IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 16, Issue 10 Ver. II (Oct. 2017), PP 38-44
www.iosrjournals.org

Root Canal Irrigation Trends When Using Sodium Hypochlorite: A Nationwide Survey Amongst Indian Dentists.

*Urvashi Sunil Keswani[1] Ajinkya Mansingh Pawar[2]
[1]*(Intern) Department Of Conservative Dentistry And Endodontics, Nair Hospital Dental College, Mumbai, India*
[2] *(Professor) Department Of Conservative Dentistry And Endodontics, Nair Hospital Dental College, Mumbai, India.*
*Corresponding Author: *Urvashi Sunil Keswani*

Abstract:
Introduction. *It is a well known fact that microorganisms either remaining in the root canal space after endodontic therapy or recolonizing the canal system post-therapy are the main cause of endodontic failure. While most practitioners spend a great deal of time on shaping procedures, not much emphasis is paid on irrigation. There is a great deal of confusion regarding the choice of irrigant, methods and protocols followed during irrigation of the canal systems. The purpose of the current survey was to find the various irrigation techniques and protocols followed by practitioners nationwide and discuss sodium hypochlorite as an irrigant.*
Methodology: *An anonymous questionnaire with ten questions covering all aspects of irrigation protocols pertaining to sodium hypochlorite was formulated using google forms® (http://docs.google.com/forms) and was sent to the intended participants across different platforms like whatsapp®, facebook® and email, responses to which were duly noted.*
Results. *We received 818 responses giving us a response rate of 40.9%. Majority of practitioners who took the survey were general dentists. A total of 45.7% of dentists said they used 5.25% sodium hypochlorite as their irrigant of choice, and 67.7% of the respondents said they stored the irrigant in its original container. 59.2% of the dentists taking the survey used side vented needles for the purpose of irrigation. 56.2% of the respondents claimed to use 5ml of irrigant per canal. When questioned regarding the adjuncts used for irrigation 43.8% dentists said they used Manual Dynamic Agitation Technique for agitation. When questioned regarding the most common complication witnessed, 61.5% dentists complained of damaged clothing. 62.4% of the practitioners said they used sodium hypochlorite in retreatment cases.*
Conclusion. *Dental practitioners in the country use sodium hypochlorite with a majority of them preferring 5.25% concentration as a primary irrigant. Also, during retreatment cases most of them use sodium hypochlorite which calls for attention. The major complications witnessed by the dentists were damaged clothing.*
Keywords: *irrigation; irrigation protocols; root canal treatment; sodium hypochlorite, survey*

Date of Submission: 25-09-2017 Date of acceptance: 05-10-2017

I. Introduction

The major objective in endodontic treatment is to disinfect the entire root canal system (RCS) and rid it off microorganisms and infected pulpal tissue remnants along with prevention of re-infection [1]. Even with modern techniques in endodontics that use motorized nickel-titanium (niti) files, more than 35%of the root canal's surface is left un-instrumented. [2] This unmet goal of disinfection may be accomplished using mechanical instrumentation and chemical irrigation, in conjunction with medication of the root canal between treatment sessions. [1] Copious irrigation of the root canal helps by eradicating microorganisms, flushing debris, and removing both the organic and inorganic portions of the smear layer from the RCS. [3]

Irrigating solutions have adequate antimicrobial activity and are capable of complete smear layer removal, nevertheless they can be irritating to the periapical tissue if they gain entry, causing severe pain, inflammation, and delayed healing. However, mechanical debridement and copious irrigation for a minimum of 20 minutes with 2.5% to 6% solutions of sodium hypochlorite followed by a rinse with 17% solution of ethylenediaminetetraacetic acid and a final rinse with 2% chlorhexidine has been the recommended choice. [4] Sodium hypochlorite, an excellent non-specific proteolytic and antimicrobial agent, is the most commonly used irrigating solution in root canal treatment. However, it exerts no effect on the inorganic component of the smear layer. [4] Thus, chelating acid solutions have been recommended for removing the smear layer from instrumented root canals, including ethylenediaminetetraacetic acid, citric acid and phosphoric acid. [5] In an effort to improve

the effectiveness and delivery of the irrigating solution, several different adjuncts have been developed. Both manual and machine-assisted systems have been studied to improve canal cleanliness and treatment outcomes. [6] Although various irrigating solutions and treatment modalities have been reported in literature, but the varying methodology and trends in using sodium hypochlorite as an irrigating solution is sparsely explored. Thus, the current survey was carried out to determine the trends in using sodium hypochlorite as a root canal irrigant amongst Indian dentists

