

Evaluation of Postoperative Pain after the Use of 5.25% Sodium Hypochlorite Gel, Solution at Room Temperature & Heated Solution Form at 50°C as Intracanal Irrigant: In Vivo Study

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Abstract

Objective- purpose of this study was to evaluate postoperative pain after the use of 5.25% sodium hypochlorite gel, solution at room temperature & heated solution form at 50°C as intracanal irrigant.

Materials and methods- A total of 90 patients were divided into 3 groups according to the form and temperature of 5.25% sodium hypochlorite for root canal irrigation in mandibular 1st and 2nd molars. Each group contained 30 patients that were randomly divided into groups. In group 1, root canals were irrigated with 5.25% NaOCl solution at room temperature. In group 2, the 5.25% NaOCl gel at room temperature was used for irrigation of root canals. In group 3, NaOCl solution preheated at 50°C was used for irrigation of root canals. The root canal treatments were completed and the participants were given instructions to record postoperative pain levels at 24, 48, and 72 hours and 1 week after treatment using VAS.

Results- Intergroup analysis revealed that VAS score values for postoperative pain were least for NaOCl solution at 50°C followed by NaOCl gel at room temperature and highest for NaOCl solution at room temperature. Although intergroup difference in VAS score values were statically non-significant. ($p>0.05$).

Conclusion- Both solution and gel form of sodium hypochlorite can be used as irrigant and solution form of sodium hypochlorite can be either used at room temperature or heated. Increasing temperature has positive effects on properties of sodium hypochlorite solution.

INTRODUCTION

Endodontic success is strictly related to the removal of pulp tissue and to the disinfection of root canal system. Irrigation of the root canals³, is an essential part of endodontic treatment because the complete elimination of microorganisms from the root canal system is impossible only with instrumentation because of complex structure of root canal system which contain accessory canals, lateral canal, apical deltas, isthmus and presence of microflora in dentinal tubules. Sodium hypochlorite (NaOCl) is the most common irrigant used in endodontics because of its physicochemical and antibacterial properties, and its unique ability to dissolve necrotic tissue remnants⁷. However, accidental extrusion of the solution into the periapical tissue can result in some serious complications such as; hemolysis, ulceration, allergic reaction and tissue necrosis⁴ because of its cytotoxic properties² which lead to inflammation of periapical region⁸ and results in pain, swelling and soft tissue necrosis⁴. To avoid these complications, gel form of the NaOCl can be proposed. Previously, it has been reported that the gel and solution both did not interfere in the EDTA solution's action. Additionally, Garcia et al have evaluated the effect of several forms of NaOCl on the microhardness of root canal dentin and reported that the NaOCl gel and solution forms have a similar effect on dentinal microhardness⁶. Moreover, the antibacterial effectiveness of NaOCl gel and solution forms were compared and it has been reported that the antibacterial efficacy of the NaOCl gel and solution forms were similar. However, the tissue dissolution capacity of the NaOCl solution was higher than the gel form⁷. Increasing temperature has a positive effect on the antibacterial and lytic action of NaOCl. In addition, heated NaOCl, solution removes organic debris from dentin crimps better than unheated solution²⁶.

MATERIALS AND METHODS

The ethical committee of RUHS College of Dental Sciences, Jaipur approved the study protocol with the proposal No. RUHS-CDS/EC/2022/PG-The/15 dated 11.08.2022. All the participants included in the study signed an informed consent form before undergoing the treatment. A total of 90 mandibular molars with symptomatic irreversible pulpitis were included in the study. Teeth were randomly divided into three groups based on the form and temperature of the sodium hypochlorite used for irrigation.

Group I - 5.25% Sodium hypochlorite solution at room temperature

Group II - 5.25% Sodium hypochlorite gel at room temperature

Group III - 5.25% Sodium hypochlorite solution heated at 50° C

Simple random sampling was used for dividing the individuals between the groups. Double-blinding technique (participants and data collector unaware of material) was used in the study. Teeth included in this study were mandibular 1st and 2nd molar with history of spontaneous, referred pain diagnosed as symptomatic irreversible pulpitis. All the cases were of primary root canal treatment. Teeth with root fracture, pathologic mobility beyond physiological limits, periodontal pocket depth more than 3 mm, apical periodontitis, swelling, abscess, intra or extra oral sinus were excluded. Patient's age range was between 18 to 60 years. Root canal treatment protocol was same for each tooth, the only difference was in irrigation protocol. Randomization was done by chit system. Then treatment was started with local anesthesia using 2% lignocaine. Rubber dam isolation was done and access cavity was prepared. Root canals orifices were negotiated with the help sharp of DG-16 explorer. Loups were used for magnification. After negotiation of all canals, coronal flaring was done, Canals were negotiated till full length using no. 10k file and apical patency were

