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RESEARCH ARTICLE

EDTA AS FINAL IRRIGATING GOLD STANDARD IN ENDODONTICS

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ABSTRACT

The irrigation of the root canal system contributes effectively to a clean and appropriate antisepsis more predictable success of endodontic treatment. An ideal protocol irrigation was suggested in order to overcome the limitations of commonly used irrigation and enhance antisepsis. This protocol is recommended the use of sodium hypochlorite for biomechanical preparation, followed by a final chelating agent. EDTA chelation is used worldwide in this role today; however there is a lack of current literature review of studies of the same, as many irrigating solutions have been developed in order to improve the final irrigation protocol. Thus the purpose of this review is to lead to different clinical indications of use as well as bringing considerations of effectiveness, biocompatibility and influences the dentin surface of the irrigating solutions.

INTRODUCTION

The endodontic therapy aims to remove the pulp tissue debris resulting from preparation of the root and microorganisms from the root canal system channels seeking cleaning and complete antisepsis. Irrigation is one of the most important aspects of biomechanical preparation of the root canal, since by this procedure the irrigating solution can reach places where instruments cannot reach because of the complex anatomy of the root canal system [26].

The arsenal of irrigating solutions designed for endodontic treatment and commercially available is wide. Choosing the right solution depends on the conjunction of the solution properties associated with the effects to be obtained with irrigation according to the clinical condition. In cases where the pulp is mortified and there infection, irrigating solutions has the function to promote asepsis, dissolve the necrotic tissue and facilitate its removal as well as neutralize the bacterial toxin [14, 29].

The ethylenedia minetetraacetic acid (EDTA) is generally used after endodontic instrumentation for their chelating action by which removes the layer of smear layer [4]. EDTA in endodontics was introduced in 1957 by Ostby, in the form of aqueous solution at 15.5% and pH 7.3. This facilitates the irrigant instrumentation channels atresia, it has the ability to demineralize dentin by means of a stable calcium ions [5]. Because EDTA is a final endodontic irrigants most used and it is important that the clinician becomes aware of the properties of the irrigator. Thus the purpose of this review is to lead to different clinical indications of use as well as bringing considerations of effectiveness, biocompatibility and influences the dentin surface of the irrigating solutions.

Literature Review

Removing Smear Layer

Remove the smear layer generated during the instrumentation of the root canal walls is an essential condition for the best antimicrobial effectiveness of irrigating solution in the dentinal tubules [6], in addition to improving the sealing ability of the shutter [7]. The removal power of the smear layer by EDTA chelating makes it one of the most used in the irrigation of root canals. This is usually used as the gold standard for the removal of smear layer in the comparative on research conducted studies comparing the effectiveness of EDTA 17% maleic acid 7%, and observed improved effectiveness of maleic acid to remove the smear layer of the apical third of human teeth

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uniradicular [8,9,10]. When compared to the maleic acid 5% EDTA 17% proved to be equally effective [11]. In a recent study evaluating the removal of smear layer in SEM for several irrigation agents (EDTA, apple cider vinegar, 5% maleic acid, acetic acid and distilled water as a control), EDTA promoted the best results, proving to be the solution most effective [9]. Another work by noticing the removal of smear layer with a SEM evaluation was performed by Cehreli *et al*. (2013) [12]. These works carried out in vivo, promoted the instrumentation and irrigation channels with 5.25% NaOCl or 17% EDTA or MTAD Biopure, and were extracted immediately. And among those irrigating solutions EDTA showed significantly better results at the expense of greater dentin erosion.

In a study by Zia *et al*. (2014) [13] performed on extracted teeth, it can be observed equivalence of EDTA to MTAD Biopure, being more efficient than brine. Another study compared three different formulations of QMix with EDTA and found a better effectiveness of QMix in removing smear layer in apical third, and equivalence between the results of the solutions in the medium and cervical thirds, showing a viable alternative to EDTA for irrigation end [14]. Alternative would be the use of EDTA gel, which has been shown to be as effective as the liquid in the same concentrations and conditions of use [15].

Antimicrobial Action

As is well used in endodontic irrigator EDTA have studied their antimicrobial properties, as is often the final irrigating treatment. Bryce *et al*. (2009) [16] conducted a study in order to verify the antimicrobial action of irrigating agents on biofilms of microorganisms isolated from root canals. The authors observed a low antimicrobial efficacy of EDTA on the biofilm, especially when compared to sodium hypochlorite. Furthermore, EDTA conditioning the dentin in such a manner that enables an increase in the amount of attached micro-organisms as well as adhesion strength thereof [17], and compared to other irrigation has a low retaining power in reinfection or residual activity is low, which can only be improved with the addition of auxiliaries in a [18,19] composition.

In mixed biofilms developed in situ in the oral cavity, Ordinola-Zapata *et al*. (2012) [20] evaluated the effectiveness of irrigation agents commonly used in endodontics and found that sodium hypochlorite was the most effective for the dissolution and the exhaustion of the biofilm. But the EDTA was not effective for this purpose and had a share compared to the saline. Low effectiveness of EDTA results were found in another study in which we compared the EDTA to Qmix, cetrimide 0.2%, 2% chlorhexidine and MTAD, the antimicrobial activity and also in the subtantividade [21].

However there are those who contradict these findings. There is a study which shows almost no potential for disruption of the biofilm structure, however, a high antimicrobial EDTA potential, reaching similar levels to those of sodium hypochlorite when used at pH 12, and 50 mmol / L, affecting the integrity biofilm membrane 24 hour E. faecalis, L. paracasei, and S. anginosus [22].

