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Irrigant Selections among Arab Dentists: Survey-Based Research

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Abstract: The use of irrigants is an important part of endodontic treatment .The aim of this study was to evaluate the current trends and selections in irrigation among Arab dentist. A standardized questionnaire about irrigants used during root canal treatment distributed to Arab active dentist, the questionnaire comprised questions about irrigant selection, irrigant concentration, smear layer removal, and use of adjuncts to irrigation. This study took place in department of restorative dental Sciences, AlFarabi College for Dentistry and Nursing, Riyadh, Saudi Arabia between May and July 2017. In this study sodium hypochlorite was the most used irrigating solution among respondents (97.6%) followed by saline (54.2%) and chlorhexidine gluconate (43.6%). Only 28.4% of respondents used the highest concentration of sodium hypochlorite. Antibacterial capability was the main reason for irrigant selection (64.1%) followed by tissue dissolution (29.6%). It has been concluded in this study that sodium hypochlorite was the most used irrigating solution among Arab dentists and there was common use of saline as irrigant. The majority of Arab dentists routinely aim to remove the smear layer during irrigation of root canals and less than half of Arab dentists used adjuncts to activate the irrigation of root canal system.

Keywords: Arab dentists; Biocompatibility; Irrigation; Smear layer; Sodium hypochlorite.

INTRODUCTION

Elimination of bacteria and debris from infected root canals is a complicated task. Many procedures have been described to reduce the number of microorganisms in the root canal system, including the use of various instrumentation techniques, irrigation regimens, and intracanal medicaments.

The use of chemical agents during instrumentation to completely clean all aspects of the root canal system is central to successful root canal treatment [1].

The use of irrigating solutions is an important part of effective chemomechanical preparation. It enhances bacterial elimination and facilitates removal of necrotic tissue and dentine chips from the root canal space. Irrigants can prevent packing of the infected hard and soft tissue apically in the root canal and into the periapical area [2].

The ideal endodontic irrigant should possess the following characteristics: be an effective germicide and fungicide, be non-irritating to the periapical tissues, remain stable in solution, have a prolonged antimicrobial effect, be active in the presence of blood, serum, and protein derivates of tissue, have low surface tension, should not interfere with repair of periapical tissues, not stain tooth structure, be capable of inactivation in a culture medium, should not induce a cell mediated immune response [3].

Sodium hypochlorite is the most commonly used irrigating solution because of its an antibacterial capacity and the ability to dissolve necrotic tissue [4], vital pulp tissue, and the organic components of dentin and biofilms in a fast manner [5]. NaOCl solution is frequently used as a disinfectant or a bleaching agent. It is the irrigant of choice in endodontics, owing to its efficacy against pathogenic organisms and pulp digestion, and satisfies most of the preferred characteristics [4].

Chlorhexidine gluconate (CHX) is a broad-spectrum antimicrobial agent that has been advocated for root canal disinfection [6, 7]. When used as an irrigant its antibacterial efficacy is equivalent to that of NaOCl [8, 9], and it is effective against certain NaOCl-

resistant bacterial strains [8, 10]. Prolonged exposure of the root dentin to CHX may impart a residual antimicrobial property to the dentin surface [8, 9, 11]. CHX has a low grade of toxicity [12], however, its inability to dissolve organic matter may be a drawback in its clinical use [13].

In endodontics smear layer results directly from instrumentation used to prepare the canal wall. The smear layer is an amorphous structure composed of an organic portion, that is coagulated proteins, necrotic and normal pulpal tissue, saliva, microorganisms, etc. and an inorganic portion that is minerals from the dentinal structure. Thus, adequate removal is not possible only by sodium hypochlorite but a chelating agent is required for removal of inorganic dentin [14]. Various substances are used for smear layer removal as Ethylenediamine tetraacetic acid (EDTA), citric acid [15, 16], MTAD, a mixture of doxycycline, citric acid, and Tween 80 detergent [17], and QMix a mixture of a bisbiguanide antimicrobial agent, a polyaminocarboxylic acid calcium-chelating agent, saline, and a surfactant [18]. These irrigants are effective for removing the inorganic component of the smear layer. They are used during irrigation or as a final rinse in combination with other irrigants [19].

The irrigants must be brought into direct contact with the entire canal wall surfaces for effective action [20, 21], particularly for the apical portions of small root canals. Throughout the history of endodontics, endeavors have continuously been made to develop more effective irrigant delivery and agitation systems for root canal irrigation. These systems might be divided into 2 broad categories [22]:

- Manual agitation techniques as: syringe irrigation with needles/cannula, brushes, and a well-fitting gutta-percha master cone.
- Machine-assisted agitation device as: rotary brushes, sonic and ultra sonic instruments, and pressure alternation devices (The EndoVac System).

