

Irrigation practice among general dental practitioners of Nepal

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Abstract

Background:

Along with biomechanical preparation of the root canal, chemical debridement of the root canal with irrigants is also very important. Many different irrigants and treatment protocols have been advocated for eradication of the infected root canals.

Aim and Objective:

The aim of this study is to determine irrigation practice among general dental practitioners of Nepal and to see if there is any difference in the choice of irrigants between the practitioners who do participate and who do not in education programs.

Materials and Methods:

A questionnaire comprising of 14 questions was distributed to 500 general dental practitioners of Nepal. The participants were asked about their irrigant selection, irrigant concentration, smear layer removal, depth of needle penetration and their participation in any endodontic education programme.

Results:

Among the 500 questionnaire distributed 238 responded. Our data indicate that 95.8% of the participants use sodium hypochlorite. There were participant who use only saline as irrigating solution while treating vital tooth (28.1%), tooth with necrotic pulp (6.7%), tooth with radiographic evidence of periapical lesion (15.1%) and previously treated tooth (20.2%). Majority (78.2%) of the participants never attended any course on irrigation in endodontic treatment after their graduation. The difference between participation in course(s) related to irrigation in endodontic treatment by the participants and the use of NaOCl and CHX is statistically significant ($p=0.000$) ($p=0.001$) respectively.

Conclusion:

Although majority of the participants use sodium hypochlorite during root canal treatment, some of the general practitioners of Nepal are still using normal saline as the only irrigating solution. The general dental practitioners should participate more in education programs related to irrigation in endodontic treatment to know the best irrigating trend.

Key words:

Chlorhexidine, irrigation, smear layer, sodium hypochlorite

Introduction:

The goal of root canal treatment is to remove the inflamed or necrotic pulp and eliminate bacteria from the root canal system and to prevent re-infection¹. Because of the complexity of the root canal system, instrumentation alone cannot remove the tissue remnants and microorganism at the canal fins, isthmus

and cul-de-sacs areas of the root canal². Thus along with the mechanical preparation, chemical debridement of the canal is indispensable during root canal treatment³. The chemical debridement is accomplished with a variety of endodontic irrigants.

The desired property of endodontic irrigants

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include 1) washing action for removal of debris 2) lubricant action for reduction of instrument friction during preparation and facilitate dentin removal 3) organic (dentin collagen, pulp tissue, biofilm) and inorganic tissue(dentin) dissolution property, 4) low surface tension for penetration into canal periphery, 5) property of killing microorganisms even in the biofilm, 6) non irritating or damaging to vital peri-apical tissues, non caustic or cytotoxic effect, 7) do not weaken tooth structure⁴. Unfortunately, to date, there is no single irrigating solution that alone possesses all the requirements of an irrigant. Optimal irrigation is based on the combined use of two or several irrigating solution to obtain effective Irrigation.

A combination of sodium hypochlorite (NaOCl) and Chlorhexidine (CHX) along with use of smear removing agent such as ethylene-diamine- tetra-acetic acid (EDTA) in a specific sequence has been advocated for optimal irrigations. NaOCl is the only root canal irrigant of those in general use that dissolves necrotic and vital organic tissue¹ whereas CHX provides good, continued, antimicrobial activity⁶. For the removal of smear layer and inorganic component (dentin debris) use of chelating agents such as EDTA has been suggested however, it is controversial whether it is advantageous to remove the smear layer formed during root canal instrumentation^{7,8}. The effectiveness and safety of the irrigation also depends on the means of delivery system¹. Various equipments for use in adjuncts to irrigation such as ultrasonic activation and

systems such as EndoVac which is based on negative pressure approach have been developed.⁹ Due to the availability of vast number of materials and techniques, we do not know the irrigation trends among general practitioners. Thus, the purpose of the research is to determine the irrigation trends among the general practitioner of Nepal and also to see if there is any difference in the choice of irrigants between the practitioners who do participate and who do not in education programs.

Materials and methods

A questionnaire comprising of 14 questions was distributed to general dental practitioners with Bachelor of Dental Surgery degree (BDS) of Kathmandu, Pokhara, Bhairawa and Dharan of Nepal. The total of 500 questionnaires were distributed. Questions consisted of multiple choice and multiple selections with options for write in answers where appropriate. The participants were asked about the irrigant(s) they use, the concentration of the irrigant, the use of adjunct to irrigation, the needle gauge used for irrigation, depth of the needle penetration into the canal during irrigation and the use of smear removing agent. The total duration of survey was 4 months (May 2012 to August 2012). Data was analysed using Stastical package SPSS 16.0 (SPSS Inc, Chicago, Ill). Chi square test was done to see if there is difference in the choice of irrigation the participants used and their participation in any course related to irrigation in endodontics after their graduation.

