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Root Canal Disinfection -A Review

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Abstract

Endodontic treatment success hinges on eliminating germs from the canal system and preventing reinfection. Along with the conventional irrigants used in endodontics, several irrigation systems have been devised to help with treatment success, such as shorter time to act and penetration at the isthmi level and lateral canals, as well as irrigation substances where instrumentation is insufficient.

Keywords: NIL

Introduction

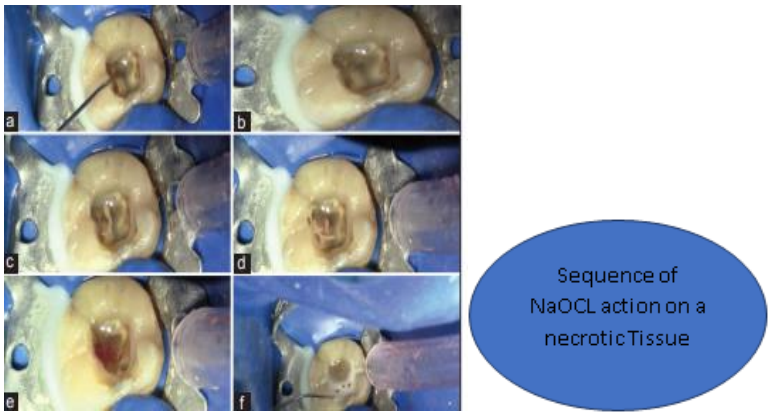
The removal of dead or necrotized tissue, the elimination of germs from the canal system, and the prevention of recontamination are all goals of endodontic treatment. Disinfection of the root canal system via preparation and irrigation, as part of endodontic therapy, is critical in reducing the amount of germs within the root canal and aiding in the control of periapical illness[1].The root canal system can be cleaned chemically and mechanically to achieve this purpose. Because the structure of the root canal system is so intricate and changeable, it's not always possible to clean and disinfect it effectively[2].Irrigants must provide particular, important benefits in order to be effective in cleansing, disinfecting, and permeating the root canal endodontics. Eliminating debris and soaking the canal walls; Destruction of germs; Dissolving organic remnants; Opening of the dentine tubules by removing the smear layer; Disinfecting and cleaning places not reachable by mechanical means are all advantages of utilising irrigants in endodontic treatment

Sodium Hypochlorite (NaOCl)

The most widely recommended and used endodontic irrigant is sodium hypochlorite (NaOCl). It has two benefits: pulpal disintegration and antibacterial activity. NaOCl is a strong base with a pH of 11 that functions as an organic solvent, causing amino acid breakdown and hydrolysis through the generation of chloramine molecules. When employing NaOCl for endodontic treatment of teeth with apical periodontitis, there is evidence that bacteria populations can be reduced[4]. Berthollet discovered potassium hypochlorite, the first chemically generated liquid chlorine solution (1748-1822). Labarraque (1777-1850), a chemist, recommended using NaOCl to prevent puerperium and other infectious disorder[5]. The use of NaOCl as a disinfectant became highly prevalent in the late nineteenth century, thanks to Koch and Pasteur's controlled laboratory research. Based on Dakin's studies of the efficiency of several solutions on diseased necrotic tissues during World War I, chemist Henry Drysdale Dakin and surgeon Alexis Carrel utilised buffered 0.5 percent NaOCl to wash

and disinfect infected wounds6. NaOCl is utilised in concentrations that range from 0.5 to 5.25 percent. Only NaOCl can dissolve necrotic and less vital pulp remnants, as well as dentinal collagen, but not the smear layer[7.]

NaOCl has a minimum antibacterial concentration of 0.5 percent in vitro. In vivo, however, the presence of biofilm and organic debris lowers the efficiency of NaOCl. As a result, a constant variation in NaOCl concentration appears to have a greater impact on the biofilm; yet, it may expose the patient to additional negative effects[8].



