Sodium hypochlorite and chlorhexidine digluconate in endodontics

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ABSTRACT
In this work, through a literature review, the theme will be addressed: sodium hypochlorite and chlorhexidine in endodontics. They are two chemical substances used as irrigating solutions and of different concentrations. This literature review aims to discuss sodium hypochlorite and chlorhexidine as irrigating solutions in endodontics, their indications, advantages and disadvantages, to assist the professional in the choice of these irrigants.

Keywords: Sodium hypochlorite, Chlorhexidine, Irrigating solution.

1 INTRODUCTION

In endodontics, success is related to microbial disinfection being one of the most important steps. Endodontic treatment aims at the removal of microorganisms present within the root canal system, as well as the removal of inflamed/necrotic pulp tissue using chemical substances with high antimicrobial action, to ensure complete disinfection of root canals (Abu Hasna et al., 2019, 2020, 2021).

Among the materials capable of performing disinfection and having great effectiveness in endodontic treatment, sodium hypochlorite and chlorhexidine correspond and pay attention to the above needs, provided that they are used correctly and without extravasation so that no lesions occur to the applied tissue (Abu Hasna et al., 2020, 2021; Carvalho et al., 2020; Oliveira et al., 2022).

Sodium hypochlorite is commonly used in endodontics as an irrigating solution because it is a substance that has as main advantages, the lubrication capacity that facilitates instrumentation when

used in endodontics, the power of dissolution of organic matter, has antimicrobial activities, thus leaving no toxic residues. It also has low surface tension, detergent action and alkaline pH in addition to the low cost in pharmacies and other businesses (Bukiet et al., 2013; Johnson & Remeikis, 1993; Poggio et al., 2010; Wong & Cheung, 2014).

Sodium hypochlorite despite its advantages, it is a cytotoxic agent, which must be used with care when having direct contact with the skin and therefore, when it comes into contact with living tissues due to root canal treatment, ulceration occurs, because it is irritating mainly to the periapical tissues, the mucosa and the skin, its greatest disadvantage being its toxicity to biological tissues. The hypochlorite solution when it leaks, can cause degenerative lesions and stain clothes, in addition to containing an unpleasant taste and poor removal ability of *smear layer* (Becking, 1991; Doherty et al., 2009; Hatton et al., 2015; Neaverth & Swindle, 1990; Spencer et al., 2007; Witton et al., 2005).

Chlorhexidine is known as a chemical antiseptic substance that currently stands out due to its advantage in relation to good biocompatibility and absence of relative toxicity, in addition to its broad spectrum of antifungal and bactericidal action acting against Gram-positive and Gram-negative bacteria (aerobic, facultative anaerobic, viruses and fungi) (Arslan et al., 2015; Bidar et al., 2012; Ferraz et al., 2007). In endodontics, most professionals and specialists recommend using chlorhexidine as an intracanal medication, as it provides a broad reduction of microorganisms in the canal. This substance can be found in two ways: liquid or gel; Both methods of use, has a concentration of 0.2% to 2%. Research indicates that chlorhexidine gel has higher efficacy and performance compared to sodium hypochlorite (Bidar et al., 2012; Ferraz et al., 2007; Joy Sinha et al., 2017; Walia et al., 2019).

2 MATERIALS AND METHODS

To carry out this work, we used as research sources: scientific articles made available by the supervising professor and on digital platforms such as Google scholar, SciELO and PubMed.

3 LITERATURE REVIEW

Endodontic treatment has important requirements to be considered for successful treatment. Among these requirements are the elimination of bacteria, residues, remains of necrotic pulp tissues and dentin scrapings from the root canals. However, among the various stages in endodontics, the ideal cleaning of these root canals is the main one, as they must be completely disinfected, leaving no source of contamination and reinfection (Albahiti, 2020; Fedorowicz et al., 2012). This same treatment requires a mechanical-chemical preparation, made by instruments and auxiliary chemical substances, whose purpose is the prevention of recontamination after treatment and an environment conducive to repair of the periradicular tissues. (Chubb, 2019; Leonardo & Leonardo, 2017).