Table 1: Sample questionnaire

- 1) How many years ago did you graduate from dental school?
 - a) >30
 - b) 21-30
 - c) 11-20
 - d) 5-10
 - e) <5
- 2) Which irrigants do you use? (please select all that apply)?
 - a) Sodium hypochlorite
 - b) Chlorhexidine
 - c) Saline
 - d) Sterile water
 - e) EDTA
 - f) Hydrogen peroxide
- 3) Which concentration of sodium hypochlorite do you use?
 - a) <0.5%
 - b) 0.5%–1.5%
 - c) 1.6%–2.5%
 - d) 2.6%–4.0%
 - e) 4.1%–5.0%
 - f) >5.0%
 - g) I do not use sodium hypochlorite

Participants with positive answers Percentage (%)

0
1.3
5.9
13
79.8

95.8
42
93.3
4.2
34.5
63

12.6
35.3
16
23.5
8.4
0
4.2

4) Which concentration of chlorhexidine do you use?	
a) 0.17%	3.4
b) 0.18%–1.9%	16
c) 2.0%	20.2
d) >2.0%	2.5
e) I do not use chlorhexidine	58
5) Do you routinely aim to remove the smear layer?	
a) Yes	80.7
b) No	19.3
6) Does your choice of irrigant(s) differ based on the pulpal or periapical diagnosis	
a) Yes	76.5
b) No	23.5
7) Which of the following irrigants would you use when treating a tooth with a vital pulp?	
a) Sodium hypochlorite	67.2
b) Chlorhexidine	7.6
c) Saline	74.8
d) Sterile water	1.7
e) Other* EDTA	1.7
H ₂ O ₂	2.5
8) Which of the following irrigants would you use when treating a tooth with a necrotic pulp?	
a) Sodium hypochlorite	83.2
b) Chlorhexidine	14.3
c) Saline	54.6
d) Sterile water	0
e) Other* Betadine	1.7
H ₂ O ₂	15.1
Doxycycline	0.8
9) Which of the following irrigants would you use when treating a tooth with radiographic evidence of a periapical lesion?	
a) Sodium hypochlorite	63.9
b) Chlorhexidine	21
c) Saline	68.1
d) Sterile water	3.4
e) Other* H ₂ O ₂	16
Antibiotic	4.2
10) Which of the following irrigants would you use when treating a previously treated tooth?	
a) Sodium hypochlorite	71.4
b) Chlorhexidine	16
c) Saline	63
d) Sterile water	0
e) Other* Betadine	0.8
11) Which, if any, adjuncts to irrigation do you use? (Please select all that apply)	
a) Ultrasonic activation	10.1
b) Sonic activation	0.8
c) Subsonic activation (example: EndoActivator)	0.8
d) Negative pressure (example: EndoVac)	3.4
e) Other	0
f) None	84.9
12) Which gauge needle do you use for irrigation?	
a) 25 gauge	60.5
b) 27 gauge	20.6
c) 30 gauge	3.4
d) 31 gauge	2.5
e) Other* 21 gauge	5
23 gauge	6.7
24 gauge	1.7
26 gauge	1.7
13) What is the depth of penetration of the needle into the canal during irrigation?	
a) Coronal 1/3rd of the root length	66
b) ½ of the root length	13.9
c) Coronal 2/3rd of the root length	16
d) Up to the working length	4.2
14) Have you participated in any course(s) related to endodontic irrigation after your graduation (within 5 years)?	
a) Once	14.3
b) 2-4 times	7.6
c) >4times	0
d) No	78.2

*Options were not included in the questionnaire but were responded by the participants

Results

Among the total number of 500 questionnaires distributed, only 238 participants completed the questionnaire. The sample of the questionnaire along with the obtained result percentage is revealed in Table 1. The difference between participation in course(s) related to irrigation in endodontic treatment by the participants and the use of NaOCl and CHX is statistically significant (for NaOCl, $p=0.000$ and for CHX, $p=0.001$).

