# Evaluation the effect of sesame oil on root dentin micro-hardness after application of chloroform and orange oil as gutta percha solvents (an in- vitro study)

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**Background and objectives:** Gutta percha solvents like chloroform and orange oil have different effects on physio-chemical properties like the microhardness of root dentine. Aim: Effects of sesame oil on the micro hardness of root dentin after using chloroform and orange oil as guttapercha solvents.

**Methods:** Twenty three extracted single rooted both upper and lower premolars were used crown separated from the root from the cement enamel junction ,remaining roots longitudinally sectioned from buccolingual direction each piece of roots mounted in cold cure acrylic resin and dentin surface of the roots were grounded. Micro hardness measurements were carried out before the application of gutta percha solvents. The root halves were randomly divided into 3 parallel groups (n=15), group A: was immersed in normal saline for 15 minute, group B: was immersed in chloroform for 15 minute and group C: was immersed in orange oil for 15 minute. The root halves from each group were subject to Vickers hardness test to measure micro hardness, then sesame oil were applied by bonding brush for 15 mint on each root dentin surface from all groups finally all roots subject to vicker hardness test to obtain the final micro hardness values.

**Results:** Data were statistically analysed using one way ANOVA test and Post Hoc test (scheffe), no significant difference in reducing dentin microhardness before and after exposure to orange oil and normal saline (negative control group), ($p<0.005$) but significant difference before and after exposure of chloroform($p>0.005$), also there was significant difference in increasing microhardness after exposure of sesame oil in the group of chloroform, but no significant difference after exposure of sesame oil and other two groups: group A,and C.

**Conclusion:** This study showed that sesame oil can increase the microhardness of root dentin, and chloroform reduce root dentin microhardness , and can be replaced with orange oil which has no effect on dentin microhardness and on the other hand dose not have carcinogenic properties.

**Key words:** Microhardness, Root dentin ,Chloroform, Orange oil and Sesame Oil.

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## Introduction

In cases of endodontic failure, the first treatment of choice is root canal retreatment comprising the removal of the filling material from the root canals which is one of the most important steps of this approach. [1] it is important to remove as much sealer and gutta-percha as possible for effective disinfection and resealing. [2]The use of solvents is essential for filling material removal within dentinal tubules and ramifications. [3] Among the chemical solvents, xylene, eucalyptol, orange oil and chloroform have been some of the options more commonly employed. [1] Oily solvents, which are alternatives to chloroform to avoid its toxicity, have been developed. These oil-based solvents such as orange oil and eucalyptol. [4,5] Trying to balance the effectiveness and toxicity of the solvent. [6] Chloroform, orange oil and eucalyptol had a higher capacity for dissolving gutta-percha, but orange oil has the highest biocompatibility among the commonly used

solvents. [7] Orange oil is effective in dissolving endomethasone (apexit plus and N) root canal sealer. [8,9]

Root canal filling solvents used during endodontic retreatment may lead to altering the ratio of calcium/phosphorus on dentin surface. [10] these alterations in the chemical structure may in turn affect the mechanical properties of dentin, consequently leading to the exposure of collagen and eventually causing decrease in dentin microhardness. [11] Reduced micro-hardness may lead to a reduction in modulus of elasticity and flexural strength of dentin, hence microhardness determination can provide indirect evidence of mineral loss or gain in dental hard tissues as it is sensitive to composition and surface change of root structure. [12] Sesame oil is commonly known as the queen of oil seeds and a gift of nature, [12,13] that exhibit excellent antioxidant properties and excellent source of phosphorous, iron, magnesium, calcium, manganese, copper, and zinc, in addition to it is bioactive composition, sesame oil proved to possess antibacterial properties. [14,15,16]

**Methods**

Specimens preparation: In this study twenty three freshly extracted single rooted premolars, with relatively similar morphology, and closed apices were selected, that were extracted for orthodontic reasons. All samples were checked any caries, fracture, restoration and curvature were excluded. Teeth were thoroughly cleaned from any soft tissue or calculus deposition, then they were stored in normal saline at room temperature. Radiograph were taked in mesio-distal direction to ensuring that there is no canal calcification or internal and external resorption and to confirm presence of patent single canal. The crown was separated from its root from the level of the cement-enamel junction with diamond burs (Diatec, colten AG, Switzerland) at high speed with water coolant to ensure a uniform sample length of 14mm(+-1mm root length).

