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Original Research Article

In vitro evaluation of gutta-percha dissolution ability of different solvents

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Abstract

Introduction: The removal of the filling material during the Endodontic retreatment is essential, so a better action of solvents on the gutta-percha is desired. **Objective:** To evaluate in vitro the gutta-percha dissolution ability of different solvents. **Material and methods:** Four solvents (xylol, eucalyptol, citrol, and orange oil) were applied on gutta-percha points, which had been later submitted to the weight loss analysis at 2, 5, and 10 minutes. For each solvent, 30 size #60 main cones were used, divided into three groups. Distilled water was used as control group. The statistical test applied was Kruskal-Wallis. **Results:** No statistically significant difference occurred among the solvents at 2 minutes ($p > 0.05$); however, during this period, citrol had the best performance. In longer time intervals, the xylol showed differences compared to eucalyptol at 5 minutes and to eucalyptol and citrol at 10 minutes ($p < 0.05$). The worst results were found for eucalyptol. **Conclusion:** This xylol was the solvent with improved ability to dissolve the gutta-percha points, with better results at longer time periods.

Introduction

Complete removal of the filling material from the root canals is a fundamental stage of retreatment [2], preferably procedure adopted in case of failure of the Endodontic therapy [4, 12].

The emptying of the root canal, in these situations, many times is not a simple task, because many materials are used in endodontic fillings, such as pastes, cements, silver cones, amongst others, highlighting gutta-percha [4].

Aiming at the easy penetration of the instruments inside the filled root canal, the solvents are elect because they allow the "softening" of filling material [11].

The genotoxic and cytotoxic potential of the solvents is known [19]. This took to the search for a biocompatible material that allows to an effective removal of the filling material, resulting in faster treatment and better capacity of cleanness and disinfection [7, 18]. Although the high performance in terms of capacity of dissolution of gutta-percha [17], the xylol presents undesirable effect and its use must be cautious [10]. The eucalyptol is taken from the essential oil of eucalyptus, is antiseptic and antibacterial, with low toxicity [8]. Its main drawback is the delay in solubilize the gutta-percha, a fact that can be improved if it is heated [25]. Both the orange oil and orange terpene (citrol) are essential oils extracted from the bark of sweet orange. These compounds have the advantage of the pleasant odor and the absence of harmful effects, for example, the orange oil, has a similar action on the gutta-percha when compared to xylene [15] and chloroform [18, 20, 21].

Based on the above, this study aimed to evaluate in vitro the gutta-percha solubilization ability of xylol, eucalyptol, citrol, and orange oil.

Material and methods

Only one operator led all the experimental part. One hundred-fifty size #60 gutta-percha master cones were selected (Dentsply, Petrópolis, RJ, Brazil). All cones were weighed on an analytical scale of high precision (Bioprecisa JA3003N, Curitiba, PR, Brazil) at the beginning of the experiment.

Then, the cones were divided into five groups (n= 30) according to the solvent used:

GI – Eucalyptol (Biodinâmica Química e Farmacêutica Ltd., Ibiporã, PR, Brazil);

GII – Xylol (Inodon, Porto Alegre, RS, Brazil);

GIII – Citrol (Biodinâmica Farmacêutica e Química Ltd., Ibiporã, PR, Brazil);

GIV – Orange oil (Maquira Indústria de Produtos Odontológicos Ltd., Maringá, PR, Brazil);

GV – distilled water (control) (Asfer Indústria Química Ltd., São Caetano do Sul, SP, Brazil).

Each solvent was tested at three different time intervals: 2, 5, and 10 minutes. Each cone was placed individually onto Petri dishes (Prolab, São Paulo, SP, Brazil) completely immersed on 5 ml of solvent, at room temperature. The time was measured and, when the determined time was reached, the solvent was completely removed out of the plate with the aid of a disposable plastic syringe. Then, Ethyl alcohol was poured onto the cone on the plate for 5 minutes for initial washing. After that period, the alcohol was removed with the aid of the syringe and 5 ml of distilled water was used for more 5 minutes. Distilled water was removed and the cone was dried at environmental temperature for 1 hour.

After these procedures, the cones were again weighed and the dissolution caused by the solvent was obtained from the difference between the initial and final weights.

The loss of weight was calculated in percentage, and the data was statistically analyzed for each time interval. The Kruskal-Wallis test for was used for the analysis among groups, with a significance level of 5%.

Results

The results of the tests of gutta-percha dissolution ability are shown in table I and figure 1.

