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Current Irrigation Protocol used in Endodontic Offices: A 2022 Survey

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Abstract

Introduction: The goal of this study was to evaluate the most common irrigation methods and solutions currently being used by endodontist members of American Association of Endodontists (AAE).

Methods: A survey consisting of 16 questions was emailed to 3,398 active endodontist members of AAE. The survey included questions regarding the solutions, percentages and methods used in irrigation of root canal systems. The survey had a response time interval of two months.

Results: Of the respondents, 89% and 85% used NaOCl and EDTA, respectively, for root canal treatment. Other commonly used solutions included Chlorhexidine (64%), Saline (61%), and Chloroform solution (60%). The majority of respondents used 6% NaOCl and 17% EDTA. The order of solutions used for irrigation was NaOCl followed by EDTA. The smear layer was removed by 84.7% of the respondents, and the most commonly used solution was EDTA. The most popular irrigation delivery system was a needle delivery system using a 30-gauge side-vented needle with an average irrigation time of 30 minutes and 10-15ml total volume delivery.

Conclusions: NaOCl was the most common irrigation solution used by endodontist members of AAE, followed by EDTA. The most common irrigation delivery system was needle with average irrigation time of 30 minutes and 10-15ml total volume delivery.

Keywords: Irrigation solution; Irrigation concentration; Irrigation time; Irrigation volume; Gentle Wave; Smear layer

Introduction

Bacteria is the primary cause of endodontic disease [1], therefore disinfection of the root canal system is critical for treatment success [2]. Mechanical instrumentation and irrigation are different treatment techniques used to decrease bacteria loads. This study's focus was on the endodontic irrigation of root canal systems. A strong antibacterial solution is indicated to remove microorganisms to prevent intraradicular and extraradicular infection. Properties of an ideal irrigation solution include low cytotoxicity, antimicrobial properties, and the ability to dissolve organic and inorganic tissue [3]. There are various solutions and techniques currently used for disinfection of a root canal system. Several studies have reported the use of various solutions/protocols to disinfect root canal systems [4-7]. Interestingly, a study by Peters in 2001 showed that rotary files used for cleaning the canals left 35% or more of the canal walls unchanged [8]. Therefore, it is important to investigate current trends to gain knowledge about these antibacterial solutions where irrigation is one of the key factors for the success of root canal therapy. Currently, there is no widespread acceptance of a particular solution, solution concentration, and method between endodontists [9]. The objective of this research was to discover the most common irrigation solutions/protocol used currently by endodontist members of AAE and assess usage trends with modern developed irrigation systems such as laser and multisonic irrigation methods. Additionally, this study can help our understanding and assess if there are changes in irrigation trends currently from the most cited irrigation article by Yamada published in 1983, which recommended Sodium Hypochlorite (NaOCl) 5.25% and Ethylenediaminetetraacetic acid (EDTA) 17% for disinfection of root canal systems, as well as a more recent survey in irrigation protocols among members of AAE in 2012 [10].

Materials and Methods

A 16-questions survey was sent to 3398 active Endodontist members of AAE through email. Informed consent obtained. The survey included questions regarding the solutions, percentages, order of sequence for specific solution, irrigation time, irrigation

volume, smear layer removal, and methods used in irrigation of root canal system. The survey time interval included 2 months of response time with 1 month follow-up reminder. Data was collected using REDCap, metadata-driven electronic data capture software. The results of the survey were statically analyzed by a statistician using Chi-squared test.

Results

The total number of respondents included 523 participants. A significant proportion of the survey participants originated from the western and southern regions of the United States. The average age of respondents was 47.20 with an average of 15.85 years in practice. Seventy-nine percent of respondents work in private practice and 40% of the respondents were board-certified. Of the respondents, 89% and 85% used NaOCl and EDTA, respectively, for root canal treatment. Other most commonly used solutions included Chlorhexidine (64%), Saline (61%) and Chloroform solution (60%). The majority of the respondents used concentration of 6% NaOCl and 17% EDTA. Twenty-three percent of the respondents did not know the percentage of NaOCl used for their treatment. The order of solution used for irrigation included NaOCl followed by EDTA. The smear layer was removed by 84.7% of the respondents, and the most commonly used solution was EDTA. The average irrigation time for root canal therapy by most of the respondents was 30 minutes. The most common irrigation delivery system included needle delivery (56.4%). Thirty-gauge side-vented needle was the most common needle used for irrigation with 10-15ml volume of irrigation delivered by most respondents. Commercial irrigation system was used by 16.3% of the respondents, and 8% used laser for root canal disinfection.

