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SODIUM HYPOCHLORITE USE, STORAGE, AND DELIVERY METHODS: A SURVEY BY GENERAL DENTAL PRACTITIONERS (GDPS) AND SPECIALISTS OF SRINAGAR CITY, JAMMU AND KASHMIR, INDIA

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ABSTRACT

Aim: The aim of this study was to investigate sodium hypochlorite (NaOCl) delivery and storage methods by general dental practitioners (GDPs) and specialists.

Materials and Methods: A self-reporting questionnaire was distributed to academic, governmental, and private dental centers in Srinagar city, Jammu and Kashmir, India. The survey consisted of questions related to the concentration, duration, volume, delivery methods of NaOCl irrigation, storage materials, and conditions.

Results: Of the 261 dentists that responded, 63.2% were GDPs, 21.8% were endodontists, and 14.9% were advanced restorative specialists. A NaOCl concentration of 2.5%–5% was the most commonly selected (52.7%), 37.2% used 5–10 ml for irrigation of each canal and 44.8% performed irrigation for <1 min. Dentists who used higher concentrations reported longer irrigation durations. Irrigant delivery by needles and a syringe was reported by 83.9% of respondents, but only 5.7% applied irrigation activation methods. Regarding storage conditions, 40% used clear containers, and 75.5% stored it at room temperature. Endodontists used significantly higher concentrations, longer durations, and activated the irrigant more than GDPs.

Conclusion: The most commonly used NaOCl concentration is 2.5%–5%. The storage conditions of NaOCl and use of activation methods need to be improved. In addition, practices of specialists differed from those of GDPs with regard to concentrations, duration of irrigation, storage of NaOCl, and use of irrigation adjuncts.

KEYWORDS : Endodontists, general dentists, root canal irrigants, Srinagar, sodium hypochlorite

IN RODUC ION

The role of irrigation is pivotal to the success of root canal treatment.[1]

Many types of root canal irrigants have been used in endodontics, yet sodium hypochlorite (NaOCl) is the recommended main irrigants.[2] NaOCl has strong antimicrobial effects against bacteria including those organized in biofilms, fungi, and viruses. It is fast -acting, can dissolve organic compounds including pulpal issue, inexpensive, and readily available.[3]

NaOCl is commonly used in concentrations ranging from 0.5% o 6%, which is achieved by purchasing it at the desired concentration or by diluting a full-strength solution. Its properties originate from he availability of he chlorine ion, which directly depends on he concentra ion of he solution.[4] Thus, higher concentrations possess stronger tissue dissolution capabilities and effectivity on biofilms.[5] However, they can cause weakening of he tooth structure and severe irritations if exposed to the oral issues.[6] Clinical studies have demonstrated that a low concentra ions are effective against bacteria.[7] Nevertheless, he chlorine ion, especially in lower concentrations, can rapidly become ineffective.

Despite this, literature on dental practices regarding these issues is scarce. Therefore, his study aimed to investigate he practices used by dentists in srinagar city, jammu and kashmir, india, regarding the use, delivery, application, and storage of NaOCl in endodontics.

MATERIALS AND METHODS

A two part questionnaire was designed, piloted, and modified. The first part was related to the participants' demographic data including age, gender, specialty, place of work, and number of cases treated per month. The second part inquired about the NaOCl concentration and volume used, delivery methods, andTstorage conditions, andTfinally, on the irrigant delivery systems used. Questions included multiple selections with the option of write in answers. The survey included questions on irrigant selection and preference according to case diagnosis.

Participants were dentists who routinely perform endodontic treatment, including general dentists, advanced restorative specialists(i.e.,specialists who received advanced endodontic training as part of their specialty training), and endodontists, working in Srinagar city, Jammu and Kashmir, India.

All data from returned questionnaires were entered and analyzed using the Statistical Package forTSocial Sciences (SPSS), version 22.0 (IBMTCorp., New York, USA). Descriptive statistics (means, frequencies, and percentages) were computed. The relationship between NaOCl concentration and the volume and duration of irrigation in addition to comparisons between general dental practitioners (GDPs) and specialists were analyzed with Chi square tests followed by Bonferroni post hoc tests. Statistical significance was set at 0.05 ($P < 0.05$).

RESULTS

Demographics of the 275 dentists who responded to the questionnaire, 14 did not meet the selection criteria (e.g., they stated that they are not dentists, or they do not perform root canal treatment routinely) and were excluded from the study. Of the remaining 261 respondents, 63.2% were GDPs, 21.8% endodontists, and 14.9% advanced restorative specialists. More than half (61.3%) of the dentists surveyed were younger than 30 years, 26.8% were aged 31–40 years old, and 11.9% were above 40. There were 43.7% males compared to 56.3% females. Nearly half (44.8%) had been practicing dentistry for 1–5 years, 16% had been practicing for over 10 years, 39.9% treated fewer than 5 endodontic cases per month while 22.2% treated >20. The nationality of the majority (83.5%) was kashmiri. Regarding workplace, 46.9% worked in academic institutions, 40% in governmental centers and 13% worked primarily in a private practice. The most common NaOCl concentration was 2.5%–5%. More than one third (37.2%) of the participants used a volume of 5–10 ml for irrigation, and nearly half of the respondents (44.8%) irrigated each canal for 5%) irrigated for the longest duration (>5 min) ($P > 0.001$).