Table 2. Irrigants used by the participants

Irrigant	Number	Percentage
NaOCl	10	4.20
CHX	2	0.84
Saline	5	2.10
Sterile Water	0	0
EDTA	0	0
Hydrogen Peroxide	0	0

Table 3. Irrigants used during treatment of vital tooth

Irrigant	Number	Percentage
NaOCl	46	19.32
CHX	4	1.68
Saline	67	28.15
Sterile Water	0	0
EDTA	2	0.84
Hydrogen Peroxide	4	1.68
<i>Number of participants who do not use NaOCl 78 (32.77%)</i>		

Table 4. Irrigants used during treatment of tooth with necrotic pulp

Irrigants	Number	Percentage
NaOCl	76	31.93
CHX	6	2.52
Saline	16	6.72
Sterile Water	0	0
Povidone Iodine	2	0.84
Hydrogen Peroxide	4	1.64
Doxycycline	0	0

Table 5. Irrigants used during treatment of tooth with radiographic evidence of periapical lesion

Irrigant	Number	Percentage
NaOCl	48	20.16
CHX	14	5.88
Saline	36	15.12
Sterile Water	0	0
Hydrogen Peroxide	6	2.52
Antibiotic	0	0

Table 6. Irrigants used during treatment of previously treated tooth

Irrigant	Number	Percentage
NaOCl	70	29.41
CHX	10	4.20
Saline	48	20.16
Sterile Water	0	0
Povidone Iodine	2	0.84

Table 7: Choice of irrigants amongst the practitioners who participated in course related to endodontic irrigation after their graduation

Irrigants	%	p value	Significance
NaOCl	95.8	0.000	***
CHX	42	0.001	***
Saline	93.3	0.332	NS
Sterile water	4.2	0.087	NS
Hydrogen peroxide	63	0.790	NS
EDTA	34.5	0.977	NS

*Chi-square test (χ^2), ***: $p < 0.05$ significant, NS: $p > 0.05$ not significant*

Discussion:

Among the various chemicals suggested for irrigation, sodium hypochlorite has been a gold standard due to its tissue dissolving property which is a highly desirable property whereas CHX is one of the most effective antimicrobial agents used in oral cavity with substantivity^{5,6}. In our survey, 95.8% of the participants used sodium hypochlorite as the primary irrigant. The other commonly used irrigations are normal saline (93.3%) and hydrogen peroxide (63%). However it is also found that 2% of the participants used only normal saline as the irrigating solution which is not justified as normal saline has no significant antimicrobial property and it does not dissolve pulp tissues. Its use can only

help in flushing of the root canal during biomechanical preparation¹⁰. In most of the studies, normal saline is just used as a control sample^{11,12,13}

Several studies have investigated the microflora of root canal system infections. The microflora in primary root canal infections, tooth with necrotic pulpal tissue, tooth with a periapical lesion and in secondary root canal infections, the type and quantity of microbial flora are different^{14,15,16}. In teeth with an unsuccessful root canal treatment Gram-positive facultative aerobics, especially *Enterococcus faecalis* has been isolated which need stronger antimicrobial agents for their eradication^{15,17}.

It is unanticipated to find that there are 32.77% (Table 3) of the participants in the study who do not use sodium hypochlorite when treating a tooth with vital pulp. More disturbing is to find that there are participant who use only saline as irrigating solution while treating vital tooth (28.15%) (Table 3), tooth with necrotic pulp (6.72%) (Table 4), tooth with radiographic evidence of periapical lesion (15.12%) (Table 5) and previously treated tooth (20.26%) (Table 6).

Another commonly used irrigating solution the participants used is hydrogen peroxide. The mechanism of action of hydrogen peroxide (H_2O_2) involves the reaction of superoxide ions to produce hydroxyl radicals which can attack membrane lipids, DNA and other essential cell components¹⁸. In various studies, it is shown that hydrogen peroxide has shown some potential in reduction of *E. faecalis* but it was the least effective irrigant when used alone¹⁹.