II. Material And Methods

An anonymous survey was conducted using a questionnaire formulated using Google forms® (http://docs.google.com/forms) and was sent to a total of 2000 dentists registered with the Dental Council Of India across different platforms like email, WhatsApp®, and Facebook®. The questionnaire (see below, TABLE 1) consisted of 10 questions with multiple-choice answers covering all aspects of irrigation protocols pertaining to sodium hypochlorite and was formulated with the help of two experts in the field. Simple random sampling was used for choosing the participants. We received a total of 818 responses (response rate 40.9%), which were recorded. The questions were framed in such a manner that all information regarding the use of sodium hypochlorite could be gained. Multiple choices were available with multiple selections where appropriate. The questionnaire was kept live for a period of 5 weeks. Data was analyzed using the Statistical Package for Social Sciences (SPSS) software version 21.0 (SPSS Inc., Chicago, IL, USA). Numbers and percentages were produced to summarize the data. Also, the chi-square test was used for comparisons among subgroups. The level of significance was set at ($P< 0.05$).

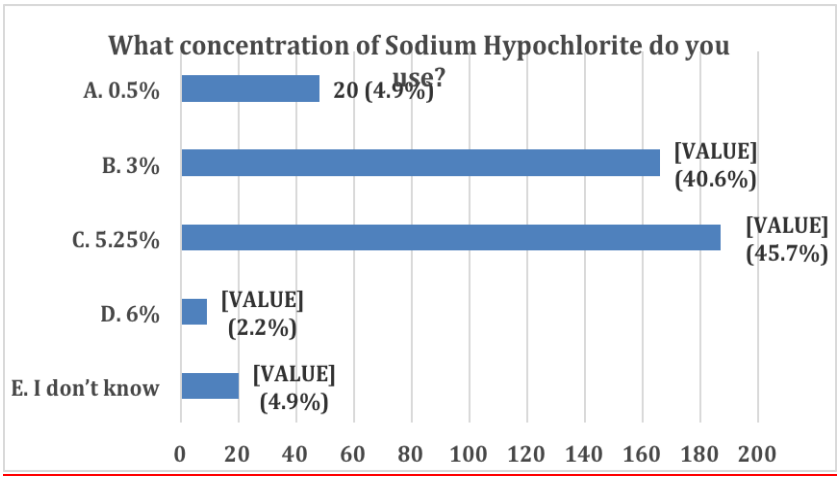
Participants who agreed to take the survey were explained the aim and objectives of the study and informed consent was obtained.

TABLE 1: SAMPLE SURVEY QUESTIONNAIRE

1. What is your qualification?			
a. BDS	b. Endodontist	c. Periodontist	d. Prosthodontist
e. Pedodontist	f. Oral Radiologist	g. Oral Pathologist	h. Orthodontist
i. Public Health Dentist			
2. What concentration of sodium hypochlorite do you use?			
a. 0.50%	b. 3.00%	c. 5.25%	d. 6.00%
e. I don't know			
3. What is your storage medium for sodium hypochlorite?			
a. Open container	b. Opaque glass bottle	c. Plastic syringe	d. Original container
e. Clear plastic	f. Fresh solution each time		
4. What needle do you use for the purpose of irrigation?			
a. End Vented		b. Side Vented	
5. What volume of irrigant do you use per canal?			
a. 5 ml	b. 10 ml	c. 15 ml	d. 20 ml
e. Not Sure			
6. Do you activate/agitate the irrigant?			
a. Yes		b. No	
7. What irrigating system do you use most frequently?			
a. Manual dynamic agitation (MDA) using master apical gutta-percha.		b. EndoActivator	
c. Passive ultrasonic irrigation (PUI)		d. EndoVac	
e. Canal Brushes		f. Not Applicable	
8. Which is the most common complication you've witnessed in your practice regarding sodium hypochlorite use?			
a. Damage to clothing		b. Damage to Eye	
c. Injection beyond periapical area		d. Allergic reaction to sodium hypochlorite	
e. Other			
9. Which irrigant do you use in re-treatment cases?			
a. Chlorhexidine		b. MTAD	
c. Sodium Hypochlorite		d. Qmix	
e. Other			
10. Main reason to irrigate the canal?			
a. Smear layer removal		b. Debris removal	
c. Dissolution of pulp		d. Cleaning of un-instrumented areas of root canal	