Using a Chi-Squared analysis with a significance level of <0.05 ($p < 0.000$), there was a significant difference between the proportions of used irrigation solvents. Sodium hypochlorite (NaOCl) and ethylenediaminetetraacetic acid (EDTA) were the most commonly used solutions among endodontist members of AAE compared to other solvents. Using a Chi-Squared analysis with a significance level of <0.05 ($p < 0.000$), there was a significant difference in the preferred irrigation delivery methods. The traditional irrigation needle delivery system was the most commonly used system among endodontist members of AAE compared to other irrigation delivery methods such as commercial irrigation system.

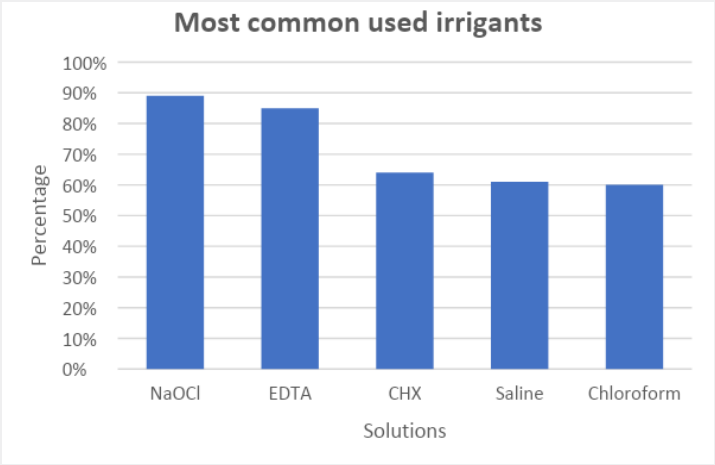

Figure 1: The most commonly used irrigant solutions used by endodontist members of AAE.

Discussions

One of the major factors in the success of root canal treatment is the irrigation used to decrease bacteria load, which is the cause of root canal infection [1]. Interestingly, there is a lack of consensus regarding irrigation protocol and methods, including the ideal percentages for various solutions used during root canal therapy. Part of it may stem from many articles published with different recommended solutions and percentages. The most cited irrigation article by Yamada recommended Sodium Hypochlorite (NaOCl) 5.25% and Ethylenediaminetetraacetic acid (EDTA) 17% for disinfection of root canal systems; however, there are other studies that have reported the use of various solutions to disinfect root canal system other than NaOCl. For example, in an article written by Jeansone and White, chlorohexidine was shown to decrease bacterial load similarly to NaOCl. In this study, 64% of respondents used CHX compared to 89% with NaOCl. CHX has substantial antimicrobial properties; however, its inability to dissolve organic substances makes it less prevalent among endodontists for irrigation purposes. Iodine Potassium Iodide was another solution that was shown to be a more effective antibacterial irrigant than NaOCl [5].

A previous survey study in 2012 by Dutner [10] concluded that NaOCl (>91%) of 5% or higher concentration was the most commonly used solution, followed by EDTA (80%) among AAE members during endodontic treatment. Based on the result of this survey, NaOCl and EDTA continue to be the most commonly

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used irrigation solution during root canal therapy. It is critical to evaluate the strengths and weaknesses of these commonly used solutions in order to optimize the irrigation protocols for root canal treatments. For example, NaOCl has been shown to reduce the flexural strength and elastic modulus of dentin if left for extended time [11]. EDTA, another common solution, has been shown to cancel the actions of NaOCl by chlorine deactivation. Many clinicians combat this issue by irrigating with NaOCl as their final irrigation solution. This causes erosion of root dentin, which, in turn, weakens the root structure [12]. One approach to address these challenges involves utilizing lower concentrations of NaOCl in combination with milder chelator solutions, such as Etidronic acid, which does not compromise NaOCl's antimicrobial properties [13].

