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Original Research

A comparative evaluation of EDTA and maleic acid on the surface microhardness of biodentine

Dr. Munish Dheeraj[1], Dr Suksham Johar[2], Dr Varun Salgotra[3], Dr Prafulla Bharti[4], Dr Dhruvika Garg[5]

[1]Senior lecturer, Dept. of Conservative Dentistry and Endodontics, Institute of Dental Sciences, Jammu, JAMMU AND KASHMIR;
[2]MDS, Conservative dentistry and endodontics, Consultant Endodontist and private practioner, Jammu;
[3]Reader, Dept of oral and maxillofacial surgery, Pacific Dental College and Reasearch Center, Udaipur;
[4]MDS (PG student), Department of periodontology & oral implantology, Luxmi bai Institute Of Dental Sciences, Patiala, Punjab;
[5]Intern, JN Kapoor DAV (C) Dental College, Yamunagar, Haryana

ABSTRACT:
Background: The present study compared EDTA and maleic acid on the surface microhardness of biodentine. **Materials & Methods:** 30 BD cylindrical-shaped specimens were prepared and were divided into 3 groups of 10 each. In Group I, the specimens were treated with 17% EDTA, in Group II with 7% MA, in Group III with 5 mL distilled water as control. The surface microhardness of the specimens was measured using Knoop hardness tester. **Results:** There was significant difference in KHN in all groups. The mean KHN in group I was 78.2 KHN, in group II was 65.2 KHN and in group III was 126.3 KHN. **Conclusion:** Maleic acid resulted in maximum reduction in microhardness as compared to EDTA.
Key words: bio dentine, Microhardness, Maleic acid

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Corresponding Author: Dr. Munish Dheeraj, Senior lecturer, Dept. of Conservative Dentistry and Endodontics, Institute of Dental Sciences, Jammu, JAMMU AND KASHMIR;

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INTRODUCTION

A remarkable biocompatible material, MTA with exciting clinical applications was pioneered by Dr. Mahmoud Torabinejad and co-workers in Loma Linda University. MTA can be used in surgical and non–surgical applications, including direct pulp capping, temporary filling material, Perforation repairs in roots or furcations, apexification and root end fillings.[1] Despite the high clinical efficacy of this wonder cement, there were always some issues which prevented the clinicians to use it for many cases. The major ones being very long setting time and difficult manipulation.[2]

Biodentine (BD) is a calcium silicate-based material which has shown to overcome the shortcomings of MTA. It consists of tricalcium silicate, zirconium oxide, calcium carbonate and a water-based liquid.[3] This new biologically active material aids its penetration through opened dentinal tubules to crystallize interlocking with dentin and provide mechanical properties. Biodentine has been formulated using MTA-based cement technology and hence; claims improvements of some of the properties such as physical qualities and handling, including its other wide range of applications like endodontic repair and pulp capping in restorative dentistry.[4]

Maleic acid (MA) is a smear layer removal agent which has displayed significant smear layer removal capacity compared to 17% EDTA, particularly in the apical third of the root canal system. It has also revealed less cytotoxicity when compared to that of EDTA.[5] The present study compared EDTA and maleic acid on the surface microhardness of biodentine.

MATERIALS & METHODS

The present study was conducted in the department of Endodontics. It comprised of 30 BD cylindrical-shaped specimens were prepared using a split mold. Approval for the study was obtained from institutional ethical and review committee.

Molds were divided into 3 groups of 10 each. In Group I, the specimens were treated with 17% EDTA, in Group II with 7% MA, in Group III with 5 mL distilled water as control. In all these groups, the irrigants were taken in a beaker and the samples were immersed with a magnetic stirrer placed to ensure complete wetting of the specimens. All the samples were then washed with distilled water and air-dried. The surface microhardness of the specimens was measured using Knoop hardness tester. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of specimen

Groups	Group I	Group II	Group III
Agent	17% EDTA	7% MA	Distilled water
Number	10	10	10