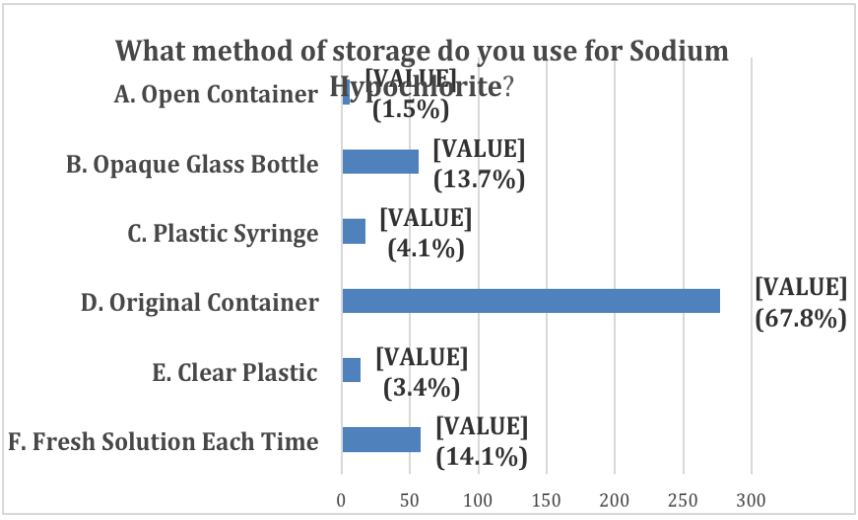
III. Results

A high percentage of respondents, that is 67% of the practitioners used an adjunct to irrigation, There were 818 respondents out of 2000, obtaining a response rate of 40.9%. Majority of dentists who took the survey were practicing general dentistry.When asked about the concentration of sodium hypochlorite used, it revealed that 45.7% of the respondents used 5.25% sodium hypochlorite, 40.6% used 3% and 11.5% used 0.5% concentration of the irrigant. Also, 2.2% of the respondents used 6% of the irrigant and 4.9% of them didn't know the exact concentration used by them. (Graph 1)



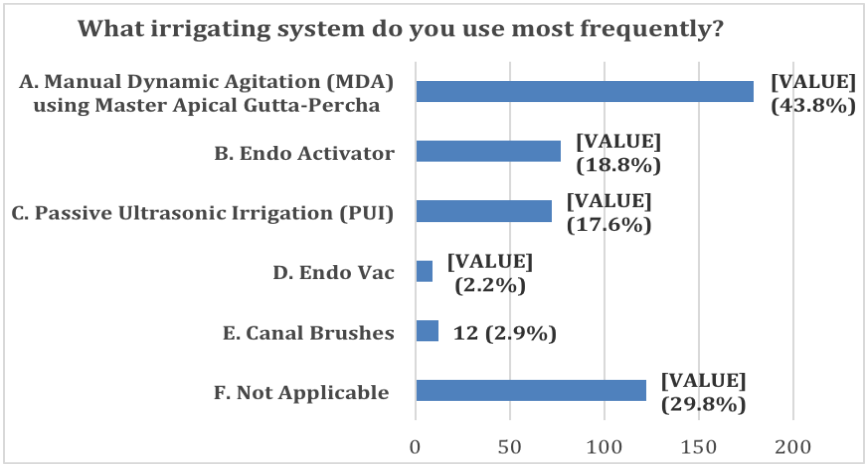
Graph 1

When questioned regarding the method of storage of sodium hypochlorite irrigating solution, 67.7% of the respondents stored the irrigant in it's original container, 14.2% used fresh solution of the irrigant each time, 13.7% stored the irrigant in an opaque container, 4.2% in plastic syringes, 3.4% in clear plastic bottles and 1.5% of them stored the irrigant in open containers. (Graph 2)



