SODIUM HYPOCHLORITE AND ITS USE AS ROOT CANAL IRRIGANT: A SURVEY AMONG GHANAIAN DENTAL PRACTITIONERS

Konadu AB[1], Ampofo PC[2], Hewlett S[2], Nyako EA[2], Ndanu TA[3]

[1] Dental Department, Korle-Bu Teaching Hospital & School of Medicine & Dentistry, University of Ghana,
[2]Restorative Department, School of Medicine and Dentistry, University of Ghana. Legon
[3]Department of Community and Preventive Dentistry, School of Medicine and Dentistry, University of Ghana. Legon.

Abstract

***Background*:** The majority of endodontic treatment in Ghana is provided by general dental practitioners due to the absence of specialists in endodontics. Sodium hypochlorite has been described as one of the commonly used irrigation solutions during endodontic treatment. However, there are no published reports on its use in Ghana.

***Aim*:** The study was to determine the proportion of Ghanaian dental practitioners who have used sodium hypochlorite for irrigation and the concentrations they usually use.

***Materials and methods*:** Self-administered questionnaires were mailed to dental practitioners in private clinics, government hospitals and clinics, teaching hospitals and training institutions across the country between December 2015 and March 2016. The collated data was analyzed using Microsoft Excel 2010 and SPSS 20.0.

Results: The most commonly used root canal irrigant was 2.5% Sodium Hypochlorite (Milton®). This was routinely used by 31 (73.7%) of the respondents as root canal irrigant while normal saline solution was used regularly by only 6(15.8%) respondents. The various concentrations of sodium hypochlorite used were 0.5%, 2.5%,1% and 5.0%; with the following percentage-use respectively, 42.9%, 32.1%,21.4% and 6.1%. Three (10.7%) respondents had reported experiencing some complications with the use of sodium hypochlorite.

Conclusion: Sodium hypochlorite is the most commonly used root canal irrigant by dental practitioners in Ghana. The concentrations usually used ranges between 0.5% and 5.0%.

Keywords : Sodium Hypochlorite, Root canal irrigation, Concentration, Survey, Ghana.

Introduction

Endodontic therapy or root canal treatment is considered an essential treatment procedure in the provision of dental services[1]. This therapy is essential in the control and management of root canal infection in a tooth[2,3]. It involves mechanical instrumentation, irrigation, intra-canal medication with anti-microbial agents and obturation[4].

Root canal infections can be caused by microorganisms as a result of dental caries, fractures of the tooth secondary to trauma[5], periodontal diseases[6] and some operative dental procedures[7].

Sodium hypochlorite (NaOCL) is the most commonly and widely used root canal irrigant in endodontic therapy and it is often used as a baseline to assess other endodontic irrigants[8-10].

It is widely accepted because of its anti-microbial[11] and tissue-dissolving properties and its relatively low cost[12,13]. It dissolves proteins, has a low viscosity, and has a reasonable shelf life[14,15].

NaOCL is a broad spectrum antimicrobial agent. It has the ability to oxidize and hydrolyze cell proteins. It is effective against root canal bacteria such as *Actinomyces naeslundi* (found in untreated necrotic root canals), *Enterococcus faecalis and Candida albicans* (found in endodontic failure cases)[16].

However, sodium hypochlorite has some disadvantages, principally due to its toxicity such as causing tissue damage and pain; when it accidentally comes into contact with surrounding tissues or goes beyond the root apex[17]. It is strongly alkaline, hypertonic and has a very unpleasant taste[14]. Sodium hypochlorite is extremely corrosive to metals. Use of rubber dam and careful irrigation techniques are vital in endodontics to help obviate some of these disadvantages by confining the hypochlorite to the pulp chamber and root canal[14].

The choice of concentration of NaOCl has been a matter of debate. The range extending from 0.5% to 5.25% has been recommended for use in endodontics[14,18]. Few studies have investigated the attitude of general dental practitioners toward various aspects of endodontic treatment in developing countries[19-21]. However, the authors are unaware of any studies that have evaluated sodium hypochlorite use among dental practitioners in Ghana.

The aim of the study was to determine the proportion of Ghanaian dental practitioners who use sodium hypochlorite for irrigation and the concentrations they usually use.

