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Research Article

Debris Removal Ability of Four Irrigating Solutions Used During Root Canal Treatment

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Abstract

Aim: The authors studied, *in vitro*, the Debris removal ability of Dakin´s solution (0.5% NaOCl), Milton´s solution (1.0% NaOCl), Clorhexidine (4.0%) and Distilled water when used as irrigants during root canal instrumentation.

Materials and Methods: Sixty extracted human maxillary incisors were divided into four groups were instrumented with same technique but each group used a different irrigant: a) Dakin´s solution (0.5% NaOCl), b) Milton´s solution (1.0% NaOCl), c) Chlorhexidine (4.0%) and d) Distilled water.

Results: The study showed that irrigating with Dakin´s and Milton's solutions resulted in significantly less debris remaining on canal walls as compared with distilled water. Chlorhexidine (4%) left less debris on canal walls compared with distilled water but the difference was not statistically significant and Milton´s solution energized by rotary leaves root canals with less debris than water. The apical third showed more debris than the middle third, and none of the irrigating solutions left the root canal walls totally free of debris.

Keywords: *Irrigation; Root Canal Treatment; Chlorhexidine; NaOCl*

Introduction

The authors studied, *in vitro*, the debris removal ability of Dakin´s solution (0.5% NaOCl), Milton´s solution (1.0% NaOCl), Chlorhexidine (4.0%) and Distilled water when used as irrigants during root canal instrumentation. Sixty extracted human maxillary incisors were divided into four groups were instrumented with same technique but each group used a different irrigant. The results showed that irrigating with Dakin´s and Milton's solutions resulted in significantly less debris remaining on canal walls as compared with distilled water. Chlorhexidine (4%) left less debris on canal walls compared with distilled water but the difference was not statistically significant. and Milton´s solution energized by rotary leaves root canals with less debris than water. The apical third showed more debris than the middle third, and none of the irrigating solutions left the root canal walls totally free of debris.

Cleaning and shaping can be easily accomplished in straight canals. However, many canals have moderate, severe, or abrupt curvatures that make them susceptible to procedural accidents such all as ledges, zips, perforations and blocked canals.

The removal of pulp tissue, debris smear layer and bacteria from the root canal space prior to obturation is one of the primary aims of root canal treatment. The degree of difficulty experienced during the cleaning and shaping procedure is affected by the curvature of canal, access to the canal space, canal length and canal diameter.

While irrigants such as sodium hypochlorite are helpful in dissolving organic debris [1], thorough instrumentation is a necessity. Many investigators have searched for irrigation solutions capable of cleaning and disinfecting root canals [2-7], as well as an instrumentation technique for efficient chemo-mechanical preparation [8-11].

Several new nickel-titanium instruments have been developed to facilitate the difficult and time consuming process of cleaning and shaping the root canal system and to improve the quality of root canal preparation.

The new designs of hand and rotary instruments include non-cutting tips, radial lands and varying tapers. These features are meant to improve the safety of canal preparation, shorten working time and create a greater flare preparation. Most are used in a crown-down sequence. The purpose of the present study was to evaluate in-vitro, the cleaning ability of Dakin's solution (0.5% NaOCl), Milton's solution (1.0% NaOCl), Chlorhexidine (4.0%) and distilled water when used during root canal instrumentation.

Material and Methods

Sixty freshly extracted human maxillary central were randomly selected, radiographed bucco-lingually and mesio-distally, then placed in individual containers with 2% formalin and stored in a refrigerator at 10˚C.

At the time of use, the teeth were removed from formalin, washed in running water for 30 minutes and randomly separated into four groups of 15 teeth. Each group was identified by the irrigating solution used.

Group (n = 15)	Irrigating solutions during root canal preparation
A	Dakin's solution (0.5% NaOCl)
B	Milton's solution (1.0% NaOCl)
C	Chlorhexidine (4%)
D	Distilled water

Table 1: *Solutions used during root canal preparation.*

After preparing a conventional access preparation for each tooth, a #15 K-type file was used to determine the working length by penetrating the apical foramen and pulling back into the clinically visible apical foramen. Working length was established 0.5 mm coronal to the apical foramen and confirmed radiographically.

All the root canals were then explored and prepared by manual instrumentation with #15 K-file (Moyco Union-Broach), establishing as the real working length the distance measured up to 0.5 mm below the root apex.

All working lengths were confirmed radiographically. Manual instrumentation was performed with Balanced Force with #15 to #25 file in the apical third. Rotary instrumentation were performed with gates Glidden drills #5, #4, #3, #2 on the body of the root canals (cervical and middle thirds) and Light Speed instruments starting with #25 to #80-#90 exclusively in the apical third.

Instrumentation was performed exactly according to the manufacturer's instructions. Apical stops prepared with Light Speed instruments were shaped to sizes 80 and 90 respectively. During this phase, the canal was irrigated with 1.8 ml of the irrigating solution. The same method was used with all of the fifteen teeth of each group only changing the irrigating solutions tested.

After cleaning and shaping the root canals, all were separated longitudinally and evaluated from cervical, middle and apical third. A stereo microscope was used with 100x magnification. Each root was selected, and did the observations.

Results

The experimental data used in this study consisted of four groups with a Q- Cochran test [12]. The Q-Cochran test showed statistical significance between the four groups. To define which of the irrigation solutions was significantly different from the others, the complementary Tukey test was used for this factor of variation. The Tukey test showed a statistical difference between the means of 4% Chlorhexidine and Distilled water. With the Tukey test, we found statistically equal with Dakin´s and Milton´s solutions.

The results showed that the increase in the percent of debris always occurs in the same direction, i.e., from the middle region to the apical, no matter which solution is utilized.

Discussion

The chemical-mechanical preparation binomial forms the key requisite or the success of root canal instrumentation. The objective of these two interdependent factors consists of the cleaning of the canal and its eventual ramifications removing the largest possible amount of debris in order to establish ideal conditions which allow a functional recuperation of the dental organ and a regeneration of tissues eventually injured by infection.

Cleaning all of the canal ramifications removing the largest amount of debris in order to establish ideal conditions which allow a functional recuperation of the dental organ and a regeneration of tissues eventually injured by infection.

The results obtained in the present work show that Dakin´s and Milton´s solutions were the solutions which left the smallest amount of residue in the interior of the canals, followed by 4% Chlorhexidine and finally, water which left the greatest amount of debris.

The fact that Dakin's and Milton´s solutions were the best cleaner of the root canal confirms the findings of Cunningham., *et al*. [10]. This may be due to the potentiation of the solvent action of the sodium hypochlorite solutions when energized by temperature [13].

Irrigating solutions used in endodontic treatment not only present antimicrobial action, but they also clean the pulp chamber [14]. None of the irrigating solutions studied in the present work was capable of eliminating all of the debris in the root canals, since none of them left the root canals completely free of debris.

Conclusion

1. The apical third showed a greater amount of debris than the middle third, regardless of the solution used.
2. None of the solutions used for irrigation of the root canals allowed full removal of the debris from the interior of the canal.
3. Dakin´s solution (.05% NaOCl), Milton´s solution (1.0% NaOCl) as an irrigating solutions, left the root canals with less debris than water.
4. 4% Chlorhexidine, as an irrigating solution, occupies a middle position, undefined between the effective action of Dakin´s and Milton´s solutions and the less efficient action of Water.

Conflict of Interest

There is no conflict of interest.

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