Canal preparation: working lengths were established by inserting a size 15 K-file (Mani, Inc, Japan), the root canals of the teeth were prepared with the protaper rotary system (Densply, Maillefer, Ballaigues, Switzerland) using a crown-down technique by using, Sx,S1,s2,F1,F2, and F3 sequence. 28 The canals were irrigated with a standardized volume of 2ml of distilled water using a universal 27-gauge needle between each file.

Sample preparation: roots were longitudinally sectioned in abucco-lingual direction by using a double- faced diamond disk at low speed (microdont LDA Brazil), and then by chisel and mallet split the root figure 1.

The root segment was then horizontally embedded in in cold cure acrylic resin (Acrostone, Dent product) leaving their dentin surface exposed, exposed dentin root surface was grounded smooth with a couple of increasing grades of abrasive carbide paper (1000 and 1200 grit) undercooling water, then specimens were polished with 0.1 Mm alumina polishing paste (Ultra-Sol R, Eminess Technologies Inc. Monroe,NC USA) on circular felt disc machine, figure 2.

**Specimens grouping:** the average dentin microhardness value from two points 2mm distance from the root canal wall, in the middle and cervical third were measured before application of chloroform and orange

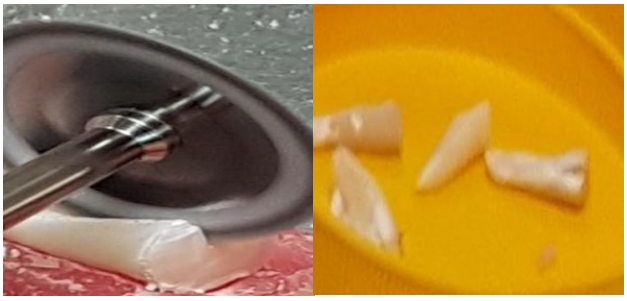

**Figure 1: sample preparation by sectioning of root for 2 halves longitudinally from bucco-lingual direction by diamond disc.**

oil gutta percha solvent which was measured by using Vicker microhardnes meter (Shimadze HMV-2, japan) figure 3. For each samples 300gm of force for 20 seconds was applied. [10] then samples grouped as follow:

**Group A:** 15 samples of the surface of dentin immersed into 3 mm normal saline as a negative control group for 15 minutes.

**Group B:** 15 samples the surface of dentine immersed in 3mm chloroform for 15 minute.

**Group C:** 15 samples of the surface of dentine immersed in 3 mm of orange oil for 15minutes.

After that the samples were washed with distilled water and dried they subject to Vickers hardness test machine to evaluate the average microhardness in two different points from the cervical and middle third 2mm away from root canal wall.

Finally the surface dentine of all samples was immersed into sesame oil for 15 minutes then swabbed with a cotton pellet and then washed with distilled water, and dried figure 4. All samples were again subjected to vicker microhardness test, and the average of two values from the cervical and middle third of the root was obtained. All data were recorded and statistically analyzed by One Way ANOVA- test when p value>0.05 was regarded as non- significant.

## Statistical Analysis:

The obtained results analyzed statistically with the statistical package for social sciences(SPSS) version 21.0. One way ANOVA (f -test) analysis of variance and post Hoc test (Scheffe) were used to compare the difference micro hardness values of the group, (P<0.05) regards as significant and (p>0.05) regards as a non-significant difference.