Corresponding Author: Dr. Akua B. Konadu
Department of Restorative Dentistry School of Medicine and Dentistry College of Health Sciences University of Ghana. Legon
E-mail: akulyn@yahoo.com
Tel: +233 243 213100
Conflict of Interest : none declared

Materials and Methods

The study was conducted using self-administered questionnaire with both open and close ended questions. It involved licensed dental practitioners who practice in

private clinics, government hospitals and clinics, teaching hospitals and training institutions. The questionnaire was sent through mass mailing to seventy-two (72) dental practitioners who were recognized members of the Ghana Dental Association. The questionnaire was accompanied by an explanatory email after pretesting.

Data collected included, demographic data, number of years of practice, specialty, foreign trained experience, the use of root canal irrigants, the concentrations of sodium hypochlorite used.

The collected data were entered and analyzed using Microsoft excel 2010 and SPSS 20.0. Data was summarized by frequencies and percentages. Proportions were compared between various variables using chi-square test. The chosen level of significance was $\alpha < 0.05$.

Results

Out of the seventy-two (72) questionnaires emailed, forty–five (45) were correctly filled and submitted. Twenty-nine males (64.9%) and 16 females (35.6%) participated in the survey. The response rate was 60.5%. About half of the respondents were in the 20-30year age group 21(51.2%).A total of 20(45.5%) of the respondents were dental (medical) officers having practiced for a minimum of three years. All the respondents performed endodontic treatment with 26(57.7%) routinely performing endodontic treatment while 18 (40%) performed it sometimes. The distribution of the respondents and the institution where they practiced is shown in Table 1.

Table 1. Institutions of practice by full-time practitioners.

Institution	Number	Percentage (%)
Ministry of Health / Ghana Health Service	24	53.3
Teaching Hospital	11	24.4
Private practice	6	13.3
Dental School	5	11.1

Majority (77.7%) of practitioners work either with the Ghana Health Service or at a teaching hospital

Twenty four (53.3%) respondents said apart from their regular jobs they also engage in some part-time work at other institutions Table 2.

Table 2. Part time practitioners and their institutions of practice

Institution	Number	Percentage (%)
Ministry of Health/ Ghana Health Service	5	20.9
Private Practice	15	62.5
Teaching Hospital	2	8.3
Dental School	2	8.3

Over 60% of respondents did part-time practice in private dental clinics

Sodium hypochlorite was the irrigation solution of choice for most respondents 33(73.3%); followed by normal saline 7(15.6%) and one respondent used chlorhexidine as irrigation solution routinely. Only 4(8.8%) of the respondents used combination of irrigation solutions. There was no significant difference among the institutions of practice and the concentrations of sodium hypochlorite usage (P=0.35). The reasons attributed to the choice of irrigation solution is shown in Table 3 with local availability being the commonest reason given.

Table 3. Reasons that inform choice of irrigation solution

Reason for choice of irrigant	Number	Percentage (%)
Local Availability	33	73.3
Type of Infection	9	20.0
Primary root canal treatment	2	4.4
Cost	1	2.2

Choosing an irrigation solution was mainly determined by its availability

Out of the 33(73.3%) sodium hypochlorite users, 14(42.4%) used 2.5% followed by 12(36.7%) who used 0.5% and 7(21.2%) used 1.0%. Two respondents representing 6.1% used 5.0% concentration of sodium hypochlorite. Comparison between the institution of practice and the concentration of sodium hypochlorite used for both full and part time is shown in figures 1 and 2 respectively. Only 3(6.7%) respondents had experienced complication with the use of sodium hypochlorite without giving details.

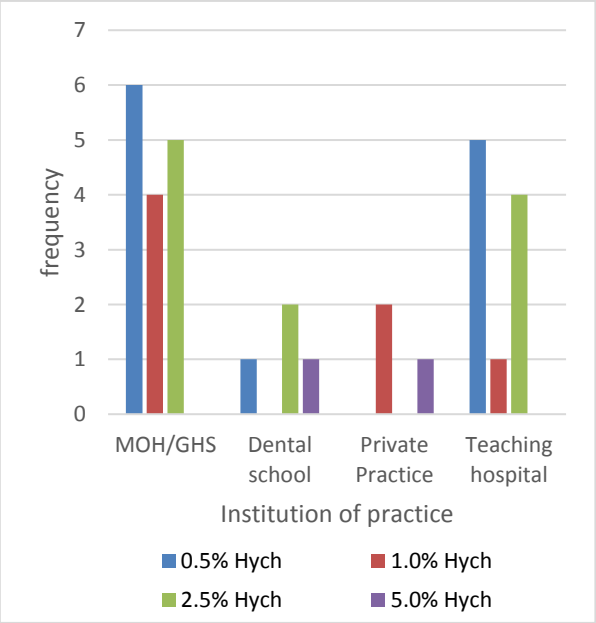

Fig. 1 Full-time institutions of practice and the concentrations of sodium hypochlorite used.

