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Original Research

Assessment of surface microhardness of biodentin using Ethylenediaminetetraacetic acid (EDTA) and Maleic acid

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ABSTRACT:
Background: Biodentine is a calcium silicate based material which has shown to overcome the shortcomings of Mineral trioxide aggregate (MTA). The present study has assessed surface microhardness of biodentine using ethylenediaminetetraacetic acid (EDTA) and maleic acid. **Materials & Methods:** 60 Biodentine cylindrical shaped specimens were prepared and divided into 3 groups of 20 each. In Group I, the specimens were treated with 7% maleic acid (MA), in Group II with 17% EDTA and in Group III with 5 mL distilled water as control. The surface microhardness of the specimens were measured using Knoop hardness tester. **Results:** The mean Knoop hardness number (KHN) in group I was 64.7 KHN, in group II was 75.2 KHN and in group III was 120.3 KHN. The difference was significant (P< 0.05). **Conclusion:** Microhardness was reduced to the maximum level with maleic acid as compared to EDTA.
Key words: Bio dentine, Ethylenediaminetetraacetic acid (EDTA), Maleic acid (MA)

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INTRODUCTION

The outcome of endodontic procedures are influenced by the chemical and physical properties of the materials used. An ideal root repair material should be biocompatible, non-resorbable, radiopaque, dimensionally stable and insoluble in tissue fluids and should have sufficient sealing property. Over the years, various root repair materials, such as amalgam, Super-EBA, Intermediate restorative material, Glass ionomer cement and Calcium phosphate cement, were used.[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 Mineral trioxide aggregate (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 claim 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 assessed surface microhardness of biodentine using EDTA and maleic acid.

MATERIALS & METHODS

The present study was conducted using 60 Biodentine cylindrical-shaped specimens made of split molds which were divided into 3 groups of 20 each. In Group I, the specimens were treated with 7% MA, in Group II with 17% EDTA, 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. The surface microhardness of the specimens was measured using Knoop hardness tester. Results were statistically analyzed. P value less than 0.05 was considered significant.

Results

Table I Distribution of specimen

Groups	Group I	Group II	Group III
Agent	7% MA	17% EDTA	Distilled water
Number	20	20	20

Table I shows that in group I, the specimens were treated with 7% MA, in Group II with 17% EDTA, in Group III with 5 mL distilled water. Each group had 20 specimens.

Table II Comparison of mean Knoop hardness values

Groups	KHN	P value
Group I	64.7	0.01
Group II	75.2	
Group III	120.3	

Table II, graph I shows that mean KHN in group I was 64.7 KHN, in group II was 75.2 KHN and in group III was 120.3 KHN. The difference was significant (P< 0.05).

