Research Report

THE DIFFERENCES OF EFFECTIVENESS BETWEEN ORANGE OIL AND EUCALYPTUS OIL IN ROOT CANAL RE-TREATMENT

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ABSTRACT
Background*: The key to success in root canal re-treatment is good removal of gutha-percha and sealer. Taking gutta-percha can be done in several ways, one of which is by using chemical solvents. Chloroform is a solvent that is often used, but it has proved to be toxic and carcinogenic. There are some organic ingredients that are safe and can be used as a substitute, two of which are orange oil and eucalyptus oil.* ***Purpose****: To see the difference in effectiveness between orange oil and eucalyptus oil as a gutta-percha solventer on root canal treatment with epoxy resin sealers.* ***Method****: The design of this study was an experimental laborarotic. This study used 27 maxillary central incisors that had been extracted. This research sample was prepared with crowndown and obturation techniques using single cone technique using gutta-percha and epoxy resin sealer (AH Plus). The research sample was divided into 3 groups (eucalyptus oil, orange oil and chloroform) and got different exposure times, then the samples were penetrated using Universal Testing Machine. Analytical analysis using the kruskal wallis test.* ***Results****: Orange oil tends to have the ability to solvent gutta-percha and sealer better than eucalyptus oil at 3 and 5 minutes exposure time. The results of analytic analysis with Kruskal Wallis Test obtained a significance value of 0.082 (p> 0.05) which means there were no significant differences in each treatment group.* ***Conclusion****: Orange oil, eucalyptus oil and chloroform have the same effect in gutta-percha solvent and epoxy resin sealer.*

Keywords*: epoxy resin sealer; orange oil; eucalyptus oil; gutta-percha solvent*

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INTRODUCTION

Root canal treatment is a treatment aimed at maintaining teeth in the oral cavity and maintaining the mastication system to remain functioning properly.[1] Indications for teeth that can be treated with root canals are teeth with abnormalities of pulp tissue and/or periapical tissue abnormalities, while teeth that cannot be restored or teeth that have a poor prognosis are contraindicated in root canal treatment.[2] Root canal treatment is divided into three main stages namely biomechanical preparation which involves opening access to the pulp chamber, forming and cleaning the root canals, and obturation of the root canal.[3]

Some of the factors that can cause treatment failure are errors in diagnosis and treatment plans, leakage of spills in the crown area, lack of knowledge in pulp anatomy, inadequate debridement, non-hermetic obturation, inadequate restriction protection and vertical root fracture.[4] Charging channels root is a very critical stage and causes almost all failures of root canal treatment so that good fillers must have several criteria, which are easily inserted into the root canal, bacteriostatic, radiopaque, do not change tooth color, are sterile or easy to clean before being inserted into the root canal, does not irritate periapical tissue and is easily removed from the root canal if needed.[2]

Gutta-percha is a root canal filling material that fulfills several requirements as an ideal filling material. Gutta-percha has the disadvantage of not being able to stick to the root canal wall so it requires sealer as a binding material between gutta-percha and root canal walls.[4] Resin-based sealers have been widely used because of their preferred characteristics which are adhesive to the tooth structure, their use is easy and has good density with root canal walls, and has the smallest microleakage rate compared to zinc oxide eugenol and calcium hydroxide sealers.[5]

Failure caused by poor root canal filling can occur in the short and long term.[6] Clinical, radiographic and histological evaluation is needed to determine the success of canal treatment. Radiographic and clinical evaluation is recommended for 6 months to 4 years after root canal treatment; because 6 months is a rational interval for almost all patients.4 One sign of failure to treat radiographs is the development or persistence of periapical lesions after several months of follow-up.[7]

Failure of root canal treatment can be overcome in two ways, namely root canal re-treatment or related tooth extraction. An important step in the re-treatment of root canals is the removal of gutta-percha and good sealers.[8] Taking gutta-percha can be done by mechanical and chemical means. The use of mechanical means to remove gutta-percha has many disadvantages, which can cause root perforation and changes in initial shape of the root canal, whereas frequently used chemical methods can be toxic or dangerous if used excessively.[9]

Chemicals that are widely used are chloroform because they are easy to obtain, inexpensive and can dissolve fillers quickly. Chloroform is known to have a high level of toxicity and has the potential to be carcinogenic, and has volatile properties so that the procedure is not clean because there is still guttapercha left on the root canal walls and pulp chambers.[10] Some essential oils are proven to be used as gutta-percha solventers including orange oil and eucalyptus oil.[9]

