



COMPARATIVE EVALUATION OF SIX DIFFERENT BRANDS OF 3% SODIUM HYPOCHLORITE USED IN DENTISTRY TO ASSESS THE AMOUNT OF CHLORINE RELEASE AT DIFFERENT TEMPERATURES

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ABSTRACT

Sodium hypochlorite is widely used in dentistry as an irrigant at a concentration of 0.5-6%. In this study we have compared six different brands of 3% sodium hypochlorite at different temperatures to assess the amount of chlorine level. Six different brands of 3% sodium hypochlorite were subjected to physicochemical test to assess the free chlorine at different temperatures i.e. 27, 32, 37, 42, 47, 52, 60 and 70 degrees. Comparisons of 6 brands of sodium hypochlorite were done at different temperatures by using one way anova. Multiple comparisons were made using Posthoc Tukeys test. Repeated measures anova was done to see if the release is different according to the temperature. None of the brands of sodium hypochlorite show any increase in chlorine content at different temperatures. Out of six brands used, the chlorine present in brands, i.e. Vishal, VIP, Novo and Deor was in accordance with the prescribed amount. The other brands, i.e. Deor and Chemedent lacked the proper amount of chlorine required.

Keywords: sodium hypochlorite, chlorine content, chlorine release

INTRODUCTION

Over a last 7-8 decades, sodium hypochlorite (NaOCl) has established itself as an excellent antibacterial agent, capable of dissolving necrotic tissue, vital pulp tissues, and organic components of dentin and biofilms¹. It has been established that NaOCl used in a concentration of 1-5.25% produces satisfactory results as an irrigating solution. The World Health Organization (WHO) recommends 25000ppm available chlorine² in 5.25% NaOCl an increase in the temperature of low concentration NaOCl, was seen to increase the effectiveness and tissue dissolving activity. Documented data on the amount of chlorine release in 5.25% is present. However, the amount of chlorine release at different temperature is yet to be documented. We compared the amount of chlorine release at different temperatures in six different brands of 3% NaOCl. Since its introduction as a hospital antiseptic under the trade names "Eusol" and "Dakin's solution"³, NaOCl has been widely used as an irrigating solution in root canal treatment.

The main factor driving the antimicrobial and proteolytic properties of NaOCl solutions is their content of free available chlorine⁵. Further factors are ph, alkaline capacity, and contact time⁵. Chlorine (a strong oxidant) presents antimicrobial action inhibiting bacterial enzymes leading to an irreversible oxidation of SH groups (sulphydryl group) of essential bacterial enzymes. One way to increase the efficacy of hypochlorite solutions could thus be to lower their pH⁶. One alternative approach to improve the effectiveness of hypochlorite irrigant in the root canal system could be an increase in the temperature up to 60 degrees⁷. This improves their immediate tissue-dissolution capacity. Furthermore, heated hypochlorite solutions remove organic debris from dentin shavings more efficiently than unheated counterparts. The antimicrobial properties of heated NaOCl solutions have also been discussed. However, there are no clinical studies available at this point to support the use of heated sodium hypochlorite of low-concentration NaOCl solutions.

Aims and objective

The aim of the current investigation was to assess the increase in chlorine release at different temperatures and to compare 6 different brands of 3% sodium hypochlorite i.e. Chemedent, Deor, Novo, Neodent, VIP and Vishal in relation to available chlorine.

MATERIALS AND METHODS

Six different brands of 3% sodium hypochlorite were used and subjected to chemical test to assess free chlorine at different temperatures. 2 ml solution from each sample was taken and diluted to 100 ml with distilled water in Nessler's cylinder. After the dilutions were done, 10ml of solution from each sample was taken. It was mixed with 5 ml of 2 N sulphuric acid and pinch of potassium iodide was added until the solution turned pale yellow. After this the solution was titrated against sodium thiosulfate till the colour turns pale yellow. 0.5-1 ml of starch was added till the solution turned blue and titration was continued until the solution became colourless. This procedure was done at room temperature of about 27-29 degree.