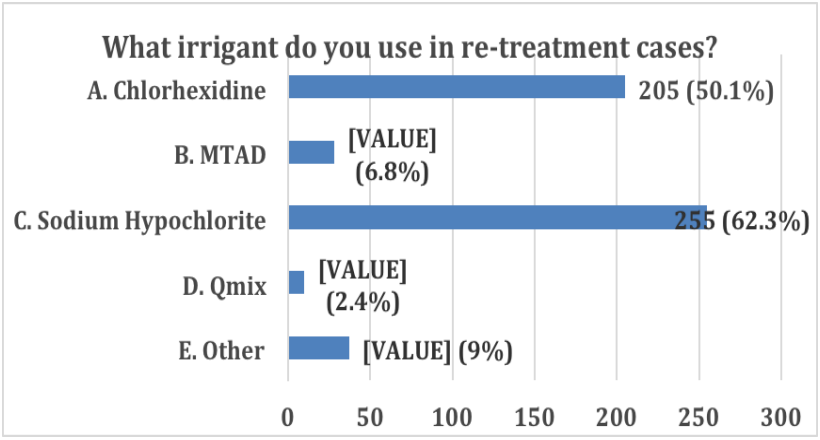
Graph 2

Our results revealed that majority of respondents, 59.2% used side vented needles and 45.5% used end vented tip design of needle for the purpose of irrigation. When asked about the volume of irrigant used per canal, 56.2% of the respondents claimed to use 5ml of irrigant per canal, 16.4% use 10ml of irrigant, 8.6% used 15ml of irrigant per canal, 7.3% of the respondents claimed to use 20 ml of irrigant for the purpose of irrigation and 14.7% of the respondents were not sure of the volume of irrigant used by them of which 43.8% used Manual Dynamic Agitation (MDA) with master apical guttapercha cone. 18.8% of practitioners who took the survey use the Endo Activator while 17.6% used Passive Ultrasonic Irrigation (PUI). Newer negative pressure systems like EndoVac were used only by 2.2% of the practicing dentists who took the survey while 29.8% of respondents did not use any adjuncts to irrigation. (Graph 3)



Graph 3

When questioned regarding the most common complication witnessed in their dental practice regarding sodium hypochlorite use, 61.5% of the respondents complained of damaged clothing due to the bleaching action of hypochlorite owing to its nascent oxygen content. 25.4% of the respondents witnessed injection of the irrigating solution beyond the periapicalarea , 6.6% of the practitioners witnessed allergic reactions to the irrigating solution while only 2.2% of the respondents witnessed damage to the eye on irrigating the root canal system with sodium hypochlorite. When asked about the irrigant used most frequently in retreatment cases, 62.4% of the clinicians said they used sodium hypochlorite, 50.2% of the respondents said they used chlorhexidine and 6.8% of the practitioners who took the survey said they used MTAD while only 2.4% said they used QMix in retreatment cases. (Graph 4)



Graph 4

When asked regarding the main reason to irrigate the canal, 62.2% of the respondents said that cleaning un-instrumented parts of the canal was their main aim behind irrigating the root canals. 49% of the respondents irrigated canals for the purpose of debris removal, 46.3% irrigated root canals for dissolution of pulp while 33.9% said smear layer removal was their main aim of irrigation.

IV. Discussion

This survey aimed to collect data from practicing general and specialist dentists in India regarding the various trends followed in using sodium hypochlorite as an irrigating solution. Sodium hypochlorite is said to be the most commonly employed root canal irrigant till date. However, no general agreement exists regarding its optimal concentration that ranges from 0.5% to 5.25%. [22] In current survey, 45.6% of respondents said they used 5.25% concentration of sodium hypochlorite as their irrigant of choice. The endodontic use of commercially available 5.25% sodium hypochlorite (full strength bleach) has raised some concerns like persistent pain on extrusion beyond the root apex leading to tissue necrosis due to the excellent tissue dissolving ability of sodium hypochlorite. Although rare, severe complications have been reported after accidental injection of 5.25% sodium hypochlorite beyond the root apex. [19] Though it is an extremely potent tissue solvent, it is highly cytotoxic to vital tissues and there is no significant difference in tissue dissolving and antibacterial