Orange oil is a material commonly used as a flavor enhancer for drinks, beauty products, and sanitary ware. Orange oil is proven to be an alternative substitute for chloroform because it does not have harmful effects, low solubility in water and dissolves in alcohol.[11] Eucalyptus oil is one type of material that is widely used in various pharmaceutical and health products. Orange oil is proven to be used as a gutta-percha solventer and does not cause harmful effects. The main component components in citrus oil (limonene) and eucalyptus oil (cineole) have a chemical structure similar to chloroform.[9]

Based on this background, it is necessary to research the differences in effectiveness between orange oil and eucalyptus oil as gutta-percha solventers on root canal treatment with epoxy resin sealers.

MATERIALS AND METHODS

The way of working in this study is divided into two stages, namely the preparation stage and the work phase. The preparatory phase of this study was carried out on the maxillary central incisors that had been extracted. The teeth were selected according to the criteria which

will be used as 27 research subjects. The selected teeth were then cut in the CEJ area and entered into 3 groups randomly. Each group consisted of 9 maxillary central incisors as follows:

a. Group A: 9 maxillary central incisors were prepared by crown down and were multipurated with gutta-percha and epoxy resin sealer with a single cone technique which was then solvented with orange oil.

b. Group B: 9 maxillary central incisors were prepared by crown down and were multipurated with gutta-percha and epoxy resin sealer with a single cone technique which was then applied with eucalyptus oil.

c. Group C: as a control group, 9 maxillary central incisors were prepared by crown down and were multipurated with gutta-percha and epoxy resin sealers with a single cone technique which was then applied with chloroform.

The work phase begins by opening access to all teeth using a round bur and a fissure bur to find the orifice. The tooth length was measured and cut at the cementoenamel junction. After the teeth are cut, root canal preparation is carried out with a crown down technique that starts from 2/3 coronal to 1/3 apical. This technique uses a ProTaper instrument file that starts with a Shaper X or SX file (without identification ring), followed by Shaping file No.1 or S1 (purple identification ring) which functions to form 1/3 coronal parts, then uses the S2 file (white identification ring) which functions to form and expand the 1/3 part of the root canal. The final file or finishing file used is F1 (indicator ring is yellow), file F2 (indicator ring is red) and ends with file F3 (indicator ring is blue). Irrigation is done every time the file is replaced by using 2.5% NaOCl and 17% EDTA then dried using a paper point.

Filling the root canal using gutta-percha and epoxy resin sealer (AH Plus) with a single cone technique. Then all samples will be x-rayed to find out whether hermetic filling or not if it is hermetic then it will be stored at room temperature for 7 days in the incubator. Then the penetration test is carried out using UTM (Universal Testing Machine) which has two surfaces, namely the top that can move and the bottom that does not move. The dictated tooth is placed at the bottom while the plugger is placed at the bottom. The vertical movement of the plugger into the gutta-percha is set at a speed of 5mm / minute with a penetration depth of 5mm starting after the penetration of chloroform, eucalyptus oil, and orange oil with a contact time of 1, 3 and 5

minutes. When the plugger has reached a depth of 5mm, the strength of the pressure is calculated in the kilogram-force (kgf).

RESULTS

Research on the effectiveness difference between orange oil and eucalyptus oil as a gutta-percha solventer on root canal treatment with epoxy resin sealer has been completed. This study used 27 extracted maxillary central incisor samples. Sampling was carried out at the Dental Study Program Lab Skill Room at the Muhammadiyah University of Yogyakarta. The sample was incubated for 7 days at the Molecular Medicine and Therapy Laboratory, Faculty of Medicine and Health Sciences, University of Muhammadiyah Yogyakarta. Testing samples using Universal Testing Machine at the Engineering Materials Laboratory, Department of Mechanical Engineering, Vocational School, Gadjah Mada University.