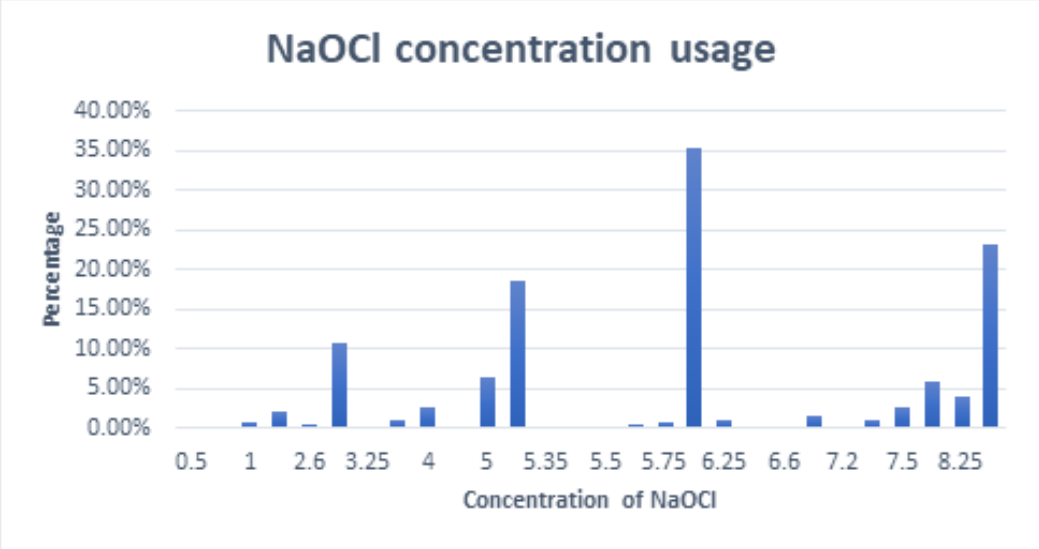

Figure 2: Concentration of NaOCl used by AAE members

Figure 3: Sample of survey questions.

In this study, the majority of the respondents used 6% NaOCl concentration. Interestingly, 23.3% of respondents did not know the percentage of NaOCl used during endodontic treatment. This is concerning, especially if among these respondents, a higher percentage of NaOCl being utilized without provider knowledge, which means greater cytotoxicity and cell destruction. The efficacy of various NaOCl concentrations have continuously been studied in Endodontic literature. In a study by Baumgartner [14], NaOCl concentration even as low as 1% was able to remove debris and pulpal remnant in uninstrumented surfaces. In another study, 2.5% was found to have similar properties to 5.25% concentration, yet less toxic to surrounding tissues [15]. With the majority of

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endodontist using concentration of 5% or more based on result of this survey and previous surveys, one can question if we really need to use higher concentration of NaOCl, which has additional cytotoxic properties, in order to disinfect root canal systems. Apart from NaOCl concentration, irrigation time during root canal therapy is also important to be considered during treatment. In a study by Milano, pulp dissolved from 20 minutes to 2 hours with different NaOCl concentration that ranged from 0.5% to 5.25%. On the contrary, much less time needed for antimicrobial/antifungal activity of NaOCl concentrations of 0.5%, 1%, 2.5% which was effective in less than 10 seconds against Candida albicans and Actinomyces naeslundii [16].

An additional concern regarding NaOCl is the concentration percentage of different commercial NaOCl products advertised by manufacturers versus the true concentration of these products. In a 2019 study by Landolo [17], different concentration of NaOCl products such as ACE, N5, and CanalPro were tested. It was found that the NaOCl concentration in ACE, which is a common household bleach, was significantly lower than the percentage advertised. In contrast, the NaOCl concentration in dental commercial products N5 and CanalPro was more accurate. Therefore, it is important for practitioners to purchase NaOCl products manufactured for dentists to have precise NaOCl concentration for the root canal system disinfection. This finding is especially concerning for practitioners who dilute NaOCl solution, as the NaOCl concentration will be even lower than expected with common bleach products and the irrigation solution utilized for their root canal therapy treatment will have minimal NaOCl concentration.

Finally, adjunct irrigation techniques such as laser and commercial multisonic irrigation systems can be used to further disinfect the root canal system. In this study, only 16.3% of respondents use commercial irrigation systems and 8% use laser for root canal disinfection. Interestingly, there are contradicting studies regarding commercial irrigation systems. In a 2015 study by Molina [18], significantly higher reduction in soft tissue and debris was shown in extracted molars using the GentleWave system compared to needle irrigation delivery system. However, in a recent 2022 study by Ordinola-Zapata [19], there was no additional reduction in bacterial load using GentleWave versus conventional needle irrigation delivery system. In fact, greater reduction in bacterial communities was seen with needle delivery systems. Ultimately, the most important question is whether these adjunct irrigation techniques lead to higher treatment success rate. Perhaps further longitudinal clinical research studies can answer this question in future.