No general agreement exists regarding the optimal concentration of NaOCl, which ranges from 0.5% to 5.25%. Higher the concentration better is the antimicrobial efficacy¹³. In our study, majority of the participants are using 0.5 to 1.5% of NaOCl. Studies have shown significant antimicrobial action even at the lowest concentration of 0.5-1%. However, at higher concentration the time needed for inhibition of bacterial growth is shortened²⁰. Higher concentration increases the ability to dissolve necrotic and vital pulp tissues but at the same time has a higher risk of damage to periapical and oral tissues²¹. Chlorhexidine (CHX) has been found to be as effective antimicrobial agent as NaOCl. But CHX possesses no tissue dissolving property so cannot be used as the only irrigating solution during the root canal therapy^{1,5}. A combination of NaOCl and CHX is found to have superior cleaning

of root canal system.^{10,19,21}

But the interaction of NaOCl and CHX was found to form insoluble precipitate and toxicologic studies in animals have shown it to have some toxic and carcinogenic effects²². This precipitate was found to be of clinical relevance with regards to staining, hampering the seal of obturation, and potential leaching into the periapex. Whereas, some studies have found the precipitate to be of some other compound which is not toxic by itself but can form toxic products²³. Thus it is suggested to reduce the precipitate formation by using intermediate flushes of saline or distilled water in greater volumes to enhance the dilution effect on NaOCl before using CHX as final irrigant²⁴. Our study does not inquire about the sequence of irrigating solutions used so the number of participants who use the combination of NaOCl and CHX without the use of intermediate flush is not known. In the present study 58% of the participants do not use CHX.

The concentration of CHX suggested is 2%⁶ but studies have shown efficacy even at lower concentration¹⁹. In this study 20.2% used 2% CHX.

It is surprising to find that 66% of the participants penetrate the irrigation needle only up to coronal 1/3 of the root. The reason for this may be because of use of large gauge needle (25 gauge) by majority of the participants (60.5%) or may be because of the size of prepared canal being smaller than the gauge of the needle used during irrigation which is not known in this study. But the proper cleaning of apical 1/3 of the root canal with the use of such needle is doubtful.

The biomechanical preparation of the root canal produces smear layer containing dentin debris, organic remains such as pulp tissue, odontoblastic process, necrotic debris, and microorganisms and their metabolic products²⁵. The smear layer prevents effective penetration of antimicrobial agents and root canal sealers into dentinal tubules compromising the quality of the root filling. Thus removal of smear layer has been suggested^{26,27}. NaOCl removes only the organic portion of the smear layer. Solution like EDTA is recommended to be used for removal of its inorganic portion¹⁰. In this study, it is found that majority of the practitioners (80.7%) routinely aim to remove smear layer.

Several irrigation devices and techniques have been introduced to aid in root canal debridement. Since agitation of irrigants has been shown to increase

irrigation effectiveness²⁸, various manual agitation techniques and machine assisted agitation devices such as ultrasonic activation, sonic activation, subsonic activation, and negative pressure technique as in case of EndoVac system have been developed⁹. Ultrasonic irrigation has been shown to produce clearer canals and isthmuses²⁹ but procedural accidents and creation of irregularly shaped canals are possible with its use³⁰. Sonic and subsonic activation also provide clear canals but their effectiveness in the apical one third is poor⁹. EndoVac system is an apical negative pressure irrigation device that is designed to deliver irrigating solution to apical end of the canal system and suction out debris³¹. It has been shown to introduce a higher flow of irrigant and produce better debridement lmm from the working length when compared with other irrigation devices³². In addition this system has been shown to extrude less irrigant and thus less risk of NaOC1 incident³³. In this study, only 3.4% of the participants use EndoVac device and majority (84.9%) do not use any adjunct to irrigation. The reason for this might be because the adjunct to irrigation system is not taught in detail during BDS course. Also the availability and cost of such devices might have made it not so popular among the general dental practitioners who participated in this survey.

It was alarming to find that 78.2% of the participants

have not participated in any course related to “irrigation in endodontic treatment” after their graduation. The difference between the use of NaOC1 and CHX and the participation of the practitioners in such course is statistically significant ($p < 0.05$) (Table 2).

Other factors such as volume of the irrigant and duration of the irrigation, which are also important regarding the complete eradication of microorganism from the root canal, were not included in the study.

Conclusion:

Most of the participants use sodium hypochlorite during root canal treatment however, some of the general practitioners of Nepal are still using normal saline as the only irrigating solution which has no or minimum benefit during endodontic treatment. The difference between the participation of the practitioner in courses related to irrigation in endodontic treatment after graduation and the use of NaOC1 and CHX are statistically significant. The general dental practitioners should participate more in education programs related to irrigation in endodontic treatment to know the best irrigating trend.

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