capabilities of 1%, 3% and 5.25% sodium hypochlorite. [7] It was observed that 0.025% was a safe concentration for clinical use maintaining the antimicrobial action without harmful effects of sodium hypochlorite on periapical tissues. [8] Many studies recommend its use at 0.5% in order to obtain acceptable cytotoxic and bactericidal levels. [9] Another study stated that the use of sodium hypochlorite in concentrations between 0.5-1% are most recommended for routine clinical use as they establish the best balance between tissue dissolution capability, antimicrobial activity, and biocompatibility. [16][18] Concentrations used vary down from 5.25% depending on the dilution and storage protocols of individual practitioners. Solution warmers are available to increase the temperature up to 60°C. Raising the temperature increases the bactericidal and pulp dissolution activity, although the effect of heat that is transferred to the adjacent tissues is unclear. [10] Thus, a 0.5 to 1% solution can act the same way as a 5.25% solution when used for 30 minutes at an increased temperature. [11] From the point of view of deterioration in concentration of available chlorine, the storage place and type of container chosen by the practitioners is an important criterion to be analyzed. The disinfecting efficiency of sodium hypochlorite depends on the concentration of undissociated hypochlorous acid in solution. Hypochlorous acid exerts its germicidal effect by an oxidative action on sulphydryl groups of bacterial enzymes. As essential enzymes are inhibited, bacterial populations are reduced. Thus, storage of sodium hypochlorite is a very important point to look into in order to preserve the efficacy of the irrigating solution. When assessing the method of storage, majority of the respondents (67.8%) stored the irrigating solution in the original closed container. This is agreement with an article by Clarkson et al., which reinforces the need to store sodium hypochlorite in closed containers. [12] Repeated opening of the containers results in greater loss in chlorine concentration of diluted sodium hypochlorite solutions, perhaps because a lower concentration of sodium hydroxide allows the pH to drop more rapidly. [11] In accordance with the same study, diluted solutions left open deteriorated rapidly but deterioration slowed with time. [11] Solutions stored in syringes exposed to sunlight showed the most rapid loss of chlorine content. [11] Heated solutions lost nearly 5% of its strength in six hours whereas, diluted bleach surprisingly increased its chlorine content in open bowls which can be attributed to the evaporation of water. [11] According to an article by Piskin et al., regarding stability of various sodium hypochlorite solutions, solutions containing 0.5% available chlorine stored at 4°C and 24°C and 5% solutions stored at 4°C showed satisfactory stability at 200 days.[13]According to our survey, very few respondents that is 13.7% stored the solution in opaque containers. Thus emphasis needs to be paid on educating Indian dentists regarding the need to use closed opaque containers to store sodium hypochlorite irrigating solution to prevent deterioration of the solution on exposure to sunlight. Different irrigation needle designs may affect the efficiency of endodontic irrigation in cleaning the root canal. [15].

Extrusion of the irrigating solution beyond the apex has been reported and has been found to cause inflammation, discomfort, pain, and delayed healing. [13] According to responses received in our survey, 59% of our respondents said they used the side vented needles for the purpose of irrigation with sodium hypochlorite. Irrigation needles with a side opening have been developed to minimize the risk of extrusion and tissue damage. [14] Our result was in accordance with a study performed by Kahn et al., which reported that side vented closed-ended needles were more efficient as opposed to conventional end vented needles in clearing red food dye from root canals. [15] However, according to a recent study the two different needle designs (side vented and end vented) resulted in similar percentages of apical cleaning for all root canals. The volume of irrigant used in the process of irrigating a root canal in of utmost importance. An increase in the volume of irrigant used is correlated with a reduction of intra-radicular microorganisms and improved canal cleanliness. [14][16] According to a study conducted by Yamada et al., A minimum of 10-20 ml of irrigant for each canal followed by a final high volume rinse after the shaping procedure is completed is the recommended choice. [17] According to Schafer, the volume of irrigant to be used between instrumentation steps is 2-5ml, and 5ml of irrigant is to be used per canal. [16] When asked about adjuncts used in the irrigation procedure, a high percentage of respondents that is 67.1% of the respondents said they used various forms of adjuncts to irrigation. However, only 2.2% of the respondents used the latest systems based on negative pressure like EndoVac. Most practitioners that is 43.9% said they used Manual Dynamic Agitation (MDA) with master apical guttapercha for the purpose of activating or agitating the irrigant. According to a study by Benjamin A Nielson and J Craig Baumgartner, the EndoVac system is superior to the conventional manual dynamic agitation method as the EndoVac has the ability to safely deliver the irrigant to working length. [18] With the EndoVac, extrusion out the apex is avoided as the irrigant is pulled into the canal and removed by negative pressure at working length which is not seen with conventional needle irrigation that occurs due to binding of the needle or over-insertion of the needle tip beyond working length. [19] Thus, there is a very strong need to introduce these modern systems at affordable costs for the practitioners.

