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Current Trends in Irrigation Protocol during Endodontic Treatment among Post Graduates in India

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Abstract

Aim: The purpose of this study was to determine the current trends in irrigation protocol during root canal treatment among post graduates in dental colleges in india.

Materials and Methods: An invitation to participate in a web-based survey was e-mailed to 500 members of post graduates who belong to the Department of Conservative Dentistry and Endodontics in India. The post graduates of other departments were excluded in the survey. The responders were queried about the type of irrigant(s) they use, the concentration of irrigants, the removal of smear layer, the penetration depth and gauge of the needle, and irrigation protocol in different treatment considerations etc.

Results: Three hundred and forty seven (347) responses were obtained out of 500 survey forms which were sent to post graduates in India with a response rate of 69.4%. The majority of respondents (80.7%) are using NaOCl

as their primary irrigant. Most post graduates using NaOCl (90.2%) and Chlorhexidine (94.8%) with concentrations of 2.6 – 4% and 2%. They are using 5–10 ml (87.3%) of irrigant per canal with a 27 gauge (84.4%) needle inserting up to 1-2 mm short of apex (85.6%).

Conclusion: Majority of post graduates in India are employing (2.6-4%) NaOCl (80.7%) as the primary endodontic irrigant with 27 gauge (84.4%) needle penetrating up to 1-2 mm short of root apex (85.6%). Further studies including all dental practitioners registered under Dental Council of India should be surveyed to regulate and improve the quality of endodontic treatment in dental practice.

Keywords: Chlorhexidine, Irrigation, Smear Layer, Sodium hypochlorite, Survey

Introduction

The success of root canal treatment depends mostly on the elimination of microorganisms from the root canals and prevention of their reinfection.[1] The shaping of root canals is done with the help of stainless steel and nickel titanium instruments. This shaping process is performed in conjunction with copious irrigation to remove necrotic tissue, microbes and biofilms from root canals.[2] In spite of modern instruments and techniques for canal shaping, more than 35% of the root canals are left uninstrumented after non-surgical root canal treatment.[3]

The vital or necrotic tissue remnants in the root canals may provide a source of nutrition for the surviving bacteria.[4] So, the microorganisms which remained in root canals after treatment or those recolonized the filled root canals are the major contributors for endodontic failures. Thus the irrigation protocol plays a key role in debridement of root canals.

According to zehnder[5] the ideal root canal irrigant has been described as being systematically non-toxic, non-caustic to periodontal tissues, possessing a broad antimicrobial spectrum, having little potential to cause an anaphylactic reaction, capable of dissolving necrotic pulp tissue, inactivating endotoxins and either preventing the formation of a smear layer or dissolving it once it has formed. Although many irrigants have been investigated, none have been able to exhibit all the above mentioned properties.

As of now, sodium hypochlorite (NaOCl) is able to meet most of the criteria. It is having broad antibacterial spectrum, and possesses some ability to inactivate endotoxin.[6-8] It is effective at dissolving tissue and removing organic component of the smear layer.[9,10] 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.[11,12] 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.[13,14]

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.[15] Recent research indicates that QMix, 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.[16]

The amount of needle penetration also plays an important role in effective irrigation procedures. This penetration and flushing action of the irrigant depend not only on the anatomy of the root canal system but also on the system of delivery, the volume of the solution used, fluid properties, and the irrigation needle size, type, and insertion depth.[17]

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 post graduates. The purpose of this survey was to ascertain the current irrigation protocol followed by post-graduate students in India.

Materials and Methods

An invitation to participate in a web-based survey was e-mailed to 500 members of post graduates who belong to the Department of Conservative Dentistry and Endodontics in India. The post graduates of other departments were excluded in the survey. A total of 16 questions were asked in the survey for post graduates (Table 1). Questions consisted of multiple choices and multiple selections with options for write-in answers where appropriate. The responders were queried about the type of irrigant(s) they use, the concentration of irrigants, the removal of smear layer, the penetration depth and gauge of the needle, and irrigation protocol in different treatment considerations etc. The data were collected and analyzed using absolute frequencies by

utilizing IBM SPSS Statistics for Windows, version 23.