established. Working length were determined using electronic apex locator and confirmed radiographically. After that cleaning and shaping was done using first glide path rotary files and then using different no. file with 4 % and 6 % taper according to need. In between sequential filing, irrigation was done. In this study irrigation was done by one of the three methods using 5.25% NaOCl. In group I, 5.25% NaOCl solution at room temperature was used as irrigation material. In group II, 5.25% NaOCl gel at room temperature & in group III, 5.25% NaOCl solution heated at 50° C was used for irrigation. Volume of NaOCl for irrigation was 1 ml for each canal. During irrigation endo-activator was used for activation of irrigation material. Final irrigation was done using 17 % EDTA solution. After that, root canals were dried using absorbent paper points and master cone radiograph were taken & obturation was done using AH plus root canal sealer. Final restoration were done using composite resin cements. No occlusal reduction was done to keep tooth in state of functional loading of occlusal forces. After finishing procedure VAS scale was explained to patient & asked to record pain after 24 hours, 48 hours, 72 hours and 1 week after treatment. Oral analgesic Diclofenac sodium and paracetamol combination tablet SOS was prescribed. Patients were recalled after 1 one week and checked for any pain, tenderness, swelling, sinus to evaluate outcome of treatment. Data were collected from all subjects and analysed.

RESULTS

The study compared the Postoperative pain after the use of 5.25% NaOCl gel, solution at room temperature & heated solution forms. Total 90 patients were included in the study and were divided into three groups. Group I: 5.25% NaOCl solution at room temperature Group, II: 5.25% NaOCl gel at room temperature Group, III: 5.25% NaOCl solution at 50°C The postoperative pain levels at 24, 48, and 72 hours and 1 week after treatment using VAS were checked. The VAS values in Group I was 2.20±1.86, in Group II was 1.90±0.92 and in Group III was 1.77±0.82. One way ANOVA test used showed non-significant difference between groups with F score 0.887 & P score 0.415. After 48 hours, the VAS Values in Group I was 1.20±1.16, in Group II was 1.10±0.84 and in Group III was 0.97±0.61. One way ANOVA test used showed non-significant difference between groups with F score 0.508 & P score 0.664. After 72 hours, VAS values in Group I was 0.23±0.50, in Group II was 0.27±0.44 and in Group III was 0.17±0.37. One way ANOVA test used showed non-significant difference between groups with F score 1.38 & P score 0.244. After 1 Week, VAS values in Group I was 0.067±0.25, in Group II was 0.00±0.00 and in Group III, 0.00±0.00. One way ANOVA test used showed non-significant difference between groups with F score 2.07 & P score 0.132.

Table 1: Comparison of pain Score between groups at 24 hours

Group	N	Mean	Std. Deviation	F score	P Score
Group I	30	2.20	1.86	0.887	0.415 [#]
Group II	30	1.90	0.92		
Group III	30	1.77	0.82		

One way ANOVA, [#]Non significant

Table 2: Comparison of pain Score between groups at 48 hours

Group	N	Mean	Std. Deviation	F score	P Score
Group I	30	1.2000	1.15669	0.508	0.664 [#]
Group II	30	1.1000	.84486		
Group III	30	.9667	.61495		

One way ANOVA, [#]Non significant

Table 3: Comparison of pain Score between groups at 72 hours

Group	N	Mean	Std. Deviation	F score	P Score
Group I	30	.2333	.50401	1.381	0.664 [#]
Group II	30	.2667	.44978		
Group III	30	.1667	.37905		

One way ANOVA, #Non significant

Table 4: Comparison of pain Score between groups after one week

Group	N	Mean	Std. Deviation	F score	P Score
Group I	30	0.067	0.25	2.07	0.132 [#]
Group II	30	0.00	0.00		
Group III	30	0.00	0.00		

One way ANOVA, #Non significant

DISCUSSION

Irreversible pulpitis¹², is a clinical diagnosis based on subjective and objective findings. Symptomatic irreversible pulpitis is one of the most common cause of dental pain. The treatment modality in such cases is root canal treatment of involved tooth. Postoperative pain^{9,11} may be due to apical extrusion of contaminated debris¹ or irrigation solution, intracanal procedure¹⁸ or because of preoperative pain as body takes little time to remove inflammatory mediators from site of inflammation. In this study, all the teeth which were included were diagnosed as Symptomatic irreversible pulpitis¹⁶ without apical periodontitis, pulpal necrosis, abscess, sinus, crown & / or root fracture etc. Irrigation material should be able to clean the canals, should have antibacterial properties and should be able to dissolve organic matter from complex root canal system especially in the areas where mechanical instrumentation is not possible. NaOCl has good antimicrobial properties^{7, 18} and soft tissue dissolving properties⁷. NaOCl have been used in various concentrations^{21, 24} available such as 0.5%, 1%, 2.5%, 3%, 5%, 5.25%. Out of them 5.25 % concentration is one of the most commonly used concentration of NaOCl for irrigation of root canal system. Gel formulation^{7, 21} of NaOCl is also used and it is based on the theory that there are chances of extruding of sodium hypochlorite solution in periapical region while using solutions and this can be reduced by using gel formulation. Heating of sodium hypochlorite solution is based on the hypothesis is that heating of solution reduces the

