The influence of papain gel as endodontic irrigant in the apical leakage

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ABSTRACT

The aim of this in vitro study was to evaluate the apical leakage in teeth obturated after they had been prepared using two different endodontic irrigants. Forty extracted straight human canines were divided into the following experimental groups: Group 1: was instrumented using 0.8% papain gel as an endodontic irrigant. Group 2 used the 1% sodium hypochlorite solution as irrigant. Both experimental groups were instrumented manually using the step-back technique, the irrigation was performed after the use of each endodontic instrument. The samples were then obturated and immersed into a 2% methylene blue solution for 7 days at 37ºC. After this period the apical leakage was linearly evaluated. The results showed that the group where the sodium hipochlorite solution was used exhibited less apical leakage, but there was no statistical difference between the experimental groups (p>0.05).

Keywords: Endodontic irrigants; endodontics.

INTRODUCTION

The biomechanical preparation of root canals aims at molding and cleansing. Didactically, the preparation includes mechanical, physical and chemical methods. The mechanical ones include the different techniques of instrumentation. The irrigation of the root canal care for the

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physical and chemical cleaning in order to facilitate the instrumentation, lubricating the root walls, removing dentin chips and, depending on the solution used, there is an additional chemical action on the organic and inorganic residues, as well as some antimicrobian action.

Ingle (1989) states that two cleaning procedures are necessary: the first has to be the gasogenic type, performed in the pulpar chamber to prevent debris from obstructing the canal or inducing increased bacterian population. It also aims at preventing pigmentation of the crown. The second one is a continuation of the procedure in the chamber, consisting in a careful cleaning of the root walls that should become smooth and shiny.

Leonardo (1998) considers three moments for the irrigation: before, during and after the instrumentation. Before instrumentation in order to neutralize toxic products and organic remains in the canal, or after the removal of the pulp to allow aseptic penetration in the interior of the canal; during the instrumentation aiming to keep the wall of the canal humid, favoring the penetration, and after to remove organic debris and dentin chips, which could harm the local action of drugs.

The objectives for endodontic irrigation could be summarized as follows:

To mobilize particles such as pulp remains, blood, dentin chips and necrotic debris that could lead to obstruction or periapical inflammatory reaction; antimicrobian action decreasing the bacterian population and acting as a coadjutant in this function with the delay dressings; lubricant, moistening the dentinary walls and facilitating the instrumentation; to remove the smear layer of the dentinary tubules, promoting the tissue dissolution; and to decrease the surface repellency of the canal using anionic detergents and EDTA, which demineralize the dentin favoring the contact and action of the intracanal drugs.

Due to the importance of this step in the biomechanic preparation of the canal, it is necessary to select the chemical substance that meets the above mentioned requirements, since this substance has the advantage of having biological compatibility in clinical use.

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This study aims to evaluate, *in vitro,* the influence of irrigation using papain gel at 0.8% as compared to the solution of sodium hypochlorite 1%, during the biomechanical preparation for apical sealing of endodontic obturations.

MATERIAL AND METHOD

Forty extracted healthy human canines with a straight and unique root were selected. Teeth were dry and were kept in saline for 48 hours before manipulation. Teeth were randomly allotted in two groups. In group 1 the irrigant was papain gel at 0.8% and in group 2, a solution of sodium hypochlorite at 1%.

After a conventional opening of the crow, the canals were explored with a #15 K file (Maillefer S.A.–Switzerland) till its visualization in the apical foramen making it possible to determine the teeth length. The apical foramen was standardized with a #30 K file. The biomechanical preparation included the step-back echelon instrumentation technique. The apical rabbet was determined at 1 mm from the apical foramen with a #50 K file. Manual irrigation was proceeded with a Luer-Lock sirynge equipped with a 30x5 needle at each change of instrument according to the determination of the each group, with 1 ml of the irrigating agent. The step-back echelon was made with K files raging from # 55 to # 80. At each increase in diameter it was retreated 1 mm of the length of the previous instrument. Irrigation and recapitulation with the memory instrument were used at each step to prevent obstruction by dentin chips.

After the instrumentation was done, the impermeabilization of the external surface of the tooth with two layers of slow setting (Araldite-Brascola, São Bernardo do Campo-SP) in intervals of twenty four hours at each layer was made. The impermeabilization was finalized with a layer of color nail enamel. After the impermeabilization the test of the main gutta-percha cone (Tanari, Manacapuru-AM) with X-ray confirmation followed. Teeth whose cones were not in the real length for work were reshaped and the test was done once again.

Obturation was done by the technique of a sole gutta-percha cone, which was settled by the traditional technique, being the canals filled previously with cement of zinc oxide and eugenol (S.S White, Rio de Janeiro-RJ) with the aid of a spiral root canal filler (Maillefer S.A.–Switzerland).

Afterwards, all specimens were immersed in a solution of methylene blue at 2% and kept at 37ºC for seven days. After this period, the teeth were rinsed, the impermeabilization was removed and the teeth were dryed. Longitudinal grooves were made in the vestibular and lingual aspect with a high-speed diamond point. Thus, with a surgical chisel, the roots were separated in two parts. The evaluation of the linear marginal leakage was made in a profile projector (Profile Projector, model 60, Nikon, Japan) with a 20-x magnification. It was taken into consideration the greater extension of dye infiltration shown in the root from the apices of each root.