Table 1: Sample questionnaire

Email Address: IACDE NO:

College Name:

1) Which of the following irrigants do you use clinically? (Please select all that apply)

a) Sodium hypochlorite b) EDTA c) Chlorhexidine d) Hydrogen peroxide

e) Saline f) Sterile water g) Citric acid h) MTAD i) Q Mix j) other irrigant

2) Which of the following irrigant do you primarily use clinically?

a) Sodium hypochlorite b) EDTA c) Chlorhexidine d) Hydrogen peroxide e) Saline f) Sterile water g) Citric acid h) MTAD i) Q MIX j) other irrigant

3) Which of the following concentration of Sodium hypochlorite do you primarily use clinically?

a) < 0.5% b) 0.5% - 1.5% c) 1.6% - 2.5% d) 2.6% - 4% e) 4.1% - 5.0% f) > 5.0% g) I do not use Sodium hypochlorite

4) Which of the following concentration of Chlorhexidine do you primarily use clinically?

a) 0.17% b) 0.18% - 1.9% c) 2.0% d) > 2.0% e) I do not use chlorhexidine

5) How much volume of the irrigant do you employ in a canal?

a) 0.5ml b) 2.5ml c) 5ml - 10ml d) > 10ml

6) Which of the following gauge needle do you use for irrigation?

a) 25 gauge b) 26 gauge c) 27 gauge d) 30 gauge e) 31 gauge

7) What is the depth of penetration of the needle into the canal during irrigation?

a) Pulp chamber b) 1/3 of the root length c) 1/2 of the root length d) 2/3 of the root length e) 1-2mm short of apex f) Up to working length

8) Which of the following irrigant do you use to remove smear layer? (Please select all that apply)

a) Sodium hypochlorite b) EDTA c) Chlorhexidine d) Hydrogen peroxide e) Saline f) Sterile water g) Citric acid h) MTAD i) Q Mix k) Other irrigant

9) Do you routinely aim to remove the smear layer?

a) Yes b) No

10) Does your choice of irrigant(s) differ based on the pulpal or periapical diagnosis?

a) Yes b) No

11) Which of the following irrigants would you use when treating a tooth with radiographic evidence of a periapical lesion? (Please select all that apply)

a) Sodium hypochlorite b) Chlorhexidine c) EDTA d) Hydrogen peroxide e) Saline f) MTAD g) Q Mix h) other irrigant

12) Which of the following irrigants would you use when treating a previously treated tooth? (Please select all that apply) a) Sodium hypochlorite b) Chlorhexidine c) EDTA d) Hydrogen peroxide e) Saline f) MTAD g) Q Mix h) other irrigant

13) Which of the following sequence of irrigation protocol would you use when treating a tooth with vital pulp?

a) 5.25%NaOCl, Saline, 17%EDTA, Saline, 2%CHX, Saline b) 17%EDTA, Saline, 5.25%NaOCl, Saline, 2%CHX, Saline c) 2%CHX, Saline, 5.25%NaOCl, Saline, 17%EDTA, Saline d) 3%NaOCl, Saline, 17%EDTA, Saline, 2%CHX e) 3%NaOCl, Saline, 17%EDTA, Saline f) 5.25%NaOCl, Saline, 17%EDTA, Saline g) Other

14) Which of the following sequence of irrigation protocol would you use when treating a tooth with necrotic pulp?

a) 5.25%NaOCl, Saline, 17%EDTA, Saline, 2%CHX

b) 17%EDTA, Saline, 5.25%NaOCl, Saline, 2%CHX, Saline c) 2%CHX, Saline, 5.25%NaOCl, Saline, 17%EDTA, Saline d) 3%NaOCl, Saline, 17%EDTA, Saline, 2%CHX e) 2%CHX, Saline, 3%NaOCl, Saline, 17%EDTA, Saline f) 5.25%NaOCl, Saline, 17%EDTA, Saline g) Other

15) Which of the following agent is used in the removal of resorptive tissue?

a) 50%Citric acid

b) 90%TCA (Trichloro acetic acid)

c) 3%NaOCl

d) 5.25%NaOCl

e) Other

16) Which of the following sequence of irrigation protocol would you use when treating a tooth for regeneration?

a) 0.5%NaOCl, Saline, 17%EDTA b) 1.5%NaOCl, Saline, 17%EDTA c) 5.25%NaOCl, Saline, 17%EDTA, Saline, 2%CHX, Saline d) 3%NaOCl, Saline, 17%EDTA, Saline, 2%CHX, Saline e) Other

Results

Three hundred and forty seven (347) responses were obtained out of 500 survey forms which were sent to post graduates in India with a response rate of 69.4%.