Improper use of sodium hypochlorite may lead to undesirable outcomes ranging from damage to clothing to allergic responses and extrusion beyond periapical area. Ideally, all irrigants must be confined to the root canal space. [16] However, on certain occasions, extrusion beyond the periapical area does occur either due to over-

instrumentation (iatrogenic), open apices of teeth, unnoticed perforations, or external resorption. When questioned regarding the most common complication witnessed during irrigation of root canals with sodium hypochlorite, 61.5% of the respondents said they witnessed damage to clothing. This is in accordance with a study done by Jackson et al., [20] Spillage of even minute quantities of this agent can cause great damage to clothing due to its bleaching action. The patient should be made to wear protective glasses and a bib; also transfer of syringes filled with hypochlorite must be carried out with caution. Shockingly, 25.4% of the respondents said they witnessed extrusion beyond the periapical area. When sodium hypochlorite is extruded beyond the root apex, the reaction is similar to that of a chemical burn leading to a localized or extensive tissue necrosis. [19] Our result is not in accordance with a study done by Haapaslo et al. as they found this complication to be rare if the procedure is performed accurately. [19] Conservative management for hypochlorite complications has been recommended. [20] While this may be the accepted norm in patients with a mild reaction, it is not universally accepted. Immediate and appropriate referral of the patient to the concerned professional is necessary, as the consequences cannot be predicted from oropharyngeal symptoms. [19] When questioned regarding the main choice of irrigant in retreatment cases, 62.4% of practitioners said they used sodium hypochlorite whereas, 50.2% of the respondents said they used Chlorhexidine (CHX). Root canal retreatment is a non-surgical procedure that deals with removal of the root filling materials and reshaping, cleaning and disinfecting the root canal system, followed lastly by re-obturation. According to an article by Ercan et al., combination of calcium hydroxide and 1% CHX is the recommended choice of irrigant and intra-canal medicament combination. [21] According to another article by Kohli et al., 2% CHX is the most effective in retreatment cases. [22] Since greater percentage of respondents said they use sodium hypochlorite irrigant in retreatment cases, this aspect of irrigation should be dwelled into detail by practicing dentists in order to prevent reinfection of the canal system. When questioned regarding the main reason to irrigate the root canal, 62.2% of the practitioners said their aim was to clean the un-instrumented areas of the root canal. 49% of the respondents stated that their main objective was debris removal while 46.3% said their aim was dissolution of pulp tissue. Only 33.9% of the practitioners said that smear layer removal was their main aim behind irrigating a root canal. Continuous irrigation with recapitulation should be done in order to dissolve the pulp tissue and prevent blockage by accumulated debris. Inadequate irrigation may leave little debris and microorganism laden pulp tissue giving rise to pain and discomfort.

V. Conclusion

Within the limitations of the current study it can be concluded that the following major conclusions which can be drawn from the current study:

1. Majority of the Indian dentists advocate the use of sodium hypochlorite as an endodontic irrigant.
2. Inappropriate storage of sodium hypochlorite was noticed.
3. Majority of Indian dentists use side-vented needles for irrigation.
4. Majority of the Indian dentist who used Hypochlorite had most common complication of damaged clothing.