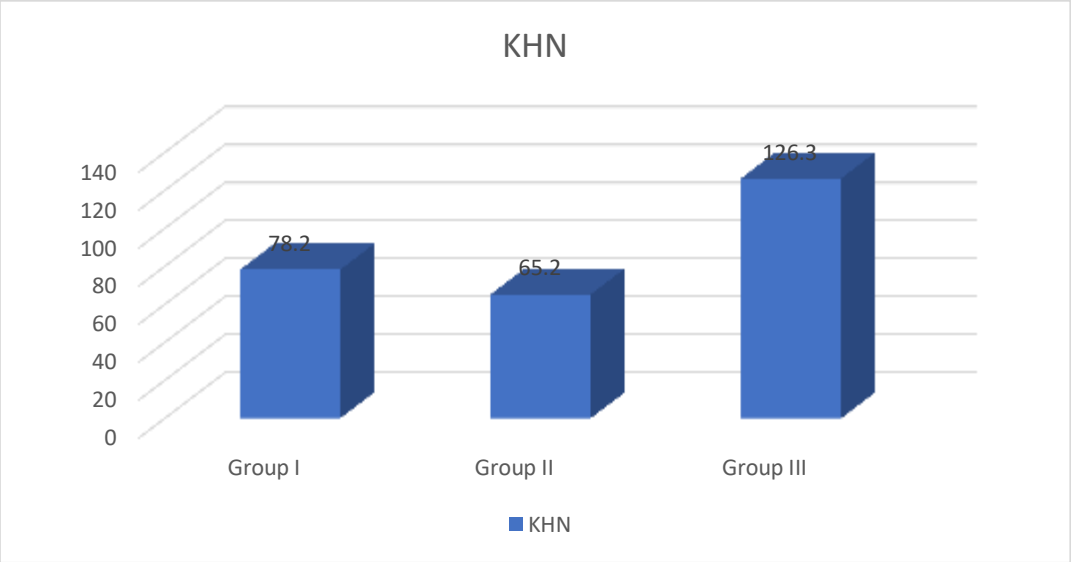
Table I shows distribution of specimens based on the type of irrigant used. Each group had 10 specimens.

Table II Mean Knoop hardness values in all groups

Groups	KHN	P value
Group I	78.2	0.001
Group II	65.2	
Group III	126.3	

Table II, graph I shows that mean KHN in group I was 78.2 KHN, in group II was 65.2 KHN and in group III was 126.3 KHN. The difference was significant (P< 0.05).

Graph I Mean Knoop hardness values in all groups



DISCUSSION

Removal of smear layer during endodontic treatment will result in achieving a three-dimensional fluid-tight seal of the root canal system as well as facilitating the penetration of intracanal medicaments and root canal sealers into the infected dentinal tubules.[6] Combined
application of sodium hypochlorite (NaOCl) and ethylenediaminetetraacetic acid (EDTA) is generally used for the efficient removal of the smear layer from the root canal system.[7] Biodentine is available in the form of a capsule containing the ideal ratio of its powder and liquid.[8] The composition of powder is tricalcium silicate (3CaO.SiO2), dicalcium silicate (2CaO.SiO2), calcium carbonate (CaCO2) (filler), zirconium Oxide (ZrO2) (radioopacifier) and iron oxide (colouring agent) while the liquid contains calcium chloride which act as an acclerator, hydrosoluble polymer function as water reducing agent and water.[9] The present study compared EDTA and maleic acid on the surface microhardness of biodentine.

In present study, the specimens were treated with 17% EDTA in Group I, in Group II with 7% MA, in Group III with 5 mL distilled water as control. Ballal et al[10] evaluate the effect of Smear OFF, 7% maleic acid (MA) and 17% ethylenediaminetetraacetic acid (EDTA), on the surface microhardness of Biodentine (BD). MA significantly compromised the microhardness of BD followed by EDTA, Smear OFF, and distilled water which was statistically significant ($P < 0.001$). On comparison between 17% EDTA and Smear OFF, 17% EDTA reduced microhardness to maximum ($P < 0.05$).