Table I – Mean of weight loss percentage differences of gutta-percha cones after use of solvents

Time	Solvent			
	Xylol	**Eucalyptol**	**Citrol**	**Orange oil**
2 minutes	0.25A	0.48A	1.70A	1.21A
5 minutes	4.13A,B,c	0.95A,B,d	1.94A,B	2.85A,B
10 minutes	9.28A,B,c	1.45A,B,d	2.62A,B,e	4.62A,B

Note: Equal uppercase letters in columns and small letters in lines indicate no statistically significant differences; different letters indicate statistically significant differences. Kruskal-Wallis ($p<0.05$)

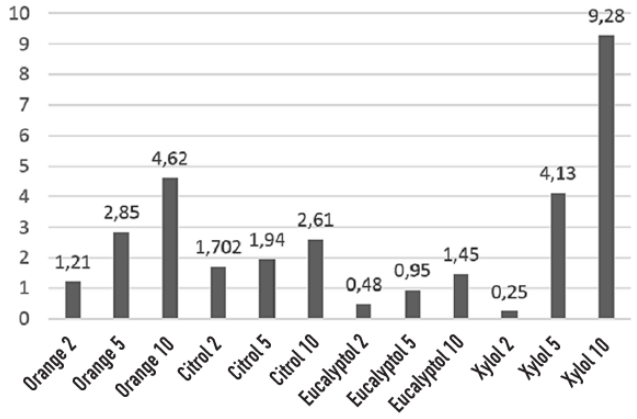

Figure 1 – Mean of weight loss percentage differences of gutta-percha cones after use of solvents

The general analysis of the solvents showed no statistically significant differences ($p>0.05$).

At 5 and 10 minutes, differences among groups occurred ($p< 0.05$).

At 5 minutes, xylol was exhibited the highest percentage of weight loss (4.13%), statistically different form that of eucalyptol, with the smallest percentage of weight loss (0.95%) (figure 1).

At 10 minutes, xylol (weight loss of 9.28%) was statistically different from ($p< 0.05$) citrol and eucalyptol, with weight losses of 2.61% and 1.45%, respectively (figure 1).

Discussion

The use of solvent in Dentistry decreases the working time in the cases requiring the removal of the filling material [11]. Amongst filling materials, gutta-percha is the most used and associated with endodontic cements [4, 8]. With the advent of the rotary instrumentation, research has been directed more towards verifying the filling material removal capacity form the root canal system through different instruments, so the solvents act to facilitate the instrument penetration, but they make the canal difficult to clean [1]. Moreover, the solvents seem to reduce the adhesiveness of other materials to dentin [3, 14].

This study aimed to compare the gutta-percha dissolution capacity of xylol, eucalyptol, citrol, and oil of orange, at 2, 5, and 10 minutes, without any associated techniques.

Concerning to the performance as a solvent, the xylol had the highest capacity among the tested materials. In relation to the time period, 2 minutes were not enough to dissolve gutta-percha even with the weight loss, but without statistically significance, which opposes studies that found weight gain after immersion in orange oil for 1.5 minute [13].

At 5 minutes, the xylol exhibited the best solubility in relation to the other materials, result also observed by other authors [11, 13, 17, 24]. Oyama et al. [13] did not observe any dissolution capacity of eucalyptol at 5 minutes, which also al was reported in the study of Moraes *et al.* [11], who found that also orange oil showed no ability to dissolve gutta-percha after 5 minutes.

In this present study, we identified that at 5 and 10 minutes xylol presented the best solubility and eucalyptol the worst solubility. These results corroborate previous results, where the xylol had optimum performance [9, 16, 24]. However, it has consensus concerning the necessity of caution due to the carcinogenic potential of this substance [13, 17, 19].

Other researchers reported the oil of orange and xylol had better results, but without significant differences [13]. In the study of Tanomaru-Filho *et al.* [24], the orange oil showed similar result to that of eucalyptol, but a result lower than xylol.

The oil of orange and eucalyptol were also studied by Limongi *et al.* [8] and Scelza *et al.* [22] as presenting similar capacity of cleanness of the filling material from the root canals.

The eucalyptol, even having the smallest gutta-percha dissolution ability in this study can also be an alternative in cases of retreatment, because of non-toxic effects [6, 9, 23].

The orange oil is indicated because of no side effects have been described in the literature and this solvent has good gutta-percha dissolution capacity [15, 18, 20, 21].

Further studies are necessary to evaluate the capacity of these solvents on other brands of gutta-percha points and solvents, given existing variability [5].

Conclusion

Considering the obtained results, xylol was the best gutta-percha dissolution capacity, while eucalyptol presented the worst results.

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