Endodontic treatment is the main part of everyday dental clinical practice. Therefore, the purpose of this study was to evaluate the current trends and selections in irrigation among Arab dentists.

MATERIALS AND METHODS

This study took place in department of restorative dental sciences, AlFarabi College for dentistry and nursing, Riyadh, Saudi Arabia between May and July 2017. This work has been conducted in full accordance with the World Medical Association Declaration of Helsinki, with an approval from the ethics committee in the university. A standardized questionnaire distributed to Arab active dentist in three countries; Saudi Arabia, Syria and Jordan. The questionnaire conducted in this study was a survey about irrigation and irrigants used during root canal treatment, The inclusion criterion for the study was, every Arab active dentist whether he or she was a specialist or general practitioner. The questionnaire comprised 13 multiple-choice questions and the participants were requested to answer these questions which contain years of experience, irrigant selection, irrigant concentration, smear layer removal, and use of adjuncts to irrigation. The questionnaire distributed in this study was used in study of [19] which conducted a survey on the irrigation trends among American association of endodontists members. Data was coded computerized and analyzed using methods of descriptive statistics.

RESULTS

The respondents of this questionnaire were 415 subjects, most of the subjects (65%) graduate from dental school since less than 10 years ago. In this study sodium hypochlorite was the most used irrigating solution among respondents (97.6%) followed by saline (54.2%) and chlorhexidine gluconate (43.6%). The results of this survey showed 85.3% of respondents are using sodium hypochlorite as their primary irrigant, but only 28.4% of respondents used the highest concentration of sodium hypochlorite (NaOCl concentration >5.0%) and 8.9% used the lowest concentration (< 0.5%). Sodium hypochlorite was also the primarily irrigant utilize when treating a tooth with a vital pulp (70.4%) or with a necrotic pulp (86.7%), and when treating apreviously treated tooth (79.3%). Antibacterial capability was the main reason for irrigant selection (64.1%) followed by tissue dissolution (29.6%). Only 4.3% of subjects considered biocompatibility primary reason for irrigant selection. The results showed that the majority of respondents (69.2%) routinely aim to remove the smear layer during irrigation of root canals, and only 32.5% of subjects said that they use ultrasonic activation as adjuncts to irrigation whereas 41.2% used nothing. (The results of this survey are shown in tables 1-13).

DISCUSSION

Many studies using sophisticated techniques such as microcomputed tomography (CT) scanning have revealed that proportionally large areas of the main root-canal wall remain untouched by the instruments, confirming the importance of chemical means of cleaning and disinfecting all areas of the root canal [23]. There is no single irrigating solution that alone sufficiently covers all of the functions required from an irrigant. Optimal irrigation is based on the combined use of 2 or several irrigating solutions, in a specific sequence, to predictably obtain the goals of safe and effective irrigation [23].

This study found that sodium hypochlorite was the most used irrigating solution among surveyed Arab dentist (97.6%). We can see this founding in previous surveys that conducted in united states [19] and in

Australia [24]. However in a survey conducted in North Jordan, it was found that only 32.9% of general dentist respondents used sodium hypochlorite [25].

Tables 1-13: Show the irrigant selections among Arab dentists

1. How many years ago did you graduate from dental school?		
5>	34.2%	142
5-10	30.8%	128
11-20	25.1%	104
21-30	6.5%	27
30<	3.4%	14

2. Which irrigants do you use? (Please select all that apply)		
Sodium hypochlorite	97.6%	405
Chlorhexidine	43.6%	181
Saline	54.2%	225
Sterile water	9.9%	41
EDTA	66.3%	275
MTAD	1.9%	8
Citric acid	2.7%	11
Others	4.8	20

3. Which irrigant do you primarily use?		
Sodium hypochlorite	85.3%	354
Chlorhexidine	1.9%	8
Saline	1.4%	6
Sterile water	1.4%	6
EDTA	2.7%	11
MTAD	0%	0
Citric acid	0%	0

4. Which concentration of sodium hypochlorite do you primarily use?		
<0.5%	8.9%	37
0.5%–1.5%	13.3%	55
1.6%–2.5%	15.9%	66
2.6%–4.0%	15.7%	65
4.1%–5.0%	16.4%	68
>5.0%	28.4%	118
I do not use sodium hypochlorite	1.4%	6

5. Which concentration of chlorhexidine do you primarily use?		
0.17%	7.5%	31
0.18%–1.9%	7.2%	30
2.0%	34%	141
>2.0%	3.6%	15
I do not use chlorhexidine	47.7%	198

6. What is the most important reason for your primary irrigant selection?		
Antibacterial capability	64.1%	266
Biocompatibility	4.3%	18
Tissue dissolution	29.6%	123
Substantivity	1.2%	5
Expense	0.7%	3