Mode of action

Nitrogen, formaldehyde, and acetaldehyde are generated when NaClO comes into contact with proteins. Peptide fragments are formed when proteins decay, allowing hydrogen from amino (NH) bonds to be replaced with sodium chlorate (NCl), generating chloramine; this is important for antibacterial effectiveness. The antimicrobial agent's potency dissolves necrotic and pustulating tissue, allowing it to reach and clean infected areas more effectively.[9]

Chlorhexidine(CHX)

Chlorhexidine, a cationic bisguanide with a 2 percent concentration, has been proposed as a substitute for sodium hypochlorite as an irrigant. Its bacteriocidal and bacteriostatic action is dependent on the concentration used, and it targets microorganisms by adsorbing onto cell walls and causing intracellular component leakage[10]. CHX is a positively charged hydrophilic and lipophilic molecule found in cell membranes, where it interacts with phospholipids and lipopolysaccharides. As a result, cell membranes are disrupted, allowing CHX molecules to enter the cell and cause intracellular harmful consequences such as cytoplasmic coagulation.CHX is self-limiting, and the number of CHX molecules accessible for contact with the dentine determines antibacterial substantivity, therefore it must be replaced often[11].

Ethylenediaminetetraacetic acid (EDTA)

Cleaning the root canal system completely necessitates the use of both organic and inorganic tissue-dissolving irrigation solutions. Other solutions should be used to remove the smear layer and debris from the root canal system because NaOCl only degrades organic tissue. It is advised that demineralizing agents like as EDTA and CA be used as supplementary solutions during root canal treatment[2]. The sodium salts of EDTA (Na2EDTA) are used in dentistry. Ethylenediaminetetraacetic acid (EDTA) is a synthetic amino acid. It is usually used in concentrations of 17%.

It is frequently employed as a chelating agent (substances that may scavenge and form ring-shaped internal complexes with metallic ions, such as calcium) and is non-corrosive to equipment. EDTA is neither bactericidal nor bacteriostatic, although it does stop bacteria from growing. Bacteria are starved and finally die as metallic ions required for growth are chelated

and hence unavailable to microorganisms[11]. When EDTA is combined with NaOCl, the amount of accessible chlorine from NaOCl is quickly reduced[12].

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Citric acid, among the numerous chelators utilised, produces a little expansion of the tubules. When compared to 17 percent concentrated EDTA, it is more effective as a decalcifying agent at both 10% and 1% concentrations[13].It also emulsifies soft tissue and dissolves the smear layer without harming pulpal or periapical tissues. Excessive erosion of peritubular and intertubular dentine has been seen after a 10-minute application of EDTA at a concentration of 17 percent. To [14]minutes.[11]

Mixture of Tetracycline Isomer, Acid, and Detergent (MTAD)

To improve smear layer removal, Torabinejad et al. used a mixture of 3 percent doxycycline, 4.25 percent CA, and detergent (Tween-80) as an alternative to EDTA. This combination possesses antibacterial and chelating properties. Its usage after NaOCl at the end of chemomechanical preparation is advised because it has no organic tissue-dissolving impact[14].MTAD is a combination of three chemicals that are thought to have a synergistic effect on bacteria[15]. At concentrations of 1–6%, its bactericidal impact on E. faecalis biofilm is weaker than that of NaOCl solution. The CA in the MTAD solution facilitates the clearance of the smear layer, allowing doxycycline to enter the dentinal tubules and exhibit antibacterial actions[16]. When used as a final irrigation solution in a canal filled with AH Plus and gutta percha, MTAD considerably reduces bond strength when compared to EDTA. When MTAD is used instead of EDTA, bacteria isolated from root canals can develop tetracycline resistance.[17]

Hydrogen Peroxide

H2O2 (hydrogen peroxide) is a colourless liquid that has been utilised in dentistry at concentrations ranging from 1% to 30%. H2O2 breaks down into water and oxygen. It works by producing hydroxyl free radicals, which target proteins and DNA, to kill viruses, bacteria, bacterial spores, and yeasts. Effervescence with H2O2 is an uncommon but serious risk, and seepage into the tissues can cause air emphysema[11].

Tetraclean

Tetraclean is a combination of CA, doxycycline (at a lower concentration than MTAD), and detergent, similar to MTAD. The antibiotic concentration (doxycycline-50 mg/ml) and detergent type (propylene glycol) are different from those used in MTAD. Tetraclean does not disintegrate organic tissue, hence it's best to use it after NaOCl at the end of the chemomechanical prep[18]. Tetraclean has a lot of activity against facultative and anaerobic bacteria. Tetraclean is more effective than MTAD against planktonic E. faecalis cultures and in vitro biofilms including mixed species.[19]

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