The disinfection of the root canal system has the effect of irrigating solutions, which must present an antibacterial action, dissolve necrotic tissue residues, promote lubrication to facilitate instrumentation and have biocompatibility with adjacent tissues so as not to injure the periapical tissues. Sodium hypochlorite and chlorhexidine, despite their different concentrations, are considered irrigating solutions conducive to endodontic treatment (Bidar et al., 2012; Elakanti et al., 2015; Jeansonne & White, 1994; Rossi-Fedele et al., 2012; Walia et al., 2019)

3.1 SODIUM HYPOCHLORITE

Sodium hypochlorite was first used in 1792 under the name Javele water, a mixture of sodium and potassium hypochlorite. Some industrialists adhered to the use of sodium hypochlorite in the hygiene of vegetables and legumes, removing all microorganisms and bacteria that could directly affect the health of those who ingested the food. Therefore, it was highly known in the market due to its great capacity for antimicrobial action and for being an excellent tissue solvent. Because it is considered a chemical compound with the formula NaOCl, it has an excellent microbial action and tissue dissolution capacity, in addition, it is the only irrigating solution that is able to break biofilms effectively. Its concentration varies between 0.5% and 5.25%. 2-3 (Estrela et al., 2002; Guida, 2006).

Research indicates that there is no consensus on which concentration is best to use, but it is known that more concentrated solutions obtain better results, however, the high concentration is toxic to periapical tissues, that is, used excessively, it can affect healthy tissues. Although toxic, this substance is chosen as one of the irrigating solutions in the treatment of canal (different concentrations), because it highlights the high capacity to dissolve organic material and necrotic tissue, and wide aspect of action. Among the various indications of sodium hypochlorite is the ability to partially neutralize toxic products, taking away the viability of spreading bacteria in the apical region; the bactericidal power, by the release of chlorine; the alkaline pH reducing acidity and making the medium unsuitable for bacterial growth; the solvent action of pulp tissue (Tartari et al., 2016; Xu et al., 2022).

Sodium hypochlorite has as main advantages when used as an irrigant, the lubrication capacity that facilitates instrumentation, the power of dissolution of organic matter, removal of dry and fixed biofilms from surfaces, antimicrobial activities - as mentioned above -, thus leaving no toxic residues, and also, has low surface tension. Because it is a cytotoxic agent, when it comes into contact with living tissues, ulceration and hemolysis occur, nullifies the migration of neutrophils and causes lesions at the level of endothelial cells (cells that cover the inside of blood vessels) and fibroblasts (synthesize connective tissue fibers). However, its biggest disadvantage in dental treatment is still its toxicity to biological tissues, already stated above (Cai et al., 2023; Petridis et al., 2019).

Among the most frequent complications: they are stains or discoloration on the patient's or professional's clothing: it may occur more often during its use in the irrigation of the root canals; To avoid it, the patient should wear a protection and the dental surgeon should carefully handle the syringes so as not to sneeze. In addition, ophthalmic damage can occur: this solution coming into contact with the eyes, causes an immediate sharp pain, pain, tearing, erythema and loss of corneal epithelial cells may occur. Abundant irrigation with water is recommended and refer the patient to the ophthalmologist. To avoid this accident, one should handle properly and carefully, and the patient and dentist should wear protective glasses.

When the sodium hypochlorite solution leaks into peri-root tissues, the effect can range from necrosis of burned or extended tissue. An inflammatory reaction of tissues evolved into a chemical burn. The sudden appearance of pain is an indication of the existence of the lesion and can occur immediately after minutes or in itself (Perotti et al., 2018).

However, an ulcerative necrosis of the mucosa adjacent to the tooth could be a direct result of the chemical burn, and may manifest itself after a few minutes or hours compared to days after the accident. These patients should be sent to the Hospital, in addition to the need for anti-inflammatory and antibiotic administration, there may also be a need for intravenous steroids. Surgical drainage may also be required based on necrosis and tissue necrosis (Bosch-Aranda et al., 2012; Perotti et al., 2018).