**Results**

In pretreated samples there were no significant differences in dentin micro hardness table 1. After immersing samples in group A : normal saline, Group B: chloroform and group c: orange oil there were no statistically significant difference in dentin micro hardness in group A and group C which were p value>0.05, but statistically signifi-

**Figure 2: mounting spacemen in auto polymerizing acrylic resin**

**Figure3: Vicker microhardnes meter (Shimadze HMV-2, japan).**

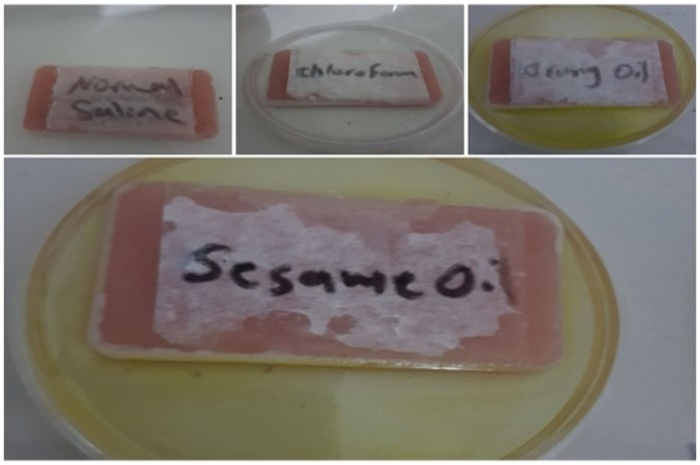


**Figure 4: immersing samples in normal saline, chloroform and orange oil and immersing all samples into sesame oil**.

cant decrease in dentin micro hardness in group B:chloroform P-value(P=0.009).
After immersing all samples in sesame oil for 15 minutes; in group A: normal saline and group C: orange oil, there was no statistically significant change in dentin micro hardness which were p value> 0.05 but in group B: chloroform there was a statistically significant increase in dentine micro hardness after immersing in sesame oil which was P-value =0.0071 , (Table 2).

**Table 1: micro hardness test of root dentine before and after application of gutta-percha solvents:**

| Groups | Sample Size N | Vicher micro hardness measurement (VMH) | | Standard Deviation(SD±) | | |
|---|---|---|---|---|---|---|
| | | before | after | before | after | |
| A Normal saline | 15 | 52.701 | 44.897 | 17.534 | 14.989 | 0.084 |
| B Chloroform | 15 | 55.603 | 9.1012 | 4.945 | 4.256 | 0.009 |
| C Orange Oil | 15 | 50.610 | 51.026 | 8.4093 | 8.193 | 0.095 |

**Table 2: Vicker micro hardness test after application of sesame oil in all 3 groups:**

| Groups | Sample Size N | Vicker micro hardness measurement (VMH) | | Standard Deviation (SD±) | P-Value |
|---|---|---|---|---|---|
| | | before | after | | |
| A Normal saline +sesame oil | 15 | 44.811 | 44.791 | 14.691 | 0.097 |
| B Chloroform+ sesame oil | 15 | 9.100 | 21.732 | 6.7103 | 0.0071 |
| C Orange Oil+ sesame oil | 15 | 51.023 | 54.039 | 8.319 | 0.081 |

## Discussion

The main goal of root canal treatment and retreatment is to clean the canal by considering biological, chemical, and mechanical objectives. [17.18]

During endodontic retreatment the root canal dentine is exposed to solvents that facilitate the removal of gutta-percha and sealer. The use of solvents is proven to facilitate the re-moval of gutta percha as it softens the root canal filling and solvents are effective with different seal-ers.[13] Chloroform has proven to have great results in the removal of root canal filling materials. [19,20]

These solvents may change the physical and chemical properties of dentin like micro hardness and this issue is clinically important. [21]Although a reduction in micro hardness may weaken the root structure, consequently root canal- treated and retreated teeth are more prone to fracture, in addition, it may increase the permeability, and solubility of the root canal dentin and adversely affects the sealing ability and adhesion of root canal sealer to dentin which in turn inhibits resistance to bacterial ingress and permits coronal leakage. [12,22]