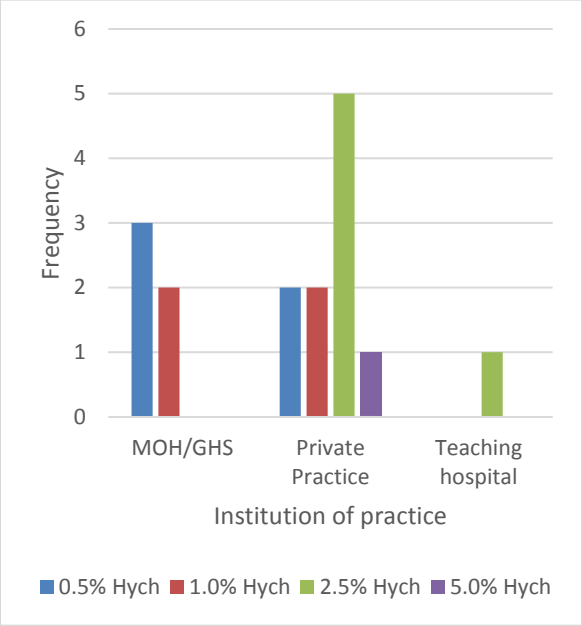

Fig 2. Part-time institutions of practice and the concentrations of sodium hypochlorite used

Discussion

A total of 45 dentists returned their filled questionnaire out of 72, giving a 60.5% response rate. The dental practitioners who responded to the survey had in-depth knowledge and skill to enable them provide accurate and beneficial information about endodontic treatment in Ghana.

All the practitioners who responded to the survey undertook endodontic treatment in their practice. This is expected as even practitioners who generally do not want to perform endodontic treatment would sometimes do so to give their patients pain relief.

The above finding compares with studies in Australia where 98% of general practitioners performed endodontic treatment in their practice[15] but differs with studies in Kenya where only 63% of general practitioners performed root canal treatment, due to unavailability of specialists[20].

In the current survey, most dental practitioners used sodium hypochlorite and normal saline solutions as canal irrigants. Sodium hypochlorite is recommended as the material of choice for irrigating the root canal system because of its effective anti-microbial and its ability to remove smear layer[22]; 31(73.7%) of our respondents shared this opinion.

In Nigeria and Switzerland, most dentists used hydrogen peroxide and sodium hypochlorite solutions[21,23]. In a Sudanese study, over 50% of respondents irrigated root canals with hydrogen peroxide and 14% used normal saline as root canal irrigant[24], while the majority of Flemish respondents (59.2%) used sodium hypochlorite[25].

Among the sodium hypochlorite users, the concentrations commonly used were 0.5%, 2.5% and 1% with the following percentages respectively, 37.5%, 34.4% and 21.9%. Two respondents representing 6.3% used 5.0% concentration of sodium hypochlorite. The other irrigation solutions used were chlorhexidine, normal saline and combination of multiple irrigation solutions.

The choice of more dilute solutions may be related to the reluctance of the dental practitioners to use rubber dam. The reasons that informed the choice of irrigation solution included availability of solution, the type of infection and the cost.

The incidence of complications associated with sodium hypochlorite use is not common but there are reported cases of adverse reactions to sodium hypochlorite use[26,27]. In this study only three (6.7%) of respondent indicated having experienced some complications but none of them indicated the specific complications experienced with Sodium hypochlorite use.

Conclusion

The assumption that sodium hypochlorite is used widely by these practitioners as an endodontic irrigant has been confirmed by this study. The concentrations of sodium hypochlorite used by dental practitioners in Ghana ranges between 0.5% and 5.0% and majority use 2.5%.