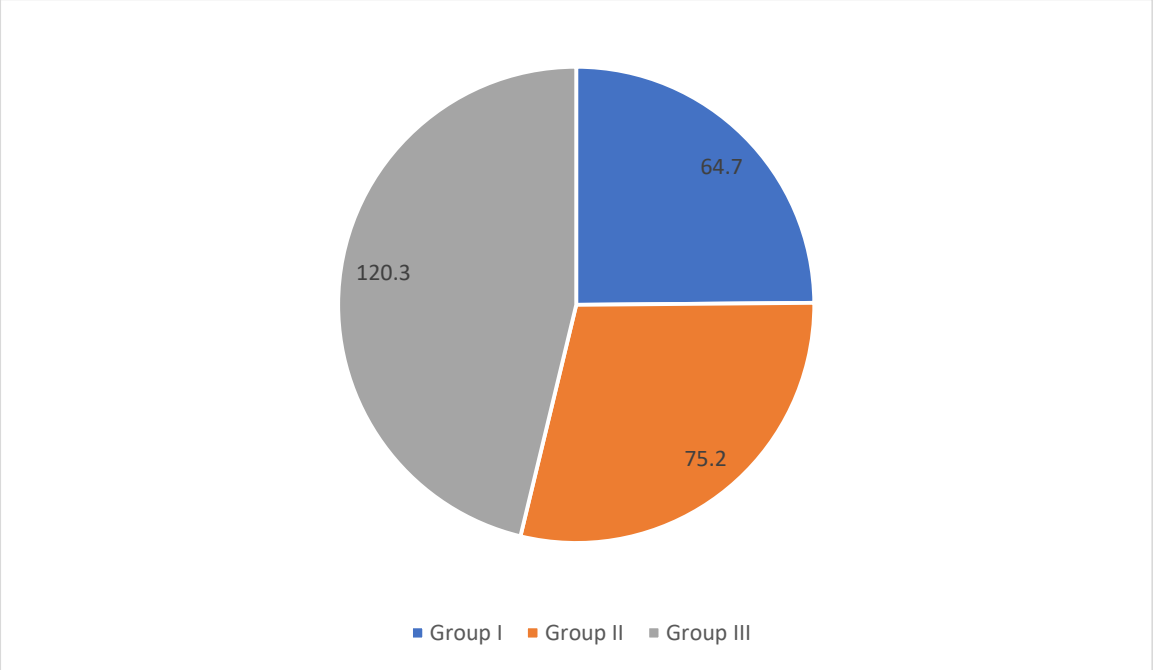
DISCUSSION

Microhardness test is not only a measure of strength or resistance to deformation but also it is influenced by the crystal structure stability and has an inverse relationship with porosity. In many clinical applications, reparative materials are placed in contact with inflamed tissues and environments where it may be exposed to a low pH. It is possible that variations in the pH value of host tissues at the time of mineral trioxide aggregate (MTA) placement could affect its physical and chemical properties. A low pH might affect setting reactions, adhesion, sealing ability, compressive strength and solubility.[6]

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.[7]Combine 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.[8] The present study assessed surface microhardness of biodentine using EDTA and maleic acid.

In present study, group I specimens were treated with 7% maleic acid (MA), group II spicemens with 17% ethylenediaminetetraacetic acid(EDTA), and group III with 5 mL distilled water. Each group had 20 specimens.

Graph I Comparison of mean Knoop hardness values



Butala et al[9] 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). 35 non-carious human anterior teeth with single roots were selected for the study. The samples were randomly divided into three experimental groups and one control group.The groups were, the maleic acid group 0.7%, the peracetic acid (PAA) group 0.5%, the EDTA group 17% and the control group 0.9% saline. 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.

Ballal et al[10] evaluated 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. On comparison between 17% EDTA and Smear OFF, 17% EDTA reduced microhardness to maximum.

We found that mean KHN in group I was 64.7 KHN, in group II was 75.2 KHN and in group III was 120.3 KHN respectively. Biodentine is available in the form of a capsule containing the ideal ratio of its powder and liquid.[11] 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.

Bayraktar et al[12] compared the microhardness values of ProRoot mineral trioxide aggregate (MTA), Biodentine and total fill root repair material (TF-RRM) Putty at varying pH and times. Materials were mixed and placed in cylindrical blocks with internal dimensions of 6 mm × 4 mm. Ten samples of each material were soaked in buffered solutions of butyric acid with 4.4, 5.4, 6.4, and 7.4 pH respectively and stored at 37°C in 100% humidity. The samples were submitted to the microhardness test at the end of 1 week and then 1 month. Low pH caused a significant decrease in the microhardness values of all samples. Surface microhardness increased with time. The microhardness values of Biodentine were significantly greater than those of ProRoot MTA and TF-RRM (Total fill- Root repair material) putty. The lowest microhardness values were recorded for TF-RRM putty groups regardless of the pH of the environment and the evaluation time.

CONCLUSION

From the above study we have concluded that microhardness was reduced to the maximu level with maleic acid as compared to EDTA.

REFERENCES

1. 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.
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. 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.
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. McComb D, Smith DC. A preliminary scanning electron microscopic study of root canals after endodontic procedures. J Endod 1975;1:238-42.
12. Bayraktar K, Basturk FB, Turkaydin D, Gunday M. Long-term effect of acidic pH on the surface microhardness of ProRoot mineral trioxide aggregate, Biodentine, and total fill root repair material putty. Dent Res J 2021;18:2.