Review Article

Critical Review on Root Canal Irrigants Used in Dentistry

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Abstract

The purpose of the endodontic treatment is to eliminating the entire pulp including both vital and necrotic tissues along with the microorganisms and its byproducts from root canal system, with the help of chemical and mechanical aids. The present article summarizes a brief note on endodontic irrigant solutions and also its negative impact which should also be considered to lead a discovery of better endodontic treatment systems.

Keywords: Endodontic, irrigant, negative impact

Introduction

Bacteria have long been recognized as the primary etiologic factors in the development of pulp and periapical lesions,[1-3] which are supposed to be eliminated which is commonly done with the help of chemical irrigants and mechanical endodontic files. Irrigant solutions are important because they could influence the mechanical properties of the dental structure,[4,5] as well as assist in cleaning the root canal. Some studies have identified a relationship between mechanical defects in dental structures, such as a reduction in the microhardness of root dentin or an increase in the incidence of vertical fracture with auxiliary chemical solutions.[5,6] Factors such as increased concentrations of irrigant solutions, high capacity to remove smear layer, and time of dentin exposure to solutions are being discussed as possible causes of these faults.[5,7-11] However, this issue is still controversial, and it is unclear in the literature which mechanical properties could be affected by irrigant solutions. Accordingly, scoping reviews offer an important tool that can provide a map of the range of available evidence. Table 1 shows the classification of root canal irrigation solutions.

Table 1: Classification of Root Canal[12]

	Chemical agent	Natural agent
Tissue-dissolving agents	NaOCl	
Antibacterial agents	CHX, NaOCl, some ATB	Green tea, Triphala, Curcuma longa
Chelating agents	HEBP, EDTA	
Product combination	MTAD, QMiX, Smearclear, Tetraclean	

CHX: Chlorhexidine, ATB: Antibiotic Q mix- bisbiguanide antimicrobial agent (2% CHX) and a polyaminocarboxylic acid calcium-chelating agent (17% EDTA), HEBP: HEBP-1-hydroxyethylidene-1, 1-bisphosphonate, EDTA: Ethylene diamine tetracetic acid, MTDA: Mixture of tetracycline, acid and detergent

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Negative Impact of Different Endodontic Irrigants

Cavalleri *et al.* have shown that using sodium hypochlorite (NaOCl) as an irrigating solution in root canals for short-term contact (several minutes, as is the case in clinical practice) does not alter the surface structure of the files through corrosion and does not cause any risk of fracture of nickel-titanium instruments.[13] NaOCl irrigation decreases bond strength between resin cements and dentin because hypochlorite affects the polymerization of the resin sealer.[14]

NaOCl and chlorhexidine (CHX) are not soluble in each other, and a brownish orange precipitate is formed, which is a carcinogenic product, parachloroanaline (PCA). PCA has mutagenic potential. Atomic absorption spectrophotometry has indicated that the precipitate contains iron, which may be the reason for the orange development. This reaction coats the canal surface and significantly occludes the dentinal tubules

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and affects the seal of the root canal. It would appear prudent to minimize the formation of PCA by washing away the remaining NaOCl with alcohol or ethylene diamine tetracetic acid (EDTA) before using CHX.[15]

NaOCl is caustic if accidentally extruded into periapical tissue or adjacent anatomical structures such as the maxillary sinus. Emphysema develops within 10–20 min if accidentally injected into the periapical tissue. Edema and paresthesia may result due to the tissue-dissolving capability of NaOCl. Because the potential for spread of infection is related to tissue destruction, medications such as antibiotics, analgesics, and antihistamines should be prescribed accordingly.[15]

CHX cannot be advocated as the main irrigant in standard endodontic cases because it is unable to dissolve necrotic tissue remnants and remove biofilm and it is less effective on Gram-negative than Gram-positive bacteria. Direct contact between NaOCl and CHX should be avoided; otherwise, red CHX crystals will precipitate immediately (PCA, which is known to be carcinogenic).[15]

Prolonged exposure to EDTA may weaken root dentin and thereby increase the risk of creating a perforation during mechanical root canal instrumentation. EDTA retains its calcium-complexing ability when mixed with NaOCl, but EDTA causes NaOCl to lose its tissue-dissolving capacity. Therefore, EDTA and NaOCl should be used separately and should never be mixed.[15]

MTAD seems to adversely influence the physical properties of dentin and causes significant reduction in bond strength of both resin-based and calcium hydroxide-based sealers due to precipitate formation.[15] Concerns have been expressed regarding the use of tetracycline (doxycycline) because of possible resistance to the antibiotic and staining of tooth hard tissue, as demonstrated by exposure to light in an *in vitro* model. However, no report of *in vivo* staining has been published.