When asked about the types of irrigants used, it was revealed that Sodium hypochlorite (99.1%) followed by Saline (96.8%), Chlorhexidine (95.1%), EDTA (91.6%), Hydrogen peroxide (7.2%), Sterile water (3.5%), MTAD (0.9%) and Q Mix (0.6%) were the percentages of respondents using irrigants clinically.

The majority of respondents (80.7%) are using NaOCl as their primary irrigant (Figure 1). Most post graduates using NaOCl (90.2%) and Chlorhexidine (94.8%) with concentrations of 2.6 – 4% and 2%. They are using 5–10 ml (87.3%) of irrigant per canal with a 27 gauge (84.4%) (Figure 4) needle inserting up to 1-2 mm short of apex (85.6%) (Figure 2).

Three hundred and twenty seven (94.2%) claimed that they are aiming routinely to eliminate smear layer

(Figure 3), using EDTA (96.3%) followed by NaOCl (79.3%), Citric acid (15.9%), MTAD (14.4%) and Q Mix (11.8%).

Most respondents (98.3%) claimed that their selection of irrigation differs based on pulpal and periapical diagnosis. Chlorhexidine (93.9%) followed by Saline (89%), EDTA (86.7%) and NaOCl (22.2%) are the choice of irrigants when there is a periapical lesion. Three hundred and twenty (92.2%) used NaOCl for irrigating previously treated tooth followed by Chlorhexidine (90.8%), EDTA (85%) and Saline (22.5%).

Most of them are using 2% chlorhexidine as final irrigant of choice in treating both vital (77.8%) and necrotic teeth (80.1%) with a sequence of 3% NaOCl-Saline-17% EDTA-Saline-2% CHX. 90% trichloro aceticacid (TCA) was used mostly (72.3%) to remove resorptive tissue in cases of resorption. The final choice of irrigant in regeneration cases used by most post graduates (79.3%) is 17% EDTA with a sequence of 1.5% NaOCl-Saline-17% EDTA.

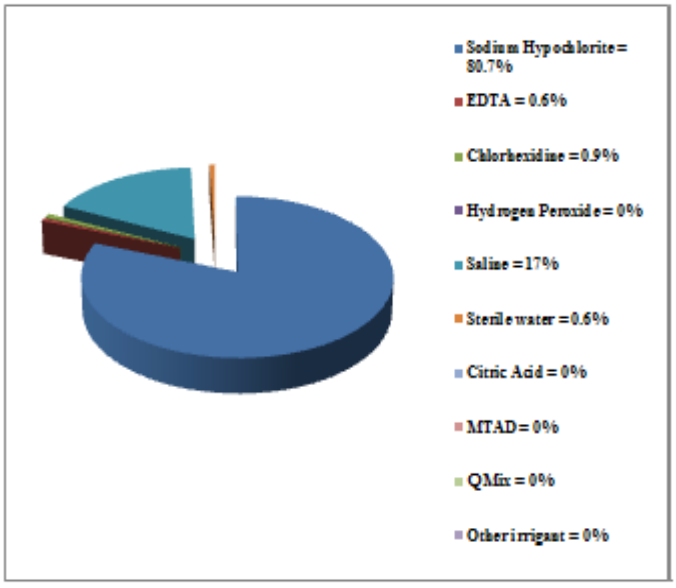

Figure 1: Percentage of respondents who utilize each irrigant as their primary irrigant

