumentation of the root canal within its whole extension. Therefore, when Chlorhexidine is used as an irrigant, emphasis should be given to full canal instrumentation in order to remove all pulp tissue rests, as It does not promote a superficial necrosis[32].

v. Intracanal medicament:

Chlorhexidine is used as an intracanal medicament in both vital and non vital teeth. This property is because of its alkaline pH[33]. It is bactericidal and neutralizes the remaining tissue debris in the root canal system[34]. Chlorhexidine also promotes an alkalinizing osteogenic environment on the surrounding tissues through the continuous release of OH- ions [35]. Moreover, it mediates the neutralization of lipopolysaccharides [36], helping in the cleansing the root canal [37]. Hence Chlorhexidine has been used in endodontics and proposed as both an irrigant and an intracanal medicament.

vi. Action on gutta percha cones:

Studies showed that 2% Chlorhexidine did not change gutta-percha cone properties after exposure for up to 30 min, suggesting that this substance is less harmful to guttapercha [38].

vii. Role in dentin bonding:

It has been shown that Chlorhexidine application prior to acid-etching has no adverse effects on immediate composite- adhesive bonds in coronal pulp chamber, dentin, enamel or with resin- reinforced glass-ionomer cements. Erdemir et al. [39,40] reported that endodontic irrigation with Chlorhexidine solution significantly increased bond strength to root dentin.

CONCLUSION:

Although, the use of Chlorhexidine as an irrigant is of a vast significance in the field of dentistry, it includes a few side effects such as brownish discolouration of the tooth and the restorative material[41]. There are also evidences of taste perturbation in patients using Chlorhexidine mouthrinses regularly. Sometimes mucosal erosion might also occur. But in contrast, it does not possess any toxic effects, it does not cause any teratogenic alterations and there is no formation of carcinogenic substances in the application of Chlorhexidine[42]. No dreadful adverse effects have been published regarding the use of Chlorhexidine as an irrigant. Therefore, along with its properties as an antiplaque and antigingivitis agent, it can also be accepted and widely used as a standard irrigant in root canal and other endodontic treatment procedures due to its biocompatibility substantivity and other significant characteristics.

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