

Irrigation Trends among American Association of Endodontists Members: A Web-based Survey

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Abstract

Introduction: The purpose of this study was to determine current trends in irrigation selection among endodontists. **Methods:** An invitation to participate in a web-based survey (QuestionPro) was e-mailed to 3844 members of the American Association of Endodontists. Survey participants were asked between 10 and 14 questions based on their individual responses. Among other questions, participants were asked about their irrigant selection, irrigant concentration, smear layer removal, and use of adjuncts to irrigation. **Results:** A total of 3707 survey invitations were successfully delivered by e-mail after accounting for several undeliverable e-mail invitations. There were 1102 participants, with an overall completion rate of 28.5% (n = 1054). Our data indicate that >90% of respondents primarily use sodium hypochlorite, with 57% of them using it at a concentration >5.0%. Seventy-seven percent of respondents aim to remove the smear layer during endodontic treatment. At least 45% of respondents reported using an adjunct to irrigation. **Conclusions:** Most of the respondents are using full-strength sodium hypochlorite and are routinely removing the smear layer during endodontic treatment. In addition, almost half of the respondents are using an adjunct, such as ultrasonic activation, to aid in their irrigation technique. (*J Endod* 2011; ■:1–4)

Key Words

Irrigation, irrigation adjuncts, smear layer

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Even with modern techniques that use nickel-titanium files, more than 35% of the root canal's surface can be left uninstrumented after nonsurgical root canal treatment (1). To remove debris and address these uninstrumented surfaces, it is necessary to copiously irrigate the root canal (2).

The ideal root canal irrigant has been described by Zehnder (3) as being systemically nontoxic, noncaustic to periodontal tissues, having little potential to cause an anaphylactic reaction, possessing a broad antimicrobial spectrum, capable of dissolving necrotic pulp tissue, inactivating endotoxins, and either preventing the formation of a smear layer or dissolving it once it has formed. Many irrigating solutions have been studied extensively to determine which best exhibit these ideal properties, but the ideal irrigant has not yet been realized.

Sodium hypochlorite is able to meet many of these criteria. It has a broad antibacterial spectrum, while also possessing some ability to inactivate endotoxin (4–6). Unlike other irrigants, it is effective at dissolving tissue and removing the organic component of the smear layer (7, 8).

Although many authors suggest dilution of NaOCl to limit its cytotoxicity, some studies indicate that NaOCl might lose some of its antibacterial effectiveness and tissue-dissolving capability when it is diluted from a full-strength solution (9–13). Because of its irritating properties and the potential for severe inflammatory reactions, efforts have been made to find alternatives to NaOCl irrigation. Although chlorhexidine (CHX) does not dissolve tissue, it is a very effective antibacterial irrigant that also possesses substantivity (14–17).

Controversy exists regarding whether it is advantageous to remove the smear layer that is formed during root canal instrumentation. Current methods to remove the smear layer might involve the use of a chelating agent during irrigation or as a final rinse in combination with other irrigants. Ethylenediaminetetraacetic acid (EDTA) is effective for removing the inorganic component of the smear layer. MTAD, a mixture of doxycycline, citric acid, and Tween 80 detergent, has also demonstrated the ability to remove components of the smear layer (18). Recent research indicates that QMix (DENTSPLY Tulsa Dental, Tulsa, OK), an experimental irrigant containing a mixture of a bisbiguanide antimicrobial agent, a polyaminocarboxylic acid calcium-chelating agent, saline, and a surfactant, might be as effective as EDTA and MTAD at removing smear layers when used after an initial rinse with NaOCl (19).

In an effort to improve the delivery and effectiveness of irrigants, different adjuncts have been developed. Both sonic and ultrasonic agitation of the irrigant have been studied for their ability to improve canal cleanliness. Systems such as EndoVac (Discus Dental, Culver City, CA) use negative pressure to safely bring irrigants into contact with all surfaces of the root canal (20).

Although many different irrigants and treatment protocols have been studied, little research has been conducted to determine the widespread practice or acceptance of such methods and materials among American endodontists. The purpose of this study was to ascertain the current trends in irrigation among active endodontists.

Materials and Methods

An invitation to participate in a web-based survey (QuestionPro; Survey Analytics LLC, Seattle, WA) was e-mailed to 3844 members of the American Association of Endodontists. Survey participants were asked between 10 and 14 questions based on their individual responses. Among other questions, participants were asked about their

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irrigant selection, irrigant concentration, smear layer removal, and use of adjuncts to irrigation. Questions consisted of numeric rankings, multiple choice, and multiple selections with options for write-in answers where appropriate. An example of the survey questionnaire sent to participants is seen in Table 1. A total of 2 reminder e-mails were sent at 2-week intervals until the survey was closed after 6 weeks. Data were collected and analyzed by using QuestionPro software.