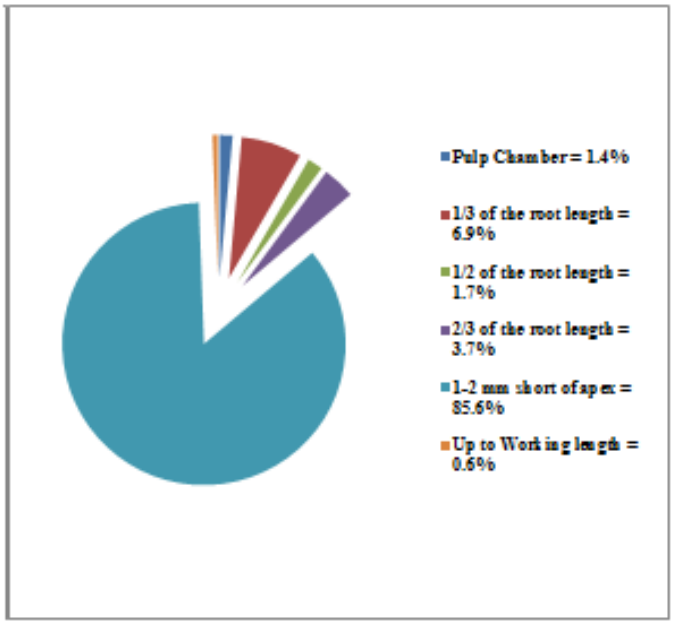

Figure 2: Percentage of respondents on penetration of needle into canal.

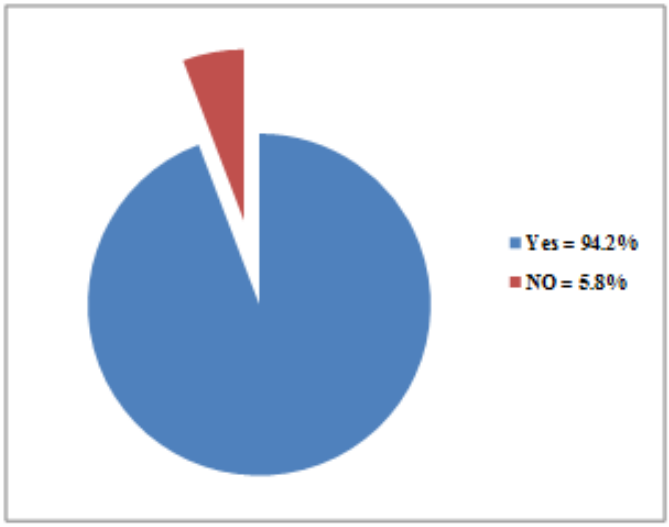

Figure 3: Percentage of respondents aimed to remove smear layer

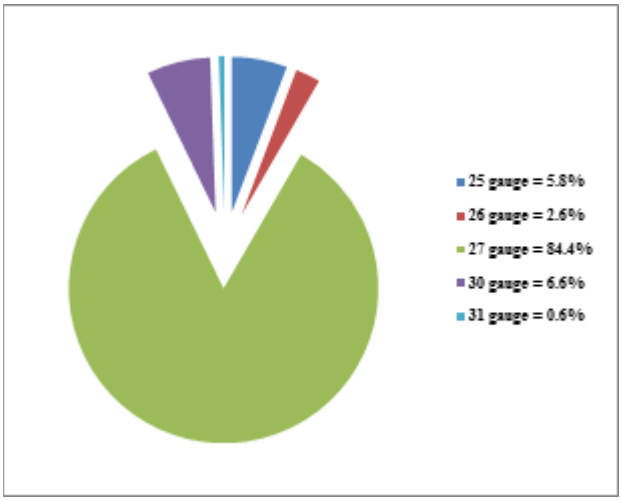

Figure 4: Percentage of respondents on needle gauge used for irrigation

Discussion

The main objective of our survey was to ascertain the irrigation trends being followed in various dental colleges by post graduates of Department of Conservative Dentistry and Endodontics in India. We have excluded post graduates of other departments from filling survey forms by asking IACDE (Indian Association of Conservative Dentistry and Endodontics) number which will be specific. Three hundred and forty seven (347) responses were obtained out of 500 survey forms which were sent to post graduates in India with a response rate of 69.4%.