The micro hardness of the radicular dentin varied at different locations within the same tooth, thus, in the present study, the indentation was made at two different points in the cervical and middle third at the 2 mm level from the root canal wall for standardization. [23,24] In the present study micro hardness of root dentin reduced non significantly in the group treated with normal saline and orange oil and these results agree with Khedmat etal 2015. [25] While in the group treated with chloroform micro hardness reduced significantly, and this study agrees with Rotstein etal 1999. [26]
Orange oil could be an appropriate alternative for chloroform in addition orange oil is more biocompatible than chloroform. [27]
Rezvani etal (2017) showed that sesame extraction had the potential of increasing the surface hardness of human enamel that was decalcified by an acidic beverage, hypothesized that the sesame,s calcium could precipitate on the tooth surface leading to enhancement of surface hardness.[28]

Hence it could be assumed that incorporated sesame gel had a possible remineralizing effect. [14,29] This result is nearly similar to present study result which sesame oil can increase micro hardness after reduction of microhardness by chloroform. The increased interest in complementary and alternative medicine has led many researchers in recent years to test the usefulness of various natural products particularly those of plant origin, cause some time natural products like plant origin are economic and without serious side effects on body tissue. [15] This is the first clinical study in our country to find the effect of sesame oil on microhardness of root dentin, our result with sesame oil showed that there was no significant increase in root micro hardness could be possibly due to lack of reduction of root micro hardness in the group treated by orange oil and normal saline as a control group, but in the group treated by chloroform because of the significant reduction of micro hardness and loss of calcium and minerals, sesame oil could be compensated these reduction may be due to sesame oil rich in calcium and minerals.[29] So further studies are needed for the evaluation of sesame oils effects on micro hardness of teeth.

## Conclusions

Within limitations of the study, showed that sesame oil can increase microhardness of root dentin. Chloroform reduces microhardness of root dentin , and can be replaced with orange oil which has less effect on dentin microhardness and on the other hand dose not have carcinogenic properties.
Sesame oil can compensate the reduction of dentin micro-hardness after chloroform application.

## Conflict of interest

The author reported no conflict of interests.

## References

1.Comes F, Daniel A, Nunes R, Fernandes A, Ferreira C, Matos H, and Nepomuceno T. Efficacy of gutta-percha solvent used in endodontic retreatment. RSBO 2013; 10(4): 356-61.
2. Endo MS, Ferraz C, Zaia A, Almeida J,and Gomes B. quantitative and qualitative analysis of micro organism in root-filled teeth with persistent infection: monitoring of endodontic retreatment. Eur J Dent 2013; 7(3): 302-9.
3.Ezzie E, Fleury A, Solomon E, Spears R, and He J. Efficacy of retreatment techniques for a resin based root canal obturation material. J Endod 2006; 32(4): 341-4
4.Esmat N, Gendy A, and Khalaf A. The effect of different organic solvents of filling removal during endodontic retreatment. Egyptian Dental Journal 2021; 67: 1641-46.
5.Mushtaq M, Masoodi A, Farooq R, and Yaqoobkhan F. The dissolving ability of different organic solvents on three different root canal sealer. In vitro study. Iran Endod J 2012; 7(4): 198-202.
6.Tanomaru filho M, Orlando T, Bortoluzzi E, Silva G, and Tanomaru T. Solvent capacity of different substances on gutta-percha and resilon. Braz Dent J 2010; 21(1): 46-9.
7.Magalhaes B, Johann J, Lund R, Martos J,and Delpino F. Dissolving efficacy of some organic solvent of gutta-percha. Braz oral Res 2007; 21(4): 303-7.
8.Senthilkumar V, Ramesh S, Jubbaraa Ch, and Ramesh S. Comparative evaluation of gutta-percha solvent in endodontic retreatment An – Invitro Analysis. Aunals of R.S.C.B 2021; 25(5): 1583-6258.
9. Aryadi, Tanujaya C, and Hardini N. Efficacy of eucalyptus oil (eucalyptus globulus) sweet organic oil (citrus sinensis) and grape fruit oil (citrus paradise) as bioceramic sealer solvents. Scientific Dental Journal 2020; Retrieved from http://doiorg\ 10.41013\sdj.sdj. 7-20.
10.Topbas C, Adiguzel O, and Golgecen O. Investigation of the effects of different chelating solutions on the microhardness and surface roughness of root canal dentin. International Dental Research (IDR) 2019;9(1):22-29.
11.Kumar V and Ramesh S. Effectiveness of various endodontic irrigant on the microhardness of the root canal dentin An Invitro study. International Dental Research 2021; 11(2): 90-95.
12.Massoud S, Moussa S, Hanafy S, and Backly R. evaluation of the microhardness of root canal dentin after different irrigation protocols(Invitro study). Alexandria Dental Journal 2017; 42: 73-79.
13.Aref N,. Sesame oil ( sesamum indicum L) as anew challenge for re inforcement of conventional glass ionomer cement,could it be? International Journal of Dentistry 2021; 20:1-7.
14.Rezvani M, Nejad M, Karimi M, Raad H, and Hamze F. Sesame extractional gel as an agent for prevention of dental caries An Invitro study. Journal Health oral epidemio 2017; 6(40): 226-30.
15. Baqer L. Antibacterial activity of sesame oil and coconut oil against the cariogenic streptococcus mutans and lactobacillus species An Invitro study. Biochem Cell Arch 2020; 20(1): 1961-64.

