Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr ICV 2018= 82.06

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Comparative analysis of solubility of MTA & Biodentine as a restorative material- An in vitro study

Tanvi Sudan[1], Anuradha[2], MunnashaUppal[3]

[1]Consultant Pedodontist & Private Practitioner, Udhampur
[2,3]PG student, Department of Pedodontics, Himachal Dental College, Sundernagar

ABSTRACT:)
Background: The present study was conducted to compare MTA with Biodentine as a restorative material. **Materials & Methods:** The present in vitro study was conducted in the department of Pedodontics. 30 ring molds of stainless steel having inner diameter of 2 cm and a height of 1.5 cm were manufactured. Mixing of MTA (Group I) and Biodentine (Group II) was done according to manufacturer's directions. In both groups, solubility and pH was assessed. **Results:** The mean solubility value of MTA in group I at 1 day was 1.65, at 3 days was 1.68, at 10 days was 2.10, at 30 days was 2.50 and at 60 days was 2.63. The mean solubility value of biodentine in group II at 1 day was 1.99, at 3 days was 2.14, at 10 days was 2.84, at 30 days was 3.64 and at 60 days was 5.40. The difference was significant (P< 0.05). In group I, pH at 2 hours was 9.24, at 6 hours was 9.24, at 24 hours was 9.28, at 7 days was 8.82 and at 28 days was 7.65. In group II, it was 8.97 at 2 hours, 9.34 at 6 hours, at 24 hours was 9.60, at 7 days was 8.21 and at 28 days was 7.75. The difference was significant (P< 0.05).**Conclusion:** Biodentine exhibited higher solubility and pH as compared to MTA at different interval of time.
Key words: Biodentine, MTA, Restorative

Received: 13 March, 2019 Revised: 10 June 2019 Accepted: 12 June 2019

Corresponding author: Dr. Tanvi Sudan, Consultant Pedodontist & Private Practitioner, Udhampur

This article may be cited as: Sudan T, Anuradha, Uppal M. Comparative analysis of solubility of MTA & Biodentine as a restorative material- An in vitro study. J Adv Med Dent Scie Res 2019;7(8): 78-81.

INTRODUCTION

Pulp treatments in primary teeth include but are not limited to vital pulpotomy, necrotic pulpotomy and pulpectomy. A pulpotomy is performed on a tooth with deep carious lesion, pulp exposure during the operatory process or after a traumatic pulp exposure.[1]Several medicaments have been used in pulpotomy procedures of primary teeth with the objective to maintain pulp vitality and promote healing of the pulp remnants and maintain the tooth until its natural exfoliation time. For vital pulpotomies, several materials are available for application in this technique; the ideal material should be bactericidal, promote healing of the radicular pulp, provide a relatively stable environment from the dentin-pulp complex, stimulate regeneration of the dentin-pulp complex and not alter the physiologic root resorption process.[2]

Root-end filling materials should possess certain properties such as it should own good sealing ability, improve the seal of existing root canal filling material, and should be biocompatible with the periradicular tissues.Low solubility frolicked an essential role on the success rate of the surgical procedure.[3]

The root-end filling material should also have the ability to increase the pH and release of calcium ions (Ca^{++}) as it leads to mineralized tissue formation.Among the available root-end filling materials, mineral trioxide aggregate (MTA) has become more popular, as it has low solubility and good sealing ability. Clinical application of Biodentine in pulpotomy has been investigated in few clinical studies as a pulpotomy medicament.[4]Like any other restorative material, Biodentine Biocompatibility was investigated to ensure its safety when applied onto the cells. Evaluation of its genotoxicity on bacteria strains by the Ames test and its

effects on the formation of micronuclei by human lymphocytes demonstrated the absence of any mutagenic effect of the material. Similarly, when tested on target human pulp cells, no DNA breaks or damage was observed with the comet assay.[5]The present study was conducted to compare MTA with biodentine as a restorative material.

