

Remaining Filling on the Root Canal Walls after Retreatment with Three Gutta-percha Solvents

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Summary

The aim of the investigation was to evaluate the amount of remaining gutta-percha and cement on dentine walls of the root canal after retreatment with three different gutta-percha solvents: eucalyptus oil, halothane and orange oil. Seventy one-rooted teeth were instrumented by "step-back" technique and filled with gutta-percha and Diaket cement using a cold lateral condensation technique. After 180 days storing in saline solution the samples were divided into three groups. Retreatment was done by hand instruments with the addition of solvent. The procedure was considered finished when there were not obvious traces of gutta-percha and cement on the instrument or paper point. The teeth were split and photographed by camera mounted on a stereomicroscope. The area of remaining gutta-percha and cement was calculated by computer program "ISSA". The greatest amount of remaining root canal filling was found after retreatment with orange oil ($3.85 \pm 3.15 \text{ mm}^2$), followed by halothane ($3.72 \pm 2.52 \text{ mm}^2$), and the best result was achieved with eucalyptus oil ($2.82 \pm 1.31 \text{ mm}^2$), but without statistical significance.

Key words: root canal, filling, gutta-percha, cement.

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Introduction

Root canal retreatment is the first procedure to be considered if the root canal filling is inappropriate and access is possible through the tooth crown (1). The root canal filling usually consists of gutta-percha and cement. Numerous investigations have been conducted to find the chemical that is effective as gutta-percha solvent

and is not harmful to adjacent tissue and the whole organism of the patient and therapist. Gutta-percha could be removed from the root canal by using hand instruments, machine driven instruments, warmed and ultrasonic instruments and laser (2-6). Different solvents are necessary when gutta-percha is removed by hand instruments. Chloroform, the most frequently used gutta-percha solvent, has been classified as a

potential carcinogen (7) and consequently other solvents were considered for gutta-percha dissolving. Different solvents such as halothane, eucalyptus oil, xilol, methyl chloroform, tetrahydrofuran, methyl chloride and others have been recommended as substitution for chloroform (7). Efficacy of gutta-percha solvent could be assessed by measuring the time needed for retreatment (9), the amount of apical protruded gutta-percha (10) and area of remaining gutta-percha on the dentine walls of the root canal after retreatment (5).

The aim of this study was to evaluate the efficacy of three gutta-percha solvents: eucalyptus oil, halothane and orange oil, by comparing the area of remaining gutta-percha and cement on the dentine walls after retreatment.

Materials and methods

Seventy one-rooted teeth with mature apex were used for the investigation. The pulp chamber was opened by a fissure diamond coated bur with water cooling. Working length was achieved and canals were instrumented by "step-back" technique with copious irrigation by 2,5% water solution of NaOCl (approximately 10 ml per tooth). All samples were instrumented with K-type reamer #40 (Dentsply Maillefer, Ballaigues, Switzerland). The orifices of root canals were enlarged by Gates-Glidden burs #3 and #4 (Dentsply Maillefer, Ballaigues, Switzerland). The samples were filed by cold lateral condensation technique using a standardized gutta-percha points (Kerr Analytc, Orange, USA) and polyketone resin Diaket (ESPE, Seefeld, Germany).

Samples were stored in saline solution 180 days at 37°C. Teeth were randomly divided into three groups with 20 samples each. Ten samples served as a control group, five positive and five negative controls. In the first group the solvent used was eucalyptus oil eukaliptol (Kemig d.o.o., Zagreb, Croatia). In the second group halothane (Zeneca, Macclesfield, Cheshire, UK), and in the third group orange oil (Aromara, d.o.o., Zagreb, Croatia). Distilled water was used for the

negative control groupe and chloroform for the positive control group (Kemika, d.o.o., Zagreb, Croatia). During retreatment hand instruments were used: K-type reamers (Maillefer, Ballaigues, Switzerland) and Hedström files (Maillefer, Ballaigues, Switzerland). Machine driven instruments were Gates Glidden burs (Maillefer, Ballaigues, Switzerland).