We found that mean knoop hardness number (KHN) in group I was 78.2 KHN, in group II was 65.2 KHN and in group III was 126.3 KHN. Krishnan et al[11] reported that Smear OFF when mixed with NaOCl solutions causes a marked reduction in free available chlorine in a similar manner to that of EDTA. They concluded that its combined use with NaOCl could not be recommended. Hence, use of EDTA or MA should be minimized in root canals restored with BD in order to prevent the deterioration of BD material, which is important for its long-term success in endodontic procedures.

Butala et al[12] assessed the ability of 7% maleic acid, 0.5% peracetic acid (PAA), and 17% ethylenediaminetetraacetic acid (EDTA) in removing smear layer from root canal system of human teeth using scanning electron microscopic analysis (SEM). Thirty-five non-carious human anterior teeth with single roots were selected for the study. The samples were divided randomly into three experimental groups and one control group: (1) The maleic acid group: 07% ($n = 10$), (2) the PAA group: 0.5% ($n = 10$), (3) the EDTA group: 17% ($n = 10$), and (4) the control group: 0.9% saline ($n = 5$). These teeth were then evaluated using SEM analysis for the absence or presence of smear layer. In the coronal thirds of the root canal, there was no statistically significant difference between the EDTA and the maleic acid groups when evaluated for their efficacy at smear layer removal. Whereas, maleic acid performed significantly better than PAA and EDTA in removing smear layer from middle and apical thirds of the root canal system.

The limitation of the study is small sample size. Only two chelating agents were studied.

CONCLUSION

Authors found that maleic acid reduced microhardness to the maximum level as compared to EDTA.

REFERENCES

1. Fridland M, Rosado R. MTA solubility: A long term study. J Endod 2005;31:376-9.
2. Islam I, Chng HK, Yap AU. Comparison of the physical and mechanical properties of MTA and Portland cement. J Endod 2006;32:193-7.
3. Laurent P, Camps J, About I. Biodentine (TM) induces TGF-β1 release from human pulp cells and early dental pulp mineralization. Int Endod J 2012;45:439-48.
4. Tran XV, Gorin C, Willig C, Baroukh B, Pellat B, Decup F, *et al.* Effect of a calcium-silicate-based restorative cement on pulp repair. J Dent Res 2012;91:1166-71.
5. Yoldaş SE, Bani M, Atabek D, Bodur H. Comparison of the potential discoloration effect of bioaggregate, biodentine, and white mineral trioxide aggregate on bovine teeth: In Vitro research. J Endod 2016;42:1815-8.
6. Rajasekharan S, Martens LC, Cauwels RG, Verbeeck RM. Biodentine™ material characteristics and clinical applications: A review of the literature. Eur Arch Paediatr Dent 2014;15:147-58.
7. Koubi G, Colon P, Franquin JC, Hartmann A, Richard G, Faure MO, et al. Clinical evaluation of the performance and safety of a new dentine substitute, biodentine, in the restoration of posterior teeth- A prospective study. Clin Oral Investig 2013;17:243-9.
8. Jeevani E, Jayaprakash T, Bolla N, Vemuri S, Sunil CR, Kalluru RS, et al. Evaluation of sealing ability of MM-MTA, endosequence, and biodentine as furcation repair materials: UV spectrophotometric analysis. J Conserv Dent 2014;17:340-3.
9. McComb D, Smith DC. A preliminary scanning electron microscopic study of root canals after endodontic procedures. J Endod 1975;1:238-42.
10. Ballal NV, Mishra P, Rao S, Upadhyay ST. Effect of chelating agents on the microhardness of Biodentine. Saudi Endod J 2019;9:109-12.
11. Krishnan U, Saji S, Clarkson R, Lalloo R, Moule AJ. Free active chlorine in sodium hypochlorite solutions admixed with octenidine, smear OFF, chlorhexidine, and EDTA. J Endod 2017;43:1354-9.
12. Butala R, Kabbinale P, Ballal V. Comparative evaluation of ethylenediaminetetraacetic acid, maleic acid, and peracetic acid in smear layer removal from instrumented root canal system: A scanning electron microscopic analysis study. Saudi Endod J 2017;7:170-5.