Data collected were submitted to the non-parametric test of Kruskal-Wallis.

RESULTS

The measures for marginal apical leakage, in millimeters, of the different groups are shown in TABLE 1. It was made an individual representation of each tooth being 20 irrigated with papain gel 0.8% (GROUP 1) and 20 with sodium hypochlorite 1% (GROUP 2).

TABLE 1: Measures for marginal leakage (mm) of dye obtained in the experimental groups.

GROUP 1	GROUP 2
3.091	5.435
5.298	3.638
3.714	4.332
4.364	3.150
4.103	3.250
4.850	3.237
12.750	2.505
4.084	2.387
4.323	3.373
2.287	2.105
3.882	3.305
2.346	3.169
2.514	4.082
2.239	3.176
4.841	3.798
4.100	3.247
4.252	2.918
3.243	12.078
1.106	3.417
2.160	2.803

TABLE 2 shows the comparison among experimental groups, the medium post and the medium scores according to the non-parametric test of Kruskal-Wallis.

TABLE 2 – Comparison among experimental groups

GROUP	SUM OF THE RANKS	MEAN RANK	MEAN SCORE	N
1	437	21.85	4.00085	20
2	383	19.15	3.79515	20

Critical value: 3.84 (5%) HC: .5334244 (not significant)

Results showed that the obtured teeth whose biomechanical preparation took irrigation with sodium hypochlorite presented less marginal leakage than the group in which the preparation included papain gel as irrigant. However, there was no statistical significant difference among groups for a: 5%.

DISCUSSION

Irrigation is an important step in the biomechanical preparation of root canals because it allows adequate condition to the next step: obturation. The success of the endodontic treatment depends mostly on this initial phase and this is the reason behind the great number of studies on irrigating solutions. Scan electronic microscopy is often used to evaluate the surface cleaning and the efficiency of the irrigating solutions (Baumgartner & Cuenin, 1992, Cheung & Stock, 1993, Sen et al., 1995). In the present study the marginal leakage was used as a parameter to evaluate this ability for an adequate biomechanical preparation using these different irrigating solutions as variables.

Sodium hypochlorite is probably the most widely used substance as irrigant agent in endodonty (Cheung & Stock, 1993, Walton & Rivera, 1996, West et al., 1997). Leonardo (1998), stresses the qualities of sodium hypochlorite solutions: it dissolves organic matter, presents bactericide action, neutralizes toxic and septic products, has low surface tension, has alkaline pH, has double detergent action and rapid action. Furthermore, is biologically compatible according to its clinical use in its different concentrations.

Taking into consideration the aspect of surface cleaning, Baumgartner & Cuenin (1992) demonstrated that a similar action when used in concentrations of 1%, 2.5% and 5.25%. However, the same solution of sodium hypochlorite showed some adverse effects such as tissue irritation and allergenic potential (Becking, 1991, Kaufman & Keila, 1989, Caliskan et al., 1994), as the risk of tissue damage would be proportional to the increase in concentration of the solution. This fact indicates the need to search for other alternative substances.

Papain gel 0.8%, being a proteolytic enzyme (Kimmel & Smith, 1957), can dissolve the pulpar tissue and is bactericide. Because of such characteristics it can be indicated as an irrigating agent (Harlan, 1900, Hension, 1977). Flindt (1978) reports that the proteolytic action occurs only on necrotic tissues. Therefore, its is possible to assume that, in endodontic use, its action be restrict to the necrotic pulp and any overflowing beyond the apices would not cause significant tissue damage. Ferreira et al. (1999), in a study that compares its affectivity as endodontic irrigating substance reveals the antimicrobian action of papain gel. However, this action is less than that of the sodium hypochlorite and a detergent derived from castor oil. Its use in endodonty is also suggested by Duarte et al. (1999) and Marchesan et al. (1999).

An efficient irrigating agent promotes cleaning of the root canal walls allowing an adequate contact and penetration of the filling material in the dentin tubules leading to a hermetic apical sealing. In this way Sen et al. (1996) demonstrated that there was a proportionally inverse relation between the penetration of the cement in the dentin tubules and marginal dye leakage in endodontic obturation, i.e., the better the clean-

ing of the root canal, the less the marginal leakage. As the instrumentation technique and the filling were the same for both groups, the comparative analysis has determined the influence of the irrigating substances alone. The obturation technique by the sole cone, although did not present optimal results regarding the apical sealing, was used to minimize the risk of increasing the possible variations, such as the familiarity with the technique, number or characteristic of secondary cones. The group in which the 1 % sodium hypochlorite was used showed less marginal leakage. However, this result did not show statistical significance when compared to those of the group that used 0.8 % papain gel. This research showed that the marginal infiltration was similar in endodontic obturations using both irrigating solutions. Other studies evaluating different properties such as the antimicrobian potential and biological compatibility for instance should be conducted to consolidate the indication of papain gel as an endodontic irrigant. According to the methodology of the present study its is possible to conclude that:

Taking into consideration the aspect of the marginal leakage, the papain gel may be suggested as an irrigating agent in endodonty.

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