A small reservoir was made by Gates Glidden burs #3 in the canal orifices to allow deposition of the first 0.2 ml of the solvent. After deposition of the solvent in the reservoir of the root canal, K-type reamer #15 was inserted to make a path for the solvent to the apical part of the canal. The procedure was repeated until reamer #40 reached the apical foramen. Softened gutta-percha was removed from the root canal by Hedström files #40. The solvent was added by syringe and needle if necessary, up to 0.8 ml for chloroform and 0.4 ml eucalyptus oil and orange oil, respectively. The procedure was assumed to be completed when there were no obvious traces of gutta-percha on instruments and paper points or if it took more than 20 minutes (negative control). The samples were split longitudinally into two halves, mesial and distal. Samples were photographed by a camera mounted on binocular lens, and photographs were stored in a computer (Figure 1) and analyzed by means of computer program "ISSA" (VAMS, Croatia). The area of remaining gutta-percha and cement was expressed in square millimeters.

Results

The average area of remaining gutta-percha and sealer after root canal removal was 2.52 mm² for chloroform, 2.82 mm² for eucalyptus oil, 3.72 mm² for halothane and 3.85 mm² for orange oil. The variability of results was significant for all solvents. It was highest in the group treated with chloroform (90.10%), followed by the group treated with orange oil (81.82%), the halothane group (67.74%) and finally the group treated with eucalyptus oil (46.57%) (Table 1). As anticipated the root canal filling could not be removed with distilled water. The area of remaining gutta-

percha and cement of samples treated with positive control was approximately equal to the area of the dentine walls of the instrumented root canal ($\sim 29.10 \text{ mm}^2$) and significantly differs from the results of other groups as can be seen in the table. Results of the group treated with positive control were excluded from the statistical analysis because the area of the root canal is a limiting factor of the total area of remaining gutta-percha and sealer.

No statistically significant difference in remaining gutta-percha was found by analysis of variance (Table 2).

Discussion

The goal of retreatment of endodontically treated teeth is complete removal of the root canal filling and cleaning and shaping of the root canal for final obturation (3). Thus, the removal of microorganisms and condition for healing periapical tissue is achieved. Although, gutta-percha can be removed from the canal using hand instruments only without solvent, such a procedure is long-lasting and solvent is desirable (11,8). Selection of the solvent should be based on the time needed for solving gutta-percha, biocompatibility for the adjacent tissue and efficacy in gutta-percha removal (12).

In this investigation complete removal of gutta-percha was not achieved with any one solvent in combination with hand instruments, and according to a study by Imura (13) neither are rotary instruments superior with regard to the area of remaining gutta-percha. The smallest amount of root canal filling was noticed after

retreatment with positive control, chloroform, followed by eucalyptus oil and halothane. The largest area of gutta-percha remained after retreatment with orange oil, although the difference among solvents was not statistically significant. This may be explained by the efficacy of halothane and chloroform in dissolving gutta-percha, which takes the most part of the root canal filling, which was proved by Wourms et al. (14) who investigated 300 noncarcinogenic solvents for their ability to dissolve gutta-percha. He noticed equal efficacy of halothane and chloroform. They dissolved gutta-percha twice as much as eucalyptus oil and other solvents. Comparing chloroform and halothane Wilcox also did not find statistically significant difference in the area of remaining gutta-percha (12). Samples in this investigation were filled by cold lateral condensation technique, and according to Friedman (15) the technique of root canal filling influences the amount of remaining gutta-percha on the dentine walls. Canals filled by cold lateral condensation showed more remaining gutta-percha in the apical area than the samples filled with one gutta-percha and glassionomer cement (15). After removal of Thermafil filling more filling remains on the dentine walls compared to cold lateral condensation (16).

According to the results of this investigation, it can be concluded that eucalyptus oil is the most effective in gutta-percha removal from the root canal, followed by halothane and orange oil. Because there was no statistically significant difference among the solvents used in this study, they can be used as a substitution for chloroform during root canal retreatment.