Conclusion

The most known and used irrigating agents today are NaOCl, CHX, and EDTA. None of these substances is the ideal irrigator; all have advantages and disadvantages, and because of this, it is convenient to use them in combination. The market is always launching new compounds or new alternatives to enhance the effects of existing irrigants. It would therefore be interesting to compare the efficacy of the old and new irrigants on the endodontic microbiota and to see if one method is more effective than another when eradicating the bacterial biofilm, until an ideal protocol is determined.

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Conflicts of interest

There are no conflicts of interest.

References

1. Kakehashi S, Stanley HR, Fitzgerald RJ. The effects of surgical exposures of dental pulps in germ-free and conventional laboratory rats. Oral Surg Oral Med Oral Pathol 1965;20:340-9.
2. Baumgartner JC, Falkler WA Jr. Bacteria in the apical 5 mm of infected root canals. J Endod 1991;17:380-3.
3. Sjögren U, Figdor D, Persson S, Sundqvist G. Influence of infection at the time of root filling on the outcome of endodontic treatment of teeth with apical periodontitis. Int Endod J 1997;30:297-306.
4. Cruz-Filho AM, Sousa-Neto MD, Savioli RN, Silva RG, Vansan LP, Pécora JD. Effect of chelating solutions on the microhardness of root canal lumen dentin. J Endod 2011;37:358-62.
5. Pascon FM, Kantovitz KR, Sacramento PA, Nobre-dos-Santos M, Puppin-Rontani RM. Effect of sodium hypochlorite on dentine mechanical properties. A review. J Dent 2009;37:903-8.
6. Akcay I, Sen BH. The effect of surfactant addition to EDTA on microhardness of root dentin. J Endod 2012;38:704-7.
7. Zhang K, Kim YK, Cadenaro M, Bryan TE, Sidow SJ, Loushine RJ, *et al.* Effects of different exposure times and concentrations of sodium hypochlorite/ethylenediaminetetraacetic acid on the structural integrity of mineralized dentin. J Endod 2010;36:105-9.
8. Uzunoglu E, Aktemur S, Uyanik MO, Durmaz V, Nagas E. Effect of ethylenediaminetetraacetic acid on root fracture with respect to concentration at different time exposures. J Endod 2012;38:1110-3.
9. Uzunoglu E, Yilmaz Z, Erdogan O, Görduysus M. Final irrigation regimens affect fracture resistance values of root-filled teeth. J Endod 2016;42:493-5.
10. Wang L, Zhao Y, Mei L, Yu H, Muhammad I, Pan Y, *et al.* Effect of application time of maleic acid on smear layer removal and mechanical properties of root canal dentin. Acta Odontol Scand 2017;75:59-66.
11. Souza EM, Quadros JR, Silva EJ, De-Deus G, Belladonna FG, Maia-Filho EM. Volume and/or time of NaOCl influences the fracture strength of endodontically treated bovine teeth. Braz Dent J 2019;30:31-5.
12. Prada I, Micó-Muñoz P, Giner-Lluesma T, Micó-Martínez P, Muwaquet-Rodríguez S, Albero-Monteagudo A. Update of the therapeutic planning of irrigation and intracanal medication in root canal treatment. A literature review. J Clin Exp Dent 2019;11:e185-93.
13. Cavalleri G, Cantatore G, Costa A, Grillenzoni M, Comin Chiaramonti L, Gerosa R. The corrosive effects of sodium hypochlorite on nickel-titanium endodontic instruments: Assessment by digital scanning microscope. Minerva Stomatol 2009;58:225-31.
14. Morris MD, Lee KW, Agee KA, Bouillaguet S, Pashley DH. Effects of sodium hypochlorite and RC-prep on bond strengths of resin cement to endodontic surfaces. J Endod 2001;27:753-7.
15. Jena A, Sahoo SK, Govind S. Root canal irrigants: A review of their interactions, benefits, and limitations. Compend Contin Educ Dent 2015;36:256-61.