Conclusion

NaOCl was the most common irrigation solution used by endodontist members of AAE, followed by EDTA. The majority of the respondents used 6% NaOCl and 17% EDTA concentration. The most common irrigation delivery system was needle with average irrigation time of 30 minutes and a total volume delivery of 10-15ml.

References

1. Kakehashi S, Stanley HR, Fitzgerald RJ (1965) The effects of surgical exposures of dental pulps in germfree and conventional laboratory rats. Oral Surg Oral Med Oral Pathol 20: 340-349.
2. Teves Abel, Daniel Blanco, Mario Casaretto, John Torres, Debora Alvarado, et al. (2019) Effectiveness of different disinfection techniques of the root canal in the elimination of a multi-species biofilm. Journal of clinical and experimental dentistry 11(11): e978-e983.
3. Torabinejad M, Walton RE (2009) St Louis, Missouri: Saunders Elsevier; Endodontics. Principles and Practice
4. Jeansonne MJ, White RR (1994) A comparison of 2.0% chlorhexidine gluconate and 5.25% sodium hypochlorite as antimicrobial endodontic irrigants. J Endod 20(6): 276-278.
5. Orstavik, Dag and M P Haapasalo (1990) Disinfection by endodontic irrigants and dressings of experimentally infected dentinal tubules. Endodontics & dental traumatology 6(4): 142-149.
6. Yamada RS, Armas A, Goldman M, Lin PS (1983) A scanning electron microscopic comparison of a high-volume final flush with several irrigating solutions: part 3. J Endod 9(4): 137-142.
7. Zehnder M (2006) Root canal irrigants. J Endod 32(5): 389-398.109.
8. Peters OA, Schönenberger K, Laib A (2001) Effects of four Ni-Ti preparation techniques on root canal geometry assessed by micro computed tomography. Int Endod J 34(3): 221-230.
9. Marion Jefferson, Manhães Frederico, Bajo H, Duque Thais (2012) Efficiency of different concentrations of sodium hypochlorite during endodontic treatment. Literature review. Dental Press Endodontics 2: 32-37.
10. Dutner J, Mines P, Anderson A (2012) Irrigation Trends among American Association of Endodontists Members: A Web-based Survey. J Endod 38(1): 37-40.
11. Grigoratos D, Knowles J, Ng YL, Gulabivala K (2001) Effect of exposing dentine to sodium hypochlorite and calcium hydroxide on its flexural strength and elastic modulus. Int Endod J 34(2): 113-119.
12. Qian W, Shen Y, Haapasalo M (2011) Quantitative analysis of the effect of irrigant solution sequences on dentin erosion. J Endod 37(10): 1437-1441.
13. Basrani BR, Malkhassian G (2001) Update on Irrigation Disinfection.
14. Baumgartner JC, Cuenin PR (1992) Efficacy of several concentrations of sodium hypochlorite for root canal irrigation. J Endod 18(12): 605-612.
15. Milano NF, Girardi V, Bergola AM, Chiapini IG (1991) Alguns aspectos do uso do NaOCl em Endodontia. Rev Fac Odontol Porto Alegre 32(1): 7-10.
16. Radcliffe CEL, Potouridou R, Qureshi N, Habahbeh A, Qualtrough H, et al. (2004) Antimicrobial activity of varying concentrations of sodium hypochlorite on the endodontic microorganisms Actinomyces israelii, A. naeslundii, Candida albicans and Enterococcus faecalis. Int Endod J 37(7): 438-446.
17. Landolo A, Dagna A, Poggio C, Capar I, Amato A, et al. (2019) Evaluation of the actual chlorine concentration and the required time for pulp dissolution using different sodium hypochlorite irrigating solutions. J Conserv Dent 22(2): 108-113.

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18. Molina B, Glickman G, Vandrangi P, Khakpour M (2015) Evaluation of root canal debridement of human molars using the Gentlewave system. Journal of Endodontics 41(10): 1701-1705.

19. Ordinola-Zapata R, Mansour D, Saavedra F, Staley C, Chen R, et al. (2022) In vitro efficacy of a non-instrumentation technique to remove intracanal multispecies biofilm. Int Endod J 55(5): 495-504.

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