EDTA also has antifungal activity against Candidaalbicans, which is a fungus commonly associated with endodontic failures. Evaluating the antifungal effect of EDTA in relation to thyleneglycol-tetraacetic acid (EGTA), titanium tetrafluoride, sodium fluoride, nystatin, ketoconazole, EDTA and titanium tetrafluoride showed better antifungal activity [23]. This study corroborates a previous study of Sen *et al*. (2000) compared the inhibition halo EDTA in relation to various antifungal and sodium hypochlorite, and the EDTA with more satisfactory results.

One way to improve the antimicrobial action of EDTA would be the association with cetrimide. Ferrer-Luque *et al*. (2010) [11] found that EDTA associated with the same 15% cetrimide, compared to maleic acid has a lower antimicrobial activity. Also, EDTA has a low potential to prevent recolonization of the root canal, and thus can associate other irrigating solution to it, to improve the substantivity of action of the final irrigant. One of the viable options that have been studied is the addition of the EDTA cetrimide with promising results [12].

Biocompatibility

Chandrasekhar *et al* (2013) [24] injected 0.1 ml of various solutions in the dorsum of mice and found that EDTA had similar toxicity to QMix and less toxic when compared to NaOCl 3%, and more toxic than the solution fisiológica.Em a more recent study, Prado *et al* (2015) compared the cytotoxicity of EDTA 17% compared to 37% phosphoric acid, 10% citric acid, 5.25% NaOCl and 2% chlorhexidine. In this study it can be observed a minor citotxidade EDTA and citric acids when compared with other tested substances show a good biocompatibility EDTA.

An alternative EDTA (EDTA - T) to conventional has been studied and has shown good results for removing smear layer and a good antimicrobial action, but has shown a greater potential to generate inflammation than conventional 17% EDTA and citric acid 10% [25]. Even when compared to staff sensitized by light as FotoSan EDTA showed similar cytotoxic action showing a biocompatible material and similar to other decontamination methods used [26].

Dentin changes

Studies have shown that beyond the removal of microorganisms, dissolved organic and inorganic matter, irrigators are able to damage the dentin microstructure leading to alterations in the organic material / inorganic surface [27].
The type and intensity of these changes in the proportion of dentinal components depend on irrigating solution used and can influence the quality of the accession of sealers and cements used for cementing intraradicular [28, 29].

Tuncer Kara *et al* (2014) [30] evaluated the effects of QMix EDTA Chlorhexidine + EDTA + NaOCl and maleic acid in the root dentin microhardness. In this study the authors found that maleic acid has a high capacity reduction of dentin hardness compared to the other groups. The smallest reduction in hardness was found in EDTA + NaOCl association, which can be explained by the fact that a substance has the power to neutralize the other.

Garcia-Aranda *et al* (2013) [31] examined the effect of final irrigation protocols (17% EDTA, Biopure MTAD, and SmearClearQMiX) on the hardness and erosion of dentin root canal. All irrigators agents promoted a reduction in dentin hardness and EDTA promoted erosion of dentin tubules dentinários.Quando compared to alternative chelating agents such as peracetic acid at 2.25%, which has shown good antimicrobial power EDTA 17% have a similar power erosion of dentinal walls [8].

Ballal *et al* (2013) [32] evaluated the influence of irrigants (EDTA, 2.5% NaOCl, maleic acid and 7% QMix) in wettability two cements (AH Plus and ThermaSeal) in the intra-radicular dentin. The QMix proved to be the most favored irrigator that the wettability of cements in dentin of the root canal, which promoted better adhesion and sealing of the shutter. Since Aranda-Garcia *et al* 2013 studied the influence of three different irrigating (QMix, EDTA and Smear Clear) adhesiveness of a cement epoxy resin, not checking the interference of these irrigators adhesiveness of the material to the root canal wall.

Elnaghy (2014) [33] conducted a study which evaluated the influence of various irrigation in the adhesion of sealers, biodentine and MTA. The author found that QMix did not influence the adhesion of materials and obtained results similar to those of EDTA and NaOCl. Another study Elnaghy (2014) [34] conducted to assess the influence of EDTA associated with chlorhexidine on the adhesion of glass fiber posts cemented with resin cement in the root canal, and showed that QMix and EDTA associated with chlorhexidine provided the best adhesion results.

METHODOLOGY

Scan Type

This study is based on literature search cientificade qualitative approach, realizadona library of the University Center North Paulista (UNORP), St. Joseph region of Black River-SP.A choose this theme is justified by the specificity of the dentist. The literature or from secondary sources, covers the entire bibliography already published by Topic of estudocolocando researcher in direct contact with anything that has been studied related to the subject allowing an examination theme under new approaches and can lead to innovative conclusions (MARCONI, Lakatos, 2003).

Ethical Considerations

It is not necessary to submit this study to the ZIP Code of Ethics in Research of the University Center North Paulista Committee (UNORP), Sao Jose do Rio Preto, because it is a literature review, and no direct research on human subjects.

Data collect

The articles were initially selected using the following criteria: an article available in full eletrônica PUBMED database, being held from January to September 2014 was used to refine the search using the following keywords: EDTA, Endodontics and Irrigation.

CONCLUSION

EDTA is also the final irrigating more used in endodontics since it has an excellent chelating action and provides a sufficient opening of dentinal tubules, as well as having a good biocompatibility. Despite this, there has a good antimicrobial action which has provided alternative search for this solution, either with other substances, or by the use of antimicrobial agents to EDTA associations.

Competing interests

The authors declare que they have no competing interests.

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