Analysis of concentration and storage method of sodium hypochlorite solutions in dental offices

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ABSTRACT

Objective: Evaluate the concentration and storage method of sodium hypochlorite solution in dental offices from Santa Cruz do Sul/RS, Brazil. **Methods:** Fifty samples of the solution were collected, where, by titration, we analyzed the concentration of active chlorine. Besides the collection, a questionnaire was conducted in order to verify the type of packaging and cover that the sodium hypochlorite solution was in, as well as the storage location. **Results:** Thirty-eight of the 50 samples tested had concentrations below the indicated, 3 had active chlorine content above of the information from the professional and only 9 had the indicated concentration. As regards the packaging and the type of cover that hypochlorite solutions were stored, 40 of the 50 samples were stored in milky plastic containers, 6 in amber plastic containers, 3 in transparent plastic containers and 1 in glass bottle. Regarding the type of cover, 46 of the collected solutions were found stored in containers with screw cover, and only 4 in packages of pressure cover. Moreover, 43 of the 50 solutions collected were stored in cabinets, 6 in refrigerated environments and 1 was found on the counter next to a stove. **Conclusion:** The majority of the sodium hypochlorite solutions collected and analyzed showed a lower percentage of active chlorine than the informed by the professional, were stored in milky plastic containers with screw cover and kept at room temperature in cabinets.

Keywords: Sodium hypochlorite. Titration. Concentration. Storage.

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Introduction

The success of endodontic treatment is reached being careful, observing techniques and biological principles in all phases of implementation. Therefore, it is necessary to sanitize the root canal using an irrigating solution with proper concentration able to remove debris and microorganisms within the canal, facilitating its shaping.

Several substances have been used during root canal preparation, performing chemical and physical actions concurrently with the mechanical action of endodontic instruments.[1] It is highly desirable that the agents selected as endodontic irrigants possess some fundamental properties such as antimicrobial activity, dissolve organic tissue, assist in debridement and absence of cytotoxicity to periapical tissues.[2,3]

Among the chemical substances used there is the sodium hypochlorite, a chlorinated classified as the main auxiliary chemical substance used in currently endodontics.[4] This compound has a number of properties and advantages, among which it is included the ability to dissolve organic matter,[5] and the broad antibacterial spectrum that enables the effective elimination of microorganisms from the root canal[6] and the dentinal tubules.[7] The concentration and temperature interfere with the antimicrobial action and tissue dissolution capacity of sodium hypochlorite, where the higher concentration and temperature, the greater the antimicrobial activity and faster tissue dissolving.[8,9]

Among its disadvantages, sodium hypochlorite is unstable to storage and it is inactivated by organic matter[1], highly cytotoxic when extravasated within the periradicular tissues,[10] reduces the fracture resistance of teeth and the bond strength of restorative materials to dentin.[11]

Thus, the aim of this study was to evaluate the concentration and the storage method of sodium hypochlorite solution used in dental offices from Santa Cruz do Sul - RS.

Methodology

Fifty dental offices located in Santa Cruz do Sul – RS - Brazil were selected. Prior to the sample collection, professionals received and signed the Informed Consent Statement.

In each dental office it was sampled a quantity of 50 ml of sodium hypochlorite used in the endodontic therapy by the dentist at the collection site. This solution was stored in a clear plastic with screw cap. The offices were identified by numbers 1 through 50, as well as the samples of sodium hypochlorite.

Immediately after the collection, the container with the respective solutions of sodium hypochlorite for each office was taken to an analytical center (CAUNISC - Analytical Center of the University of Santa Cruz do Sul) to carry out the analysis of the content of chlorine through the titulometric test, defined as the process used to experimentally determine the concentration of a particular solution.

A questionnaire was applied along the sample collection (Fig 1) aimed at dentists responsible for the offices, which contained questions regarding packaging, type of package cover and storage site of sodium hypochlorite solutions collected.

The descriptive statistical analysis of data was performed after obtaining the results.

Results

Of the 50 samples of sodium hypochlorite solution that were collected and analyzed, 9 had the concentration indicated by the professional (Fig 1). Regarding the packing that the solutions of sodium hypochlorite were stored, the majority was in milky plastic packing (Fig 2). Regarding the type of cover of the packages where the solutions were stored, most were found in containers with screw cap (Fig 3). And finally, as for the storage of sodium hypochlorite solutions, most were found in cabinets (Fig 4).

QUESTIONNAIRE

Dental office number: _____

Concentration of the solution collected: _____

1) Packing used:

( ) milky plastic ( ) transparent plastic ( ) amber plastic ( ) glass bottle

2) Type of packing cover

( ) screw ( ) pressure ( ) other: _____

3) Storage site

( ) cabinets ( ) refrigerated environment ( ) other: _____

Figure 1. Questionnaire used in this research.

Discussion

In endodontic therapy, part of the capacity of the root canal disinfection is due to mechanical instrumentation, removing debris and microorganisms from the root canal. The other part concerns the actions of chemical cleaning and disinfection promoted by irrigating solutions.

Sodium hypochlorite is the substance that combines the best physical and chemical properties and therefore is the most commonly used.[12] The solution of sodium hypochlorite is found only in aqueous form, having its disinfectant action by the release of chlorine.[13]

Due to the instability of sodium hypochlorite, it was recommended to store it in a fresh place away from light and renewed every three months.[14] Hence, the present study took into consideration the location and storage method of sodium hypochlorite solution, relating these factors to the concentrations indicated by the professionals.