Participants who answered "I do not know" regarding the concentration answered the same regarding the volume used significantly more frequently than those that provided a concentration (χ^2 (12) = 30.151, P = 0.003). A significant relationship was found between the concentration of NaOCl used and age (χ^2 (12) = 37.844, P < 0.001), number of cases treated per month (χ^2 (12) = 46.569, P < 0.001), and the workplace (χ^2 (12) = 35.024, P < 0.001). The highest concentrations (>5%) was used significantly more by participants who treat >20 cases/ month than those who treat < 0.001), and by the age group 31–40 (P < 0.001) and in governmental centers more than

academic institutions (P < 0.001). Preparation and storage Seventy percent of the participants had dental assistants prepare and dilute the NaOCl solution for them. One quarter of the dentists (25.4%) had the solution prepared just before treatment, 9.6% had it prepared once a week, and half of the dentists (50%) did not know when it was prepared. NaOCl was stored at room temperature by 75.5% of dentists, and 8% stored it in the refrigerator. Regarding the storage containers, 41.4% reported the use of opaque containers, 39.5% clear containers, and 17.2% did not know how it was stored. Sodium hypochlorite delivery Most of the participants(86.6%) used regular stainless steel needles with syringes to deliver the irrigant. Nickel titanium needles were used by 6.5% of the respondents. The most commonly used needle gauges (G) were 25 G or less (29.1%) followed by 27 G (26.8%), and 30 G (10%). Nearly one third of the respondents (32.6%) did not know the needle size they used. Irrigation adjuncts, such as sonic, ultrasonic, and pressure devices, were used by only 5.7% of the respondents and five respondents added that they delivered their irrigants using pipettes. General dental practitioners and specialists Figure 1 presents the preferred concentrations by the different types of practitioners. The differences between them were statistically significant ($\chi 2$ (8) =57.53, P < 0.001). Endodontists used full-strength concentrations (>5%) significantly more than the other participants (P < 0.001) and concentrations below 2.5% significantly less frequently than GDPs (P = 0.001). While GDPS significantly preferred the concentrations below 2.5% more than the other participants (P < 0.001). Endodontists significantly irrigated for longer durations (36.8% irrigated for>5 min) (P< 0.001). Endodontists also used higher volumes of the irrigant, smaller needle gauges, and relied less on the dental assistants to prepare and mix the irrigant, although not statistically significant. Restorative specialists used higher concentrations of NaOCl, more volume, and longer duration of irrigation than GDPs; however, this difference was also not statistically significant. In addition, GDPs were significantly the highest to report storage of NaOCl in clear containers ($\chi 2$ (6) =30.81, P < 0.001). Regarding the use of activation methods, only 10.5% of the endodontists used irrigation adjuncts, compared to 7.7% of the restorative specialists and 3.7% of GDPs.

TABLE 1

Variable	n (%)(%)
Concentration	
<1%	
1%-<2.5%	
2.5%-5%	
>5%	
I do not know	

TABLE 2

Variable	n (%)(%)
Volume (average per canal)	
<5 ml	35 (13.4)
5-10 ml	97 (37.2)
>10 ml	71 (27.2)
I do not know	58 (22.2)

TABLE 3

Variable	n (%)(%)
Duration (average per canal)	
<1 min	117 (44.8)
1-5 min	83 (31.8)
>5 min	47 (18.0)
I do not know	14 (5.4)

DISCUSSION

NaOCl is the most commonly used endodontic irrigant by dentists in Srinagar[8] and worldwide.[9] However, the ideal concentration used in endodontics has been controversial. Studies have demonstrated the effectivity of the different concentrations of NaOCl,[1] in addition to the adverse effects in relation to them. Which prompts the clinician to weigh the benefits versus the adverse effects when managing a case. Moreover, clinical situations arise in which altering the concentration maybe beneficial.[10] Clarkson et al.[11] demonstrated that the activity of NaOCl deteriorated rapidly with heat and that undiluted NaOCl was generally more stable than a diluted solution. They emphasized that NaOCl should be stored in closed, opaque containers, away from sunlight, which is not practiced by 40% of participants, and away from heat, which is practiced by the majority of participants and is accelerated in diluted solutions as used by 80% of the participants. Moreover, in examined samples, the average reduction of chlorine in irrigating solutions was calculated to be less by 27% than the dentist's estimation.[12] Thus studies have recommended that dentists raise their preferred concentration of NaOCl to at least 2% to account for the reduction and inactivation of chlorine to reach the desired 1% which is the minimum concentration that demonstrates the activity of NaOCl.[12] In complicated root canal systems, complete disinfection and debridement may require irrigation agitation techniques rather than conventional needle-syringe irrigation alone.[13] The volume, duration of irrigation, concentration, and use of irrigant activation methods need to be improved, otherwise, the effectivity of the solutions used by a number of our participants is strongly questioned. In addition, dentists should overcome the limitations of low concentrations by increasing the duration and volumes of the solution and improve the storage conditions of NaOCl. It is strongly recommended that dentists' awareness is raised regarding these issues and on the characteristics and behavior of NaOCl in different situations and environments, to facilitate adequate irrigation, especially for GDPs, through emphasizing these roles during both undergraduate dental education and continuous professional education.

CONCLUSION

This report shows that the most commonly used NaOCl concentration by dentists in Srinagar is 2.5%–5%. The storage conditions of NaOCl and use of activation methods need to be improved. In addition, practices of specialists differed from those of GDPs with regard to concentrations, duration of irrigation, and storage of NaOCl.

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