

# A COMPARATIVE STUDY OF THE EFFECT OF APPLE CIDER VINEGAR AND ETHYLENEDIAMINETETRAACETIC ACID CHELATING SOLUTIONS ON ROOT DENTIN MICROHARDNESS (AN IN VITRO STUDY)

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## INTRODUCTION

Chelating agents used for smear layer removal in root canal treatment (RCT) may cause excessive reduction in root dentin microhardness, thus affecting the adhesion of sealers to canal walls (1) and compromising the fracture resistance of root dentin (2). Accordingly, finding a natural chelating agent with less deleterious effect on root dentin microhardness is crucial for the longevity of endodontically treated teeth. The present study was designed to compare the effect of root canal final irrigation with apple cider vinegar (ACV) and ethylenediaminetetraacetic acid (EDTA) on microhardness of root dentin using Vickers tester.

## METHODOLOGY

Fourteen single-canaled mandibular premolars were decoronated, root canals were instrumented, then roots were sectioned longitudinally into halves which were embedded into acrylic blocks with dentin surface kept exposed (Figure 1). Specimens were randomly distributed into two groups (n = 14) according to the final irrigant in which they were immersed: group 1: 10 mL of 5% ACV and group 2: 10 mL of 17% EDTA. Vickers microhardness test was performed on dentin surface at coronal, middle, and apical thirds of each specimen before and after immersion in the specified irrigant for 3 min. The Vickers diamond indenter was applied with a 25-gram load and a dwell time of 10 s at 0.5 mm lateral to canal lumen to produce square-shaped indentations in dentin surface (Figure 2).

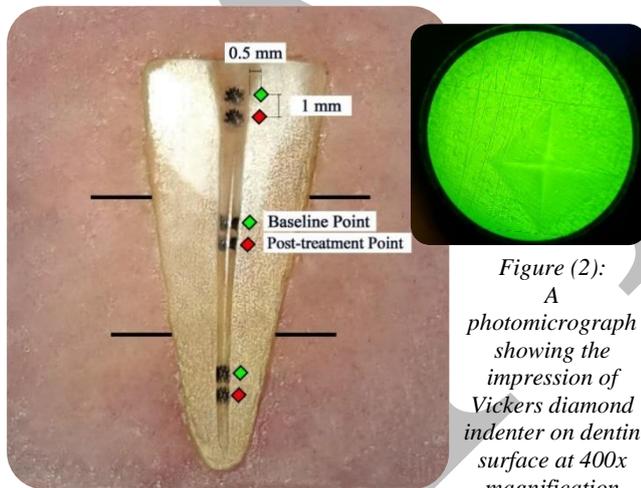


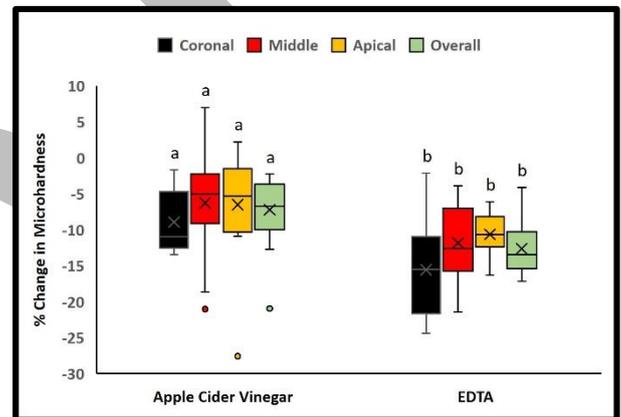
Figure (1): An illustration showing a root half and indentation sites (Green and red squares)

Figure (2):  
A  
photomicrograph  
showing the  
impression of  
Vickers diamond  
indenter on dentin  
surface at 400x  
magnification

## RESULTS AND DISCUSSION

Along the complete canal length, ACV was significantly inferior to EDTA concerning median percent reduction in dentin microhardness ( $P = 0.002$ ) (Graph 1). This finding agreed with Cruz-Filho et al (3) who reported significantly more reduction in EDTA when compared to ACV. This may be attributed to the more chelating action of EDTA in comparison to ACV as previously shown by Spanó et al (4) who reported significantly more efficiency in smear layer removal in EDTA group.

The current study showed no statistically significant difference ( $P > 0.05$ ) regarding the microhardness reduction among different root thirds of any group (Graph 1). This can be attributed to the method of treatment used in the study. Immersion of specimens in an irrigant allows the solution to be delivered to dentin surface of each root third with a standardized volume for the same contact time, which is not the case in clinical situation. This came in line with Nikhil et al (5) who reported no significant difference in microhardness reduction among root thirds in all groups.



Graph (1): A box plot of the study groups showing the percent change in dentin microhardness at each root third and along the whole length of root canal.

(Different lowercase letters denote statistically significant difference between groups)

## CONCLUSION

Apple cider vinegar is a promising natural product that can be used as a final rinse in RCT owing to its relatively moderate effect on root dentin microhardness.

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## REFERENCES

1. Neelakantan P, Subbarao C, Subbarao C v., De-Deus G, Zehnder M. The impact of root dentine conditioning on sealing ability and push-out bond strength of an epoxy resin root canal sealer. *Int Endod J.* 2011;44(6):491–8.
2. Turk T, Kaval ME, Sarikanat M, Hülsmann M. Effect of final irrigation procedures on fracture resistance of root filled teeth: an ex-vivo study. *Int Endod J.* 2017;50(8):799-804.
3. Cruz-Filho AM, Sousa-Neto MD, Savioli RN, Silva RG, Vansan LP, Pécora JD. Effect of chelating solutions on the microhardness of root canal lumen dentin. *J Endod.* 2011;37(3):358–62.
4. Spanó JC, Silva RG, Guedes DF, Sousa-Neto MD, Estrela C, Pécora JD. Atomic absorption spectrometry and scanning electron microscopy evaluation of concentration of calcium ions and smear layer removal with root canal chelators. *J Endod.* 2009;35(5):727-30.
5. Nikhil V, Jaiswal S, Bansal P, Arora R, Raj S, Malhotra P. Effect of phytic acid, ethylenediaminetetraacetic acid, and chitosan solutions on microhardness of the human radicular dentin. *J Conserv Dent.* 2016;19(2):179–83.