7. Do you routinely aim to remove the smear layer?		
Yes	69.2%	287
No	30.8%	128

8. Does your choice of irrigant(s) differ based on the pulpal or periapical diagnosis?		
Yes	56.4%	234
No	43.6%	181

9. Which of the following irrigants would you primarily utilize when treating a tooth with a vital pulp?		
Sodium hypochlorite	70.4%	292
Chlorhexidine	5.5%	23
Saline	18.8%	78
Sterile water	2.7%	11
Others	2.7%	11

10. Which of the following irrigants would you primarily utilize when treating a tooth with a necrotic pulp?		
Sodium hypochlorite	86.7%	360
Chlorhexidine	7.2%	30
Saline	4.1%	17
Sterile water	0.7%	3
Others	1.2%	5

11. Which of the following irrigants would you primarily utilize when treating a tooth with radiographic evidence of a periapical lesion?		
Sodium hypochlorite	78.3%	325
Chlorhexidine	10.4%	43
Saline	9.2%	38
Sterile water	0.7%	3
Others	1.4%	6

12. Which of the following irrigants would you primarily utilize when treating a previously treated tooth?		
Sodium hypochlorite	79.3%	329
Chlorhexidine	10.8%	45
Saline	5.5%	23
Sterile water	0.2%	1
Others	4.1%	17

13. Which, if any, adjuncts to irrigation do you utilize? (Please select all that apply)		
ultrasonic activation	32.5%	135
sonic activation	5.3%	22
Subsonic activation (example: EndoActivator	13.5%	56
Negative pressure (example: EndoVac)	8.4%	35
Other	18.1%	75
Nothing	41.2%	171

The results of this survey revealed that 54.2% of subject used normal saline, it is high when compared with founding of US survey [19], in these study only 0.9% of the subjects used saline. The survey of North Jordan demonstrated that 24.4% of respondents used normal saline [25]. Common use of normal saline may be due to this material will not burn or sting when applied and because of lack of using rubber dam during root canal treatment, the survey of North Jordan showed that none of the dentists reported using rubber dam routinely to isolate the field of operation during root canal therapy [25].

43.6% of subjects used chlorhexidine gluconate in this survey while only 1.1% of respondents used this irrigant in the US survey. CHX has gained considerable popularity in endodontics as an irrigating solution and as an intracanal medicament. CHX does not possess some of the undesired characteristics of NaOcl (ie, bad smell and strong irritation to periapical tissues). However, CHX has no tissue-dissolving capability therefore it cannot replace sodium hypochlorite [23]. It has been recommend the use of chlorhexidine as root canal irrigant especially in the cases of retreatment and failures [26], since this irrigant has shown antibacterial activity against E. faecalis which frequently isolates from root canals in cases of failed root canal treatments [27]. The current survey revealed little attention by subject (10.8%) for using CHX in case of failed endodontic treatment.

Clinical studies have shown both low and high concentrations of NaOCl to be equally effective in reducing bacteria from the root canal system [28].

NaOCl in higher concentrations has a better tissue-dissolving ability [29], however, even in lower concentrations when used in high volumes it can equally be effective [30]. The result of this study showed that 28.4% of respondents used full-strength sodium hypochlorite (NaOCl concentration >5.0%). This result is not comparable to US survey in which 57% of respondents use full-strength sodium hypochlorite [19].

The removal of smear layer is still controversial, some investigations have focussed on its removal because it has an unpredictable thickness and volume, due its high content of water, bacteria in smear layer may survive and multiply and can proliferate into the dentinal tubules which may serve as a reservoir of microbial irritants. Smear layer also may limit the optimum penetration of disinfecting agents and sealers into root canal system, it is a loosely adherent structure and a potential avenue for leakage and bacterial contaminant passage between the root canal filling and the dentinal walls. Conversely, some authors believe in retaining the smear layer during canal preparation, because it can block the dentinal tubules, preventing the ex- change of bacteria and other irritants by altering permeability [31]. The results of this survey showed that the majority of respondents (69.2%) routinely aim to remove the smear layer during irrigation of root canals, this result is comparable to US survey. With the introduction of new materials for root canal obturation and going towards adhesive endodontics, the root canal irrigation or chemical preparation to remove smear layer is comparable to the dentine and enamel conditioning prior to the use of adhesive restorative materials with some small modifications.

CONCLUSIONS

- Sodium hypochlorite was the most used irrigating solution among Arab dentists.
- There was common use of saline as irrigant during root canal instrumentation among Arab dentists.
- The majority of Arab dentists routinely aim to remove the smear layer during irrigation of root canals.
- Less than half of Arab dentists used adjuncts to activate the irrigation of root canal system.

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