Results

A total of 3707 survey invitations were successfully delivered by e-mail after accounting for several undeliverable e-mail invitations. There were 1102 participants, with an overall completion rate of 28.5% ($n = 1054$).

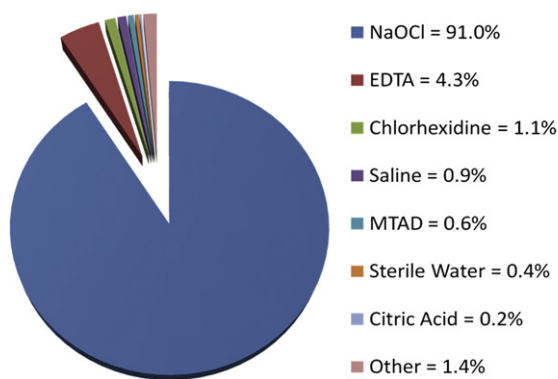
Responses were received from among the different groups based on years since graduation from dental school and endodontic residency

training. Among all year groups, our data indicate that >91% of respondents are using sodium hypochlorite as their primary irrigant (Fig. 1). When asked to rank the reasons for their primary irrigant selection, antibacterial capability was most important, followed in order by tissue dissolution, biocompatibility, substantivity, and expense. The majority of respondents are also including EDTA (80%) and CHX (56%) in their endodontic practice (Fig. 2). Most endodontists surveyed (57%) use full-strength sodium hypochlorite (NaOCl concentration >5.0%) (Fig. 3). Seventy-seven percent of respondents aim to remove the smear layer during endodontic treatment. Most endodontists (66%) will not alter their irrigant selection on the basis of pulpal or periapical diagnoses. Almost half of all respondents use an adjunct to irrigation, with 48% using ultrasonic activation and 34% using sonic (or subsonic) activation. Ten percent of those surveyed are also using negative pressure irrigation with systems such as EndoVac.

TABLE 1. Sample Questionnaire

How many years ago did you graduate from dental school?	Rank the reasons for your primary irrigant selection from most important to least important.
1. >30	1. Antibacterial capability _____
2. 21–30	2. Biocompatibility _____
3. 11–20	3. Tissue dissolution _____
4. 5–10	4. Substantivity _____
5. <5	5. Expense _____
How many years ago did you complete your postgraduate endodontic training?	Do you routinely aim to remove the smear layer?
1. >30	1. Yes
2. 21–30	2. No
3. 11–20	Does your choice of irrigant(s) differ based on the pulpal or periapical diagnosis?
4. 5–10	1. Yes
5. <5	2. No
6. Still in training	Which of the following irrigants would you primarily utilize when treating a tooth with a vital pulp?
Which irrigants do you use? (Please select all that apply)	1. Sodium hypochlorite
1. Sodium hypochlorite	2. Chlorhexidine
2. Chlorhexidine	3. Saline
3. Saline	4. Sterile water
4. Sterile water	5. Other _____
5. EDTA	Which of the following irrigants would you primarily utilize when treating a tooth with a necrotic pulp?
6. MTAD	1. Sodium hypochlorite
7. Citric acid	2. Chlorhexidine
8. Other _____	3. Saline
Which irrigant do you primarily use?	4. Sterile water
1. Sodium hypochlorite	5. Other _____
2. Chlorhexidine	Which of the following irrigants would you primarily utilize when treating a tooth with radiographic evidence of a periapical lesion?
3. Saline	1. Sodium hypochlorite
4. Sterile water	2. Chlorhexidine
5. EDTA	3. Saline
6. MTAD	4. Sterile water
7. Citric acid	5. Other _____
8. Other _____	Which of the following irrigants would you primarily utilize when treating a previously treated tooth?
Which concentration of sodium hypochlorite do you primarily use?	1. Sodium hypochlorite
1. <0.5%	2. Chlorhexidine
2. 0.5%–1.5%	3. Saline
3. 1.6%–2.5%	4. Sterile water
4. 2.6%–4.0%	5. Other _____
5. 4.1%–5.0%	Which, if any, adjuncts to irrigation do you utilize? (Please select all that apply)
6. >5.0%	1. Ultrasonic activation
7. I do not use sodium hypochlorite.	2. Sonic activation
Which concentration of chlorhexidine do you primarily use?	3. Subsonic activation (example: EndoActivator)
1. 0.17%	4. Negative pressure (example: EndoVac)
2. 0.18%–1.9%	5. Other _____
3. 2.0%	
4. >2.0%	
5. I do not use chlorhexidine.	

Primary Irrigant Utilized



Percentage of respondents who utilize each irrigant as their primary, or main, irrigant during root canal treatment

Figure 1. Primary irrigant utilized.