Based on the research conducted by looking at how much the compressive force needed by the tool to reach a depth of 5mm / minute with compressive strength calculated in units of kilogram-force (kgf), the results are as follows:

Table 1. Average Distribution of Measurement Results Press Strength (kgf)

Time	Treatment Groups		
	Orange Oil	Eucalyptus Oil	Chloroform
1 minute	16	15	18
	19	20	19
	21	18	14
Average	18,67	17,67	17,00
3 minute	17	19	14
	12	17	16
	16	18	14
Average	15,00	18,00	14,67
5 minute	17	15	13
	14	14	12
	13	18	14
Average	14,67	15,67	13,00

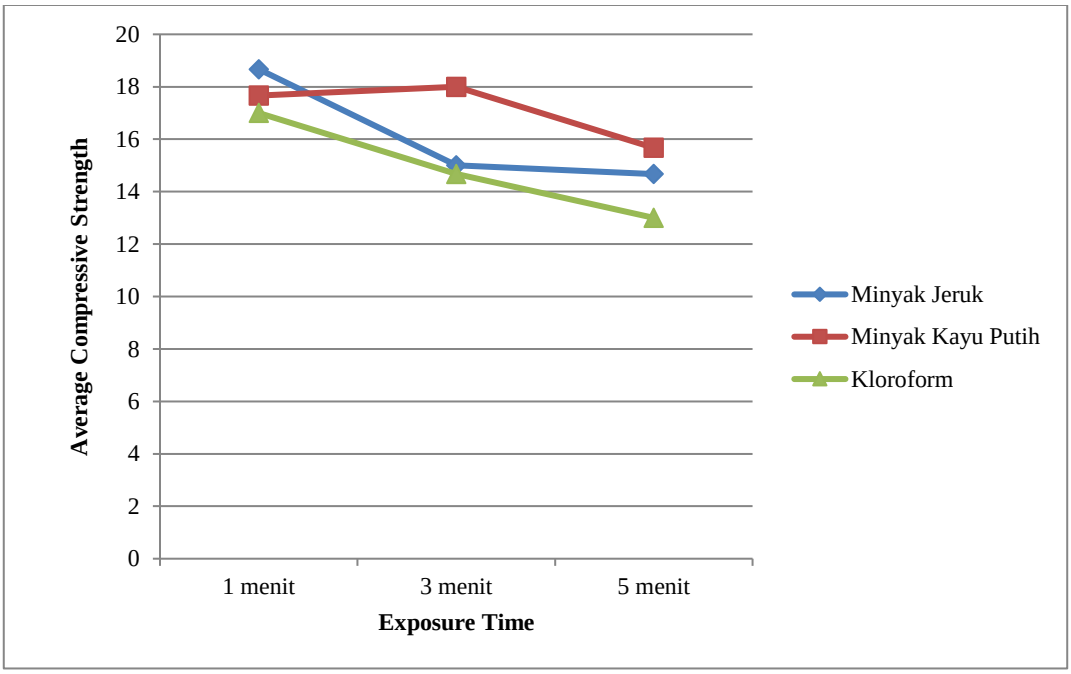

Figure 1. Graph of Force Press on Exposure Time.

Based on the graph shows the different compressive strength values in each treatment group. 1-minute orange oil showed the highest average compressive strength of 18.68 kgf and 5 minutes chloroform showed the lowest average compressive strength of 13 kgf. The above results are parametric data so that it is necessary to do a normality test using the Shapiro-Wilk test because the sample is <50.

The normality of the chloroform group data at 3 minutes exposure showed that the value was significant p <0.05 so the data distribution was not normal, while the data in the other groups had a significant value of p> 0.05 so the data distribution was normal. Because it is found that the data distribution is not normal, the hypothesis testing uses the Kruskal Wallis test non-parametric test. The Kruskal Wallis test results obtained a significance value of 0.082 which shows a value of p> 0.05, which means there is no significant difference in each treatment group.

DISCUSSION

Based on the results of the average compressive strength in table 1, chloroform 5 minutes shows the smallest value. This means that chloroform 5 minutes has the greatest solvent ability when compared with other groups. This is because chloroform has a good solvent ability, can work quickly and easily evaporates. This is not following the research conducted by Oyama et al. (2002) which stated that orange oil and xylol which came into contact with gutta-percha and sealer for 5 minutes needed the smallest compressive strength when compared to eucalyptus, halothane, chloroform, and negative controls. This means that orange oil and xylol have the greatest solvent power compared to other solvent ingredients in the study.