16. V.K.L.shanbhag. Oil pulling for maintaining oral hygiene. Journal of Traditional and Complementary Medicine 2017; 7: 06-109.
17. Aniketh T, Idris M, Geeta I, Nandakishor K , Sahu G, Arul P etal. Root canal irrigants and irrigation technique. Areview Journal of Evolution of Medical and dental Sciences 2015; 4(27): 4694-701.
18. Jain P, Bds F. Role of herbs in root canal irrigation, Areview.IOSR J Pharm Bio Sci 2016; 8(2): 95-99.
19. Martos J, Gastal M, Sommer L, Lund R, Del pino F, Osinaga P, Dissolving efficacy of organic solvents on root canal sealer. Clin Oral Investig 2006; 10(1): 50-4.
20. Gomes F, Daniel A, Nunes R, Nunes F, Manigli-Ferreira C, Meneses de Matos H, Nepomuceno T. Efficacy of gutta percha solvents used in endodontic retreatment. South Braz Oral Res 2013.
21. Hassanloo A, Watson P, Finer Y, Friedman S. Retreatment efficacy of the Epiphany soft resin obturation system. Int Endod J 2007; 40(8): 633-43.
22. Ossareh A, Kishen A. Role of dentin compositional changes and structural loss on fracture predilection in endodontically treated teeth. MSc. Thesis. Graduated Department of Dentistry, University of Toronto 2015; 1-79.
23. Ulusoy O, Gorgul G. Effect of different irrigation solusions on root dentin microhardness, smear layer removal and erosion. Aust Endod J.2013; 39: 66-72.
24. Sayin T, Serper A, Cehreli Z, Otlu H. The effect of EDTA, EGTA, EDTAC and tetracycline-Hcl with and with out subsequent NaOCl treatment on the microhardness of root canal dentin. Oral Surg Oral Med Oral Pathol Oral Radiol Endod J 2007; 104: 418-24.
26. Rostien I, Cobenca N, Teperovich E, Moshonov J, Mor C, Roman I, etal. Effect of chloroform, xylene, and halothane on enamel and dentin microhardness of human teeth. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1999; 87(3): 366-8.
27. Rodrigues D. Solvents impacts on microhardness of dentin. UPOR JO 2021: 1-28.
28. Stavileci M, Hoxha V, Gorduysus O, Tatar I, Leperrek K, Hostens J, Kucuk kaya S, and Muhaxheri E. Evaluation of root canal preparation using rotary system and hand instruments assessed by micro-computed tomograghy. Med Sci Manit Basic Res 2015; 21: 123-130.
29. Sandeepa W, Abdullah E, Mousa Y, Ganem A, Alaahtani E, and Alkhayri A. A clinical study comparing the efficacy of sesame oil with desensitizing tooth paste in reducing dentinal hypersensitivity: randomized controlled trial. International Journal of Dentistry 2020; 1: 1-5..