Acknowledgements: The dental practitioners who willingly participated in this survey

References

1. Jordan Wael M Al-Omari. Survey of attitudes, materials and methods employed in endodontic treatment by general dental practitioners in North Jordan. *BMC* Oral Health 2004; 4:1.
2. Takahashi K. Microbiological, pathological, inflammatory, immunological and molecular biological aspects of periradicular disease. *Int Endod J* 1998; 31:311–325.
3. Cohen S, Hargreaves K. Pathways of the pulp. Mosby; (2006) ISBN 032303067X.
4. Manzur A, González AM, Pozos A, Silva-Herzog D, Friedman S.Bacterial Quantification in Teeth with Apical Periodontitis Related to Instrumentation and Different Intracanal Medications: A Randomized Clinical Trial.*J Endod* 2007; 33:114–118.
5. Moller AJ, Fabricius L, Dahlen G, Ohman AE, Heyden G. Influence on periapical tissues of indigenous oral bacteria and necrotic pulp tissue in monkeys. *Scand J Dent Res* 1981; 89:475-484.
6. Sundqvist GK, Eckerbom MI, Larsson AP, Sjogren UT. Capacity of anaerobic bacteria from necrotic dental pulps to induce purulent infections. *Infect Immun* 1979; 25:685-693.
7. Kakehashi S, Stanley HR, Fitzgerald RJ. The effect of surgical exposure of dental pulps in germ-free and conventional laboratory rats. *Oral Surg Oral Med Oral Pathol* 1965; 20:340-349.

8. Koulaouzidou EA, Margelos J,Panagiotis B, Kortsaris AH.Cytotoxic effects of different concentrations of neutral and alkaline EDTA solutions used as root canal irrigants. *J Endod* 1999; 25:21-23.
9. Jeansonne MJ, White RR. A comparison of 2.0% chlorhexidine gluconate and 5.25% sodium hypochlorite as antimicrobial irrigants. *J Endod* 1994; 20:276-278.
10. Orstavik D, Haapasalo M. Disinfection by endodontic irrigants and dressings of *experimentally infected dentinal tubules. Endod Dent Traumatol* 1990; 6:142-149.
11. Rutala WA. APIC guidelines for infection control practice. *AJIC* 1990; 18:99-117.
12. Haikel Y, Gorce F, Allemann C, Voegel JC. In vitro efficiency of endodontic irrigation solutions on protein desorption. *Int Endod J* 1994; 27:16-20.
13. Senia ES, Marshall FJ, Rosen S. The solvent action of sodium hypochlorite on pulp tissue of extracted teeth. *Oral Surg Oral Med Oral Pathol* 1971; 31:96-103.
14. Clarkson RM, Moule AJ. Sodium hypochlorite and its use as an endodontic irrigant. *Aust Dent J* 1998; 43:250-256.
15. Clarkson RM, Podlich HM, Savage NW, Moule AJ. A survey of sodium hypochlorite use by general dental practitioners and Endodontists in Australia. *Aust Dent J* 2003; 48(1):20-26.
16. Iqbal A. Antimicrobial irrigants in the endodontic therapy. *International journal of health sciences* 2012; 6 (2): 186-189.
17. Pashley EL, Birdsong NL, Bowman K, Pashley DH. Cytotoxic effects of NaoCl on vital tissues. *J Endod* 1985; 11:525-528.
18. Frais S, Y-L. Ng Y-L, K. Gulabivala K. Some factors affecting the concentration of available chlorine in commercial sources of sodium hypochlorite. *Int Endod J* 2001; 34: 206 – 215.
19. Akpata ES. Endodontic treatment in Nigeria. *Int Endod J. 1984*; 17(3):139–151.
20. Maina SW, Ng'ang'a PM: Root canal treatment and pulpotomy in Kenya. *East Afr Med J*.1991; 68:243-248.
21. Udoye CL.Sede MA., Jafarzadeh .H, Abbot PV. A survey of endodontic practices among dentists in Nigeria, *J Contemp Dent Pract* 2013; 14(2):293-298.
22. Bystrom A, Sundqvist G. "Bacteriologic evaluation of the effect of 0.5 percent sodium hypochlorite in endodontic therapy," *Oral Surgery Oral Medicine and Oral Pathology*, 1983; 55(3): 307–312.
23. Barbakow F. The status of root canal therapy in Switzerland in 1993. *J Dent Assoc S Afr*. 1996; 51:819–822.
24. Ahmed MF, Elseed Al, lbrahim YE: Root canal treatment in general practice in Sudan. *Int Endod J*.2000; 33:316-319.
25. Slaus G, Bottengerg P. A survey of endodontic practice amongst Flemish dentists. *Int Endod J*. 2002; 35:759–767.
26. Crincoli V, Scivetti M, Bisceglie MBD, Pilolli GP, Favia G. Unusual case of adverse reaction in the use of sodium hypochlorite during endodontic treatment: A case report. *Quintessence Int*.2008; 39:70-73.
27. Singh PK.Root canal complications:"the hypochlorite accident.*SADJ* 2010; 65:416 – 441.