Based on table 1, it can also be seen a comparison between orange oil and eucalyptus oil at 1-minute exposure which shows that eucalyptus oil tends to have smaller compressive strength compared to an orange oil. The average compressive strength at 3 and 5 minutes showed that orange oil had a smaller compressive strength than eucalyptus oil. This means that at a longer exposure time (3 and 5 minutes), orange oil tends to have a better ability compared to eucalyptus oil.

Figure 4 about the graph of the compressive force at the time of exposure shows a decrease in compressive strength in the treatment group of orange oil and chloroform at each time of exposure. This is by the results expected by researchers, namely a decrease in compressive strength with the assumption that the longer the exposure time, the greater the solvent of gutta-percha and sealer so that the lower the compressive strength needed. The treatment group of eucalyptus oil gets results that do not match what is expected, namely an increase in compressive strength at a three minute exposure time. Possibly this happens because the volume of sealers that are inserted is different in each sample.

Based on the results of the normality test data that has been done, one of the data that is abnormally distributed is obtained. Data transformation efforts have been made to normalize the data, but still get abnormal data distribution results. Because the results of the data distribution are not normal, it is followed by a non-parametric analytic analysis, namely the Kruskal Wallis Test.

The results of the Kruskal Wallis non-parametric test in table 3 show a significance value of p> 0.05, which is equal to 0.082, which means there is no significant difference in the 9 treatments. This means that orange oil, eucalyptus oil, and chloroform with different exposure times have the same effect in solvent gutta-percha and sealer. The main components contained in citrus oil (limonene) and eucalyptus oil (cineole) have a chemical structure similar to chloroform, which is why these three ingredients have almost the same ability to solvent gutta-percha and sealer.[9] This is consistent with research that has conducted by Scelza et al (2009) using a vertical condensation filling technique accompanied by zinc oxide eugenol syringe then SEM examination was performed which found that chloroform, eucalyptus oil, and orange oil had the same ability to remove fillers from dentinal tubules.[13]

REFERENCES

1. Weine, F. S. *Endodontics Therapy.* Saint Louis. 2004.

2. Bachtiar, Z. A. Perawatan Saluran Akar pada Gigi Permanen Anak dengan Bahan Gutta Percha. *Jurnal PDGI*; 2016, 65(2): 60-67.

3. Grossman, L. I., Chandra, B. S., dan Gopikrishna, V. *Grossman's Endodontic Practice 13th Edition.* India: Wolters Kluwer Health. 2014.

4. Walton, R. E., dan Torabinejad, M. *Prinsip & praktik ilmu endodonsia.* Jakarta: EGC. 2008.

5. Orstavik, D. Materials used for root canal obturation: technical, biological, and clinical testing. 2005; 12: 25-38.

6. Giri, P. R. Hubungan antara ketepatan pengisian saluran akar dengan keberhasilan perawatan saluran akar. *MEDICINA.* 2017; 48(1): 19-23.

7. Simon, S., dan Pertot, W. J. *Clinical Success in Endodontic Retreatment.* Quintessence International. 2009.

8. Rehman, K., Khan, F. R., dan Aman, N. Comparison of Orange Oil and Chloroform as Gutta-Percha Solvents in Endodontic Retreatment. *The Journal of Contemporary Dental Practice*. 2013; 14(3): 478-482.

9. Usman, M., Meidyawati, R., dan Kurniati. The Effect of Eucalyptus Oil and Orange Oil in Softening the Gutta-Percha. 2009.

10. Sari, D. P. (2014). Pengambilan gutta percha point menggunakan bahan pelarut minyak jeruk yang dikombinasi dengan instrumen manual. *Jurnal PDGI*. 2014; 63(3): 88-94.

11. Dagna, A., Mirando, M., Betrami, R., Chiesa, M., Poggio, C., dan Colombo, M. (2017). Gutta-Perca Solvents Alternative to Chloroform: An In Vitro Comparative Evaluation. *EC Dental Science*. 2017; 15(2): 51-56.

12. Oyama, K., O., N., Siqueira, E., L., dan Santos, M. D. In Vitro Study of Effect of Solvent on Root Canal Retreatment. *BrazDentJ*. 2002; 13(3): 208-211.

13. Scelza, M. Z., Coil, J. M., Maciel, A. C., dan Oliveira, L., R. Comparative SEM Evaluation of Three Solvents Used in Endodotic Retreatment : An Ex Vivo study. *J Appl Oral Sci.* 2008;1(1): 24-29.