Solutions were subjected to heat using a hot plate and samples were obtained at different temperatures i.e. 32, 37, 42, 47 52, 60, 70 degree.

Available chlorine was calculated using the formula:

$$\text{Available chlorine} = \frac{\text{Volume of titrant} \times \text{Strength} \times \text{Equivalent wt. Of Chlorine}}{\text{Volume of sample}}$$

Data Presentation and Analysis

All chemical assessments were performed at different temperatures, mean values and standard deviations were noted. Comparisons of 6 groups at each temperature were done by using one way Anova. Multiple comparisons were made using Posthoc Tukeys test. Repeated measures of anova were done to measure the amount of chlorine released at different temperatures.

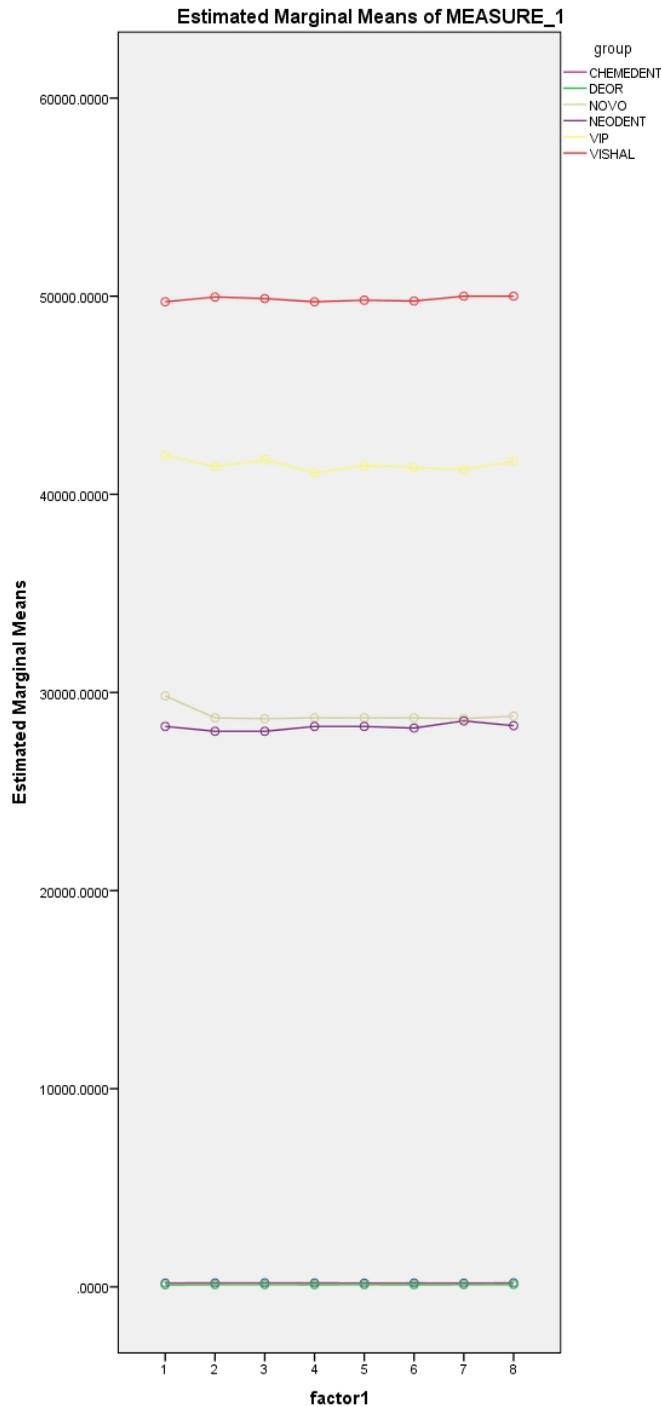
RESULTS

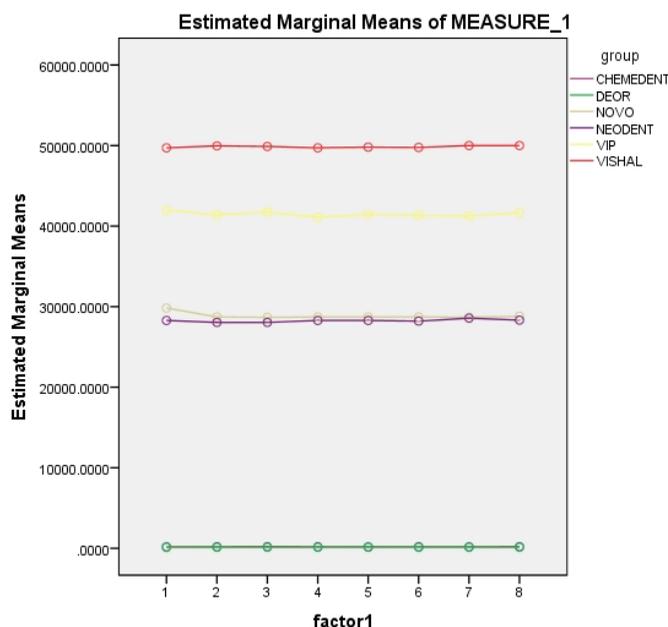
The results showed that there is no significant difference in the amount of released chlorine between the 6 groups of sodium hypochlorite used. However in the sub group comparison other than Novo and Neodent & Chemident and Deor, there is a significant difference in each of the sub

groups. The 1st row shows that there is no significance in the difference in the release of chlorine from room temp to higher temperatures.

The 2nd row shows that there is no difference in the change of release of the chlorine among the groups of hypochlorites.

TESTS OF WITHIN-SUBJECTS EFFECTS						
Measure: MEASURE_1						
Source		Type III Sum of Squares	Df	Mean Square	F	Sig.
Temperature change	Huynh-Feldt	4570574.588	7.000	652939.22	2.030	.060
Temperature change * group	Huynh-Feldt	15581208.038	35.000	445177.37	1.384	.077





DISCUSSION