Acknowledgements

"The authors deny any conflict of interests"

References

[1]. Mohammadi Z. Sodium Hypochlorite in endodontics- an update review. Int Dent J 2008; 58: 329-41.
[2]. Peters OA, SchnonenbergerK,Laib A. Effects of four NiTi preparation techniques on root canal geometry assessed by microcomputed tomography. Int Endod J 2001; 34: 221-30.
[3]. Prente JM, Loushine RJ, SusinL.Root canal debridement using manual dynamic agitation or the EndoVac for final irrigation in a closed system and an open system. Int Endod J 2010; 43; 1001-1012.
[4]. Regan JD,Fleury AA. Irrigants in nonsurgical endodontic treatment. J Ir Dent Assoc 2006; 52: 84-92.
[5]. Garberoglio R, Becce C. Smear layer removal by root canal irrigants. A comparative scanning electron microscopic study. Oral Surg Oral Med Oral Pathol 1994; 78: 359-367.
[6]. Gu L, Kim JR, Ling J. Review of contemporary irrigant agitation techniques and devices. J Endod 2009; 35: 791-804.
[7]. Baumgartner JC, Crenin PR. Efficacy of several concentrations of sodium hypochlorite for root canal irrigation. J Endod 1992;18: 605-12.
[8]. Kozol RA, Gillies C, Elgebaly SA. Effects of sodium hypochlorite (Dakin's solution) on cells of the wound module. Arch Surg 1988; 123: 420-423.
[9]. Anders Bystrom,Goran Sundquist, Spangenberg. Bacteriologic evaluation of the effect of 0.5% sodium hypochlorite in endodontic therapy. Oral surg, Oral med, Oral pathol 1983; 55:307-312.
[10]. T, Schaetzle M, GZehnderSirtes, Waltimo M. The effects of temperature on sodium hypochlorite short-term stability, pulp dissolution capacity, and antimicrobial efficacy. J Endod 2005; 31: 669-71.
[11]. Gernhardt C. R, Eppendorf. K, Kozlowski A. Toxicity of concentrated sodium hypochlorite used as an endodontic irrigant. Int Endod J 2004, 37: 272–280.
[12]. Clarkson RM, Moule AJ, Podlich HM. The Shelf Life of Sodium Hypochlorite Irrigating Solutions. Aust Dent J 2001; 46 : 269-76.
[13]. Pişkin B, Türkün M. Stability of various sodium hypochlorite solutions. J Endod1995; 21: 253-255.
[14]. Kahn FH, Rosenberg PA, Gliksberg J. An invitro evaluation of the irrigating characteristics of ultrasonic and subsonic handpieces and irrigating needles and probes. J Endod 1995; 21: 277-80.

[15]. Guerreiro-Tanomaru, Juliane Maria, Loiola Lívia Etchebehere, Efficacy of four irrigation needles in cleaning the apical third of root canals. Braz Dent J 2013; 24: 21-24.
[16]. McComb D, Smith D. C. and Beagrie G. S. The Results of in vivo Endodontic Chemomechanical Instrumentation — A Scanning Electron Microscopic Study. Int Endod J 1976; 9: 11–18.
[17]. Schäfer E, Bössmann K. Antimicrobial efficacy of chloroxylenol and chlorhexidine in the treatment of infected root canals. Am J Dent 2001;14: 233-237.
[18]. Sedgley C, Applegate B, Nagel A. Real-time imaging and quantification of bioluminescent bacteria in root canals in vitro. J Endod 2004; 30: 893-8.
[19]. Haapasalo M, Endal U, Zandi H. Eradication of endodontic infection by instrumentation and irrigation solutions. Endodontic Topics 2005, 10: 77–102.
[20]. Matthias Zehnder. Root canal irrigants. J Endod 2006; 32:389-398.
[21]. Hales JJ,Jackson CR, Everett AP et al. Treatment protocol for the management of a sodium hypochlorite accident during endodontic therapy. Gen Dent 2001; 49:278-81.
[22]. Ertugrul Ercan, Mehmet Dalli, Turksel Dulgergil. Effect of intracanal medication with calcium hydroxide and 1% chlorhexidine in endodontic retreatment cases with periapical lesions: an invivo study. J Formos Med Assoc 2007: 217-228.
[23]. Berber V. B, Gomes B. P. F. A, Sena N. T. Efficacy of various concentrations of NaOCl and instrumentation techniques in reducing Enterococcus faecalis within root canals and dentinal tubules. Int Endod J 2006; 39: 10–17.

*Urvashi Sunil Keswani. "Root Canal Irrigation Trends When Using Sodium Hypochlorite: A Nationwide Survey Amongst Indian Dentists." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 16.10 (2017): 38-44