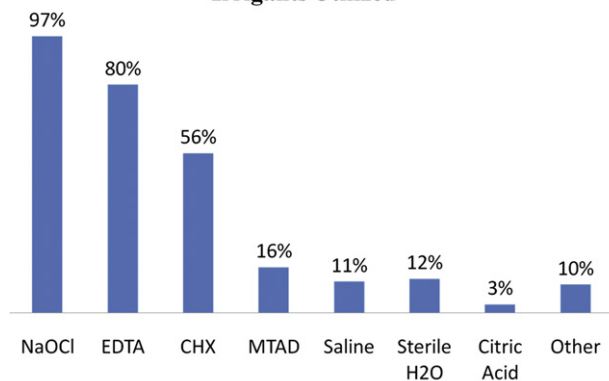
Discussion

Much research has been conducted to determine which irrigants most closely adhere to the ideal properties of such a medicament. It is beyond the scope of this article to address the many studies that evaluate and compare the antimicrobial efficacy of various solutions. For a thorough analysis, readers are referred to the review by Haapasalo et al (21) of endodontic irrigation.

In a survey conducted in North Jordan, it was found that only 32.9% of general dentist respondents used sodium hypochlorite and 33.6% used hydrogen peroxide during root canal treatment (22). In a United Kingdom survey among 643 general dental practitioners, it was found that sodium hypochlorite was used by 71% of rubber dam users and only 38% of dentists who did not use rubber dams (23). A survey conducted in Australia reported that 94% of endodontists used sodium hypochlorite, with 80% of those surveyed using a 1% NaOCl solution (24).

In this study, it was found that the overwhelming majority of respondents (91%) use sodium hypochlorite as their primary irrigant, with 57% of them using a concentration of 5% or greater. This irrigant selection satisfies our survey's highest ranked 2 reasons for irrigant

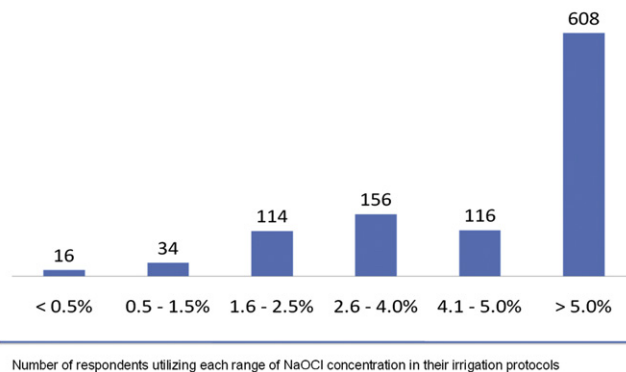
Irrigants Utilized



Percentage of respondents who include each irrigant as any part of their irrigation protocols, whether as primary or secondary irrigants. Multiple responses were allowed.

Figure 2. Irrigants utilized. CHX, chlorhexidine; EDTA, ethylenediaminetetraacetic acid.

NaOCl Concentration Utilized



Number of respondents utilizing each range of NaOCl concentration in their irrigation protocols

Figure 3. NaOCl concentration utilized.

selection; it is both antibacterial and tissue-dissolving. The differences between our results and previous surveys regarding primary irrigant selection might be attributed to regional differences because our study was limited to members of the American Association of Endodontists.

A previous survey among members of the American Association of Endodontists in 2001 revealed that 51% of practicing endodontists removed the smear layer before obturation of the root canal system (25). This differs from the results of our study that indicate 77% of endodontists routinely aim to remove the smear layer. Because the survey questions were worded similarly and addressed to the same contingent, it is quite possible that the results from our research reveal a slight change in treatment philosophies.

Although 34% of respondents in our study stated that their choice of irrigant might change on the basis of pulpal and periapical diagnosis, when asked concerning various diagnoses, their primary irrigant was still overwhelmingly sodium hypochlorite. These answers should be interpreted with caution because the questions were not open-ended and did not allow protocols with multiple irrigants to be considered.

When asked about adjuncts used for irrigation, participants were given choices including ultrasonic activation, sonic activation, subsonic activation, and negative pressure. Participants also had the option to write in an adjunct. Subsonic activation was included as a choice because devices such as the EndoActivator (Advanced Endodontics, Santa Barbara, CA) are sometimes described in this manner (26). Technically, these devices are, in fact, sonic activation systems and were considered as such when analyzing the survey data. For a detailed analysis of the various irrigant agitation techniques and devices, the reader is referred to the review by Gu et al (20) of the topic. In our study, almost half of all respondents are using some form of adjunct, with 48% using ultrasonic activation, 34% using sonic (or subsonic) activation, and 10% using a negative pressure system. These results indicate the desire of many endodontists to improve irrigation efficacy by using other means to bring irrigants into contact with the root canal walls.

Conclusions

Most of the respondents are using full-strength sodium hypochlorite and are routinely removing the smear layer during endodontic treatment. In addition, almost half of the respondents are using an adjunct, such as ultrasonic activation, to aid in their irrigation technique.

Acknowledgments

The authors deny any conflicts of interest related to this study.

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