As previously stated, the amount of chlorine content present in 5.25% NaOCl should be around 20,000-25,000 ppm². This study compared the amount of chlorine present in different brands of 3%NaOCl at room temperature. The chlorine present in brands i.e. Vishal, VIP, Novo and Neodent were in accordance with the prescribed amount. The other brands i.e. Deor and Chemedent lacked the proper amount of chlorine required. The most common method to increase the effectiveness of NaOCl is increasing the temperature of low concentration hypochlorite solutions, which improves their immediate tissue dissolution properties⁷. Furthermore, heated hypochlorite solutions remove organic debris more efficiently. The bactericidal rates for NaOCl solution are more than double for each 5 degree rise in temperature in between the range 5-60 degrees⁸. Chlorine is responsible for the antibacterial properties of NaOCl⁹. It inhibits bacterial enzymes leading to an irreversible oxidation of SH groups (sulphydryl group) of essential bacterial enzymes. This study was done to estimate the amount of chlorine release at different temperatures. Six brands of sodium hypochlorite i.e. Chemedent, Deor, Novo, Neodent, VIP, Vishal were used and subjected to chemical tests at different temperature i.e. 32, 37, 42, 47, 52, 60 and 70 degree. The study showed that there was no significant increase in chlorine content with every 5 degree increase of temperature. Hence, this study does not show that chlorine content increases with increase in temperature. This could be due to the fact that the concentration used of NaOCl used was less i.e. 3%.

In summary, dentists should always be careful while selecting the make and concentration of sodium hypochlorite used,

because the amount of chlorine released is the governing factor in the effectiveness of this irrigant.

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