MATERIALS & METHODS

The present in vitro study was conducted in the department of Pedodontics. The study protocol was approved from institutional ethical committee.

30 ring molds of stainless steel having inner diameter of 2 cm and a height of 1.5 cm were manufactured. Mixing of MTA and biodentine was done according to manufacturer's directions. In group I specimens, the molds were filled to excess with MTA and in group II, with biodentine. Following this, the molds were placed inside an incubator cabinet at 37°C.

The mass of dried glass bottles was measured. This procedure was repeated for 3, 10, 30, and 60 days. 30 polyethylene tubes 1 mm long were filled with MTA and biodentine and placed in lidded flasks containing 10 mL distilled water and were preserved in an oven at 37°C. After 2 h, the flasks were removed from hot air oven, and the water was assessed for pH. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of teeth

Groups	Group I	Group II
Material used	MTA	Biodentine
Teeth sample	15	15

Table I shows that in group I, MTA and in group II, biodentine material was used. Each group had 15 teeth sample.

Table II Mean solubility in both groups

Time	Group I	Group II	P value
1 day	1.65	1.99	0.01
3 days	1.68	2.14	
10 days	2.10	2.84	
30 days	2.50	3.64	
60 days	2.63	5.40	

Table II, graph I shows that mean solubility value of MTA in group I at 1 day was 1.65, at 3 days was 1.68, at 10 days was 2.10, at 30 days was 2.50 and at 60 days was 2.63. The mean solubility value of biodentine in group II at 1 day was 1.99, at 3 days was 2.14, at 10 days was 2.84, at 30 days was 3.64 and at 60 days was 5.40. The difference was significant (P< 0.05).

Graph I: Mean solubility in both groups

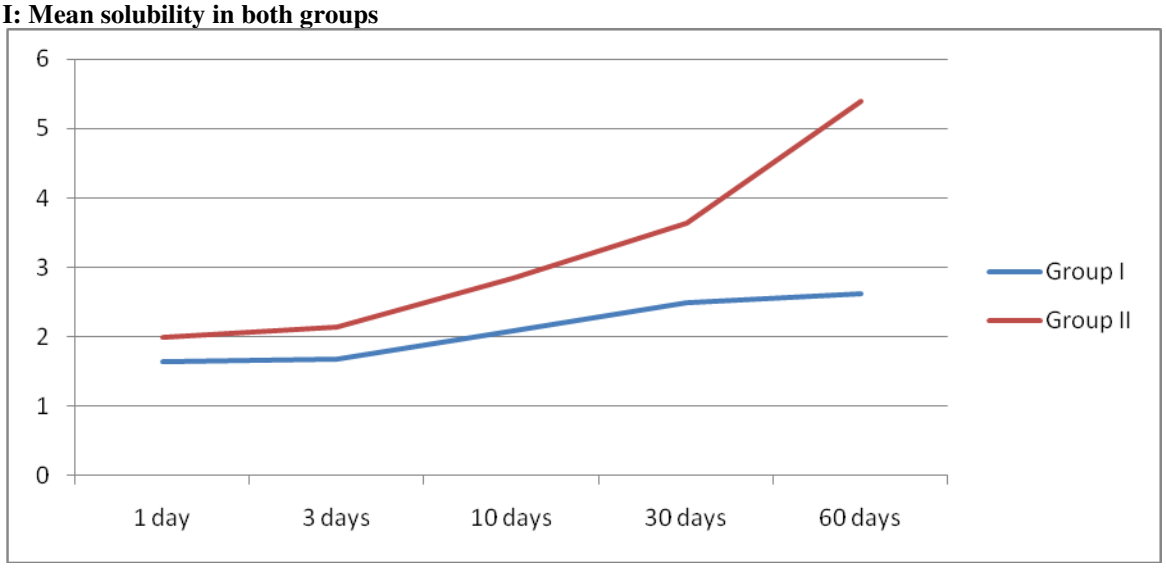