In this survey majority of respondents (80.7%) use NaOCl as their primary irrigant with (90.2%) a concentration of 2.6-4%. The results were higher than a survey conducted in North Jordan, which reported that only 32.9% used NaOCl, with the main concentration of 0.5%.[18] The possible cause for the widely use of NaOCl perhaps referred to its strong antibacterial characteristic, effective ability on tissue dissolution, and its unique antibiofilm activity.[19,20] The antibacterial feature rose to be the most common motive for irrigants choice in this survey.

According to our survey the highest ranked reasons for irrigant selection is its antibacterial and tissue-dissolving capability. It was found that 87.3% of the respondents use 5-10 ml of irrigants per canal during the shaping and cleaning procedure. Irrigation is commonly applied by a syringe and a needle, which vary in sizes. The relationship between a prepared canal and irrigation needle size is important for apical irrigation. In addition, the proximity of the needle used for irrigation to the root apex plays an important role in removing debris root canal system.[21,22,23] In the current study 85.6% respondents found to penetrate needle up to 1-2 mm short of root apex.

94.2% of all respondents were aimed to remove smear layer by using irrigants like EDTA (96.3%) followed by NaOCl (79.3%), Citric acid (15.9%), MTAD (14.4%) and Q Mix (11.8%). These irrigants removes both the organic and inorganic parts of smear layer. Although 98.3% of all respondents changed their irrigant according to pulp and periapical status, 22.2% use NaOCl when there is a periapical lesion. Incidentally, in the American survey II, 66% of the respondents said they do not alter the irrigant based on the condition of the pulp and periapex.

Most commonly Chlorhexidine is preferred when there is a periapical lesion (93.9%) and in retreatment cases (90.8%) with a concentration of 2% (94.8%). The use of chief irrigants with good substantivity like chlorhexidine was found to be high among the respondents. The earlier studies by Torabinejad recommend the use of chlorhexidine as root canal irrigant, especially in the cases of retreatment and failures, which have increased over the past.[24]

In this survey they used 2% chlorhexidine as final irrigant of choice in treating both vital (77.8%) and necrotic teeth (80.1%) with a sequence of 3% NaOCl-Saline-17% EDTA-Saline-2% CHX to achieve canal

walls clean of debris. 2% CHX was found to be a very effective irrigant against Enterococcus faecalis and was recommended specially to use as final irrigant in necrotic and retreatment cases.[25]

90% trichloro aceticacid (TCA) was used mostly (72.3%) to remove resorptive tissue in cases of resorption. However, 3% NaOCl (14.3%) and 50% Citric acid (9%) are also used to remove resorptive tissue by some of the respondents. The final choice of irrigant in regeneration cases used by most post graduates (79.3%) is 17% EDTA with a sequence of 1.5% NaOCl-Saline-17% EDTA. A lower concentration of NaOCl is used to prevent cytotoxic effects in the periapical region. 2% CHX solution has been found to induce serious cytotoxic effects of stem cells. The cytotoxicity of chx probably prevents clinicians from using it as the final irrigant in Regenration cases. Martin et al found that a final irrigation with 17% EDTA partially reverses the detrimental effects of high-concentration NaOCl solutions on the survival and differentiation of Stem cells of Apical Papilla (SCAP's).[26,27]

These results indicate the desire of many post graduates in improving the irrigation efficacy by choosing different irrigation protocol depending on the clinical situations. Other factors such as adjuncts in irrigation and intracanal medicaments are also significant regarding the complete elimination of microbes from root canal system and should be encompassed in future surveys.

Conclusion

Majority of post graduates in India are employing (2.6-4%) NaOCl (80.7%) as the primary endodontic irrigant with 27 gauge (84.4%) needle penetrating up to 1-2 mm short of root apex (85.6%). The concept of smear layer removal is high (94.2%) among them and there is general trend to modify the irrigant protocol according to the status of the periapex and retreatment cases. Further studies including all dental practitioners registered under Dental Council of India should be surveyed to regulate and improve the quality of endodontic treatment in dental practice.

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