According to previous studies, factors such as light, temperature and storage method of sodium hypochlorite solutions can promote changes in the concentration of active chlorine.[15,16] So, this study sought to analyze the solutions used in dental offices in Santa Cruz do Sul, in order to verify that at the time that sodium hypochlorite was used as a irrigant for cleaning and sanitation of the root canal, it was in the same concentration that when it was acquired.

It is known that the hypochlorite solutions are not stable. According to the method and time of storage, may significantly lose the concentration of active chlorine. This factor must be taken into account, since these solutions may remain stored in the market for a long time, and when they are used, the professional is not aware of the real concentration that the product has at the time of use.[17]

Other authors have evaluated the active chlorine content of different brands,[16] concluding that sodium hypochlorite is an unstable chemical substance and presents reduction on the concentration of available chlorine, which was also concluded in this study.

Previous study confirmed the decreased percentage of active chlorine when sodium hypochlorite was exposed to sunlight.[18] However, this study covered only solutions stored in amber colored glass. In the present study there was a slight difference in results as regards

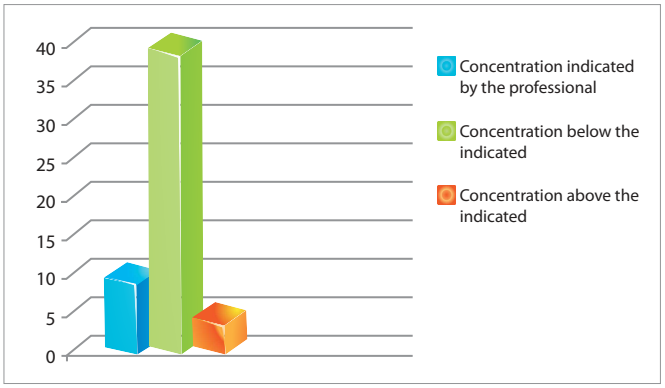

Figure 1. Concentration of samples collected.

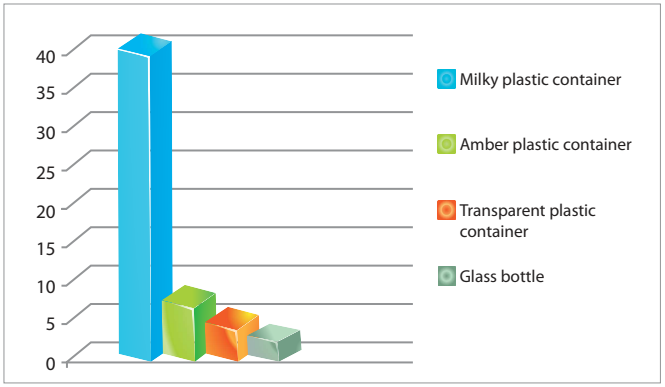

Figure 2. Packing used.

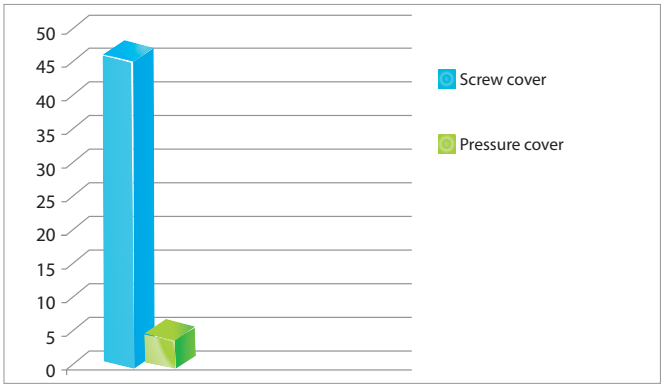

Figure 3. Type of packing cover.

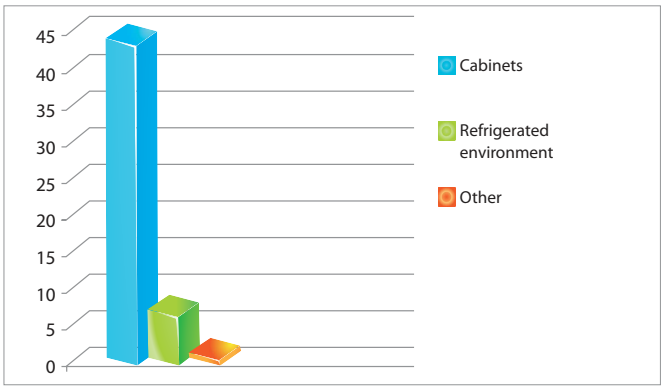

Figure 4. Storage site.

the coloration of the pack. Solutions that were stored either in milky plastic or amber plastic container resulted in very close final concentrations, with a minimum level of variation. The difference of active chlorine can be noticed when comparing the plastic containers with glass bottle (vial of anesthetic), which has a much lower concentration than the first. The reaction of active chlorine with oxygen causes a decrease in its concentration, which could explain the reduction in content of active chlorine when the transport of the substance from the original packing to vials.[17]

These results also showed that when stored under refrigeration, it was observed an increase in active chlorine content of the substance. But when the solution was stored in cabinets, the decrease was the same. Some studies have confirmed that the packing at lower temperatures has brought greater stability to the solutions of 1% sodium hypochlorite,[18,19] which actually occurred in this study.

By the collected data from the analysis was possible to conclude that the vast majority of sodium hypochlorite solutions that were collected and analyzed showed lower percentage of active chlorine than the informed by the professional; were stored in milky plastic containers with screw cover and kept at room temperature in cabinets. Clinically, it is suggested that greater care must be taken to the continued use of this solution, being attentive to the actual concentrations of the same, since this factor may influence the prognosis of endodontic therapy.

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