3.2 CHLORHEXIDINE

Chlorhexidine is used as an antimicrobial agent against Gram-positive and Gram-negative bacteria and antiseptic action. It is able to adhere to dentin tissue and the oral mucosa with its good compatibility, is absorbed by the cell wall of microorganisms and causes breakdown of intracellular components, and can be used in liquid or gel form (0.2% to 2%).

Chlorhexidine despite being a microbial agent, antiseptic and with good compatibility, at concentration 2% has low harmful effect in root canal treatments, suitable for irrigation; concentration 2%, makes it an auxiliary chemical substance and intracanal medication, being considered less harmful than sodium hypochlorite. Still, the high concentration of chlorhexidine has a bactericidal effect (precipitation and coagulation of the cytoplasm), while the low concentration has a bacteriostatic effect. In necrotic lesions, 2.5% to 5.25% of sodium hypochlorite, or 2% of chlorhexidine, is also indicated for irrigation with a high antibacterial effect (Gomes et al., 2013; PRETEL et al., 2011).

Chlorhexidine currently stands out due to its advantage in relation to biocompatibility and absence of relative toxicity, in addition to its broad spectrum against G+ and G- (aerobic, anaerobic and fungi). In endodontics, it is recommended to use in the concentration of 2% in gel. Chlorhexidine has as its main disadvantage, not to dissolve pulp tissue, being thus indicated, only when the patient presents hypersensitivity to sodium hypochlorite. (Gomes et al., 2013; Mohammadi Z, Abbott, 2009)

The properties of chlorhexidine are: substantivity (retentivity): ability to remain retained at the active site of action (dental surface, gums and oral mucosa), releasing slowly so that it is not quickly neutralized by salivary flow. Because microbial agents require a certain amount of contact time to inhibit or kill a microorganism. Its efficacy has been shown to be an effective antimicrobial agent in the treatment of gingivitis, disperser of plaque already formed and inhibitor of plaque recolonization. However, safety to date has shown low evidence of systemic toxicity in humans, in addition to not producing any appreciable resistance of mouth microorganisms (Carrilho et al., 2010; Souza et al., 2018).

Chlorhexidine interacts with the bacterium, altering the surface structures and increasing the permeability of the bacterial membrane, facilitating entry into the cytoplasm. In the case of the spectrum of action, Gram-positive patients have high susceptibility to chlorhexidine in relation to gram-negative ones, and their indications in dentistry are for the prevention and treatment of oral diseases, low local and systemic toxicity. It acts in a preventive way in the reduction of bacterial plaque, the reduction of cross-infections, generated in prophylactic procedures, in the reduction of post-surgical bacteremias before surgical or periodontal procedures.

Chlorhexidine in gel form facilitates instrumentation by lubricating the root canal lumen, which decreases the friction between the wall and the instrument and can reduce the occurrence of instrument fractures within the root canal system. In addition to facilitating instrumentation, it presents a better elimination of organic tissues during instrumentation, which supplies its inability to dissolve them (de Vasconcelos et al., 2007; Zahed Mohammadi, 2008).

Contraindications to chlorhexidine are not usually found. Despite having low levels of toxicity, chlorhexidine can cause an inflammatory response if exposed beyond apical constriction. There may also be reactions such as small sites of necrotic tissues, apoptosis of fibroblasts, inflammatory response and tissue death, and these reactions are dependent on the concentrations of CHX used in irrigation. However, chlorhexidine has some side effects such as staining of the tooth surface, making it brownish, although these come out with a professional prophylaxis. It has an unpleasant aroma, and can leave a metallic taste in the mouth, burning sensation, loss of taste, peeling of the mucosa and allergic reactions (Faria et al., 2009).

4 CONCLUSION

Sodium hypochlorite and chlorhexidine are two chemical substances used as irrigating solution in endodontics, each of which has advantages and disadvantages.

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