surface tension enhances the reach of solution in fine accessory, lateral root canals and isthmus. Previous studies have concluded that increasing temperature of solution has positive effects on properties of sodium hypochlorite²⁶. In our study irrigation was done first using sodium hypochlorite and final irrigation was done using 17% EDTA solution. Root canal treatment was completed in one visit in each of the subject & Patients were asked to record their pain using VAS pain score after 24 hours, 48 hours, 72 hours and 1 week. After 24 hours, mean values of VAS score were 2.20 for group-I, 1.90 for group-II, 1.77 for group-III. There was no significance difference among groups, although values were least for group-III, followed by group-II and maximum for group-I. This indicates that both gel and solution form of NaOCl were more or less similar effective but values were least for group-III which indicates that heated NaOCl solution provided best outcome. This can be explain by results of previous studies which conclude that increasing temperature enhances properties of NaOCl solution. Similarly, after 48 hours, mean values of VAS were least for group-III, followed by group-II and maximum for group-I. After 72 hours, mean values of VAS were 0.233 for group-I, 0.267 for group-II and 0.167 for group-III. More VAS score mean values in group-II (NaOCl gel group) may be explained by in vitro study conducted by L. Luz *et al* (2019) in which they concluded that NaOCl gel showed less soft tissue dissolution as compared to solution form. After 1 week, mean values of VAS score were 0.06 for group-I, 0.00 for group-II and III. There were no

significant difference among groups. In intra group comparison, mean values of VAS score for group-I were 2.20, 1.20, 0.233 and 0.06 after 24 hours, 48 hours, 72 hours and 1 week. There were significant reduction in values (P-value = .0001). This indicates significant reduction in postoperative pain in patients. For group-II mean values of VAS score were 1.90, 1.10, 0.267 and 0.00 after 24 hours, 48 hours, 72 hours and 1 week. There were significant reduction in values (P-value = .0001). For group-III mean values of VAS score were 1.77, 0.9667, 0.167 and 0.00 after 24 hours, 48 hours, 72 hours and 1 week. There were significant reduction in values (P-value = .0001). If we take mean values of VAS score after 24 hours as baseline data, pain scored recorded during 48 hours, 72 hours and 1 week showed significant reduction in each group. VAS score mean values for group-II were less than group-I and least for group-III.

All these values indicate that NaOCl can be used either as solution or gel and solution can be used at room temperature or preheated. Least values for preheated NaOCl solution group (group-III) may be due to reduction of surface tension of solution and better penetration in 3 dimensionally complex root canal anatomy²⁵. Using gel formulations of NaOCl may reduce the chances of periapical extrusion of chemical and thus less inflammatory response leading to less pain. Previous in vitro studies indicate that gel formulations have less penetration in fine accessory and lateral canal systems and less tissue dissolution properties. Root canal system in posterior teeth specially is a complex root canal anatomy²⁵ containing not only more than one main root canals, but also contains accessory canals, lateral canals, isthmus, and apical deltas. In this 3 dimensional complex structure containing pulp

tissue, mechanical cleaning and shaping is not possible in entire volume, so there is big role of irrigation of root canal system³. Endodontic postoperative pain^{9, 11} is affected by several factors such as preoperative pain level, the number of appointments, irrigation method, the method of the determination of the working length, type of the tooth, type of the instrument, movement kinematic of the instrument, extrusion of root canal filling material and apically extruded debris. Although there was no significant difference in postoperative pain between different groups but postoperative pain was reduced in NaOCl gel group and further in NaOCl pre-heated solution group. This could be due to less apical extrusion of NaOCl gel as compared to solution. More reduction of postoperative pain in NaOCl preheated solution could be due to decrease in surface tension that help the solution to reach in 3 dimensionally complex structures with narrow isthmus and accessory and lateral canals. There are few limitations of this study such as small sample size, limited time period and stricter inclusion, exclusion criteria, specific tooth type and subjective nature of postoperative pain which is influenced by multiple clinical factors. All these limitations of this study indicate that further detailed investigations are required with large sample size to evaluate the effect of form and temperature of sodium hypochlorite as intracanal irrigant.

CONCLUSION

Considering the results of our study, both solution and gel form of sodium hypochlorite can be used as irrigant and solution form of sodium hypochlorite can be either used at room temperature or heated. Increasing temperature has positive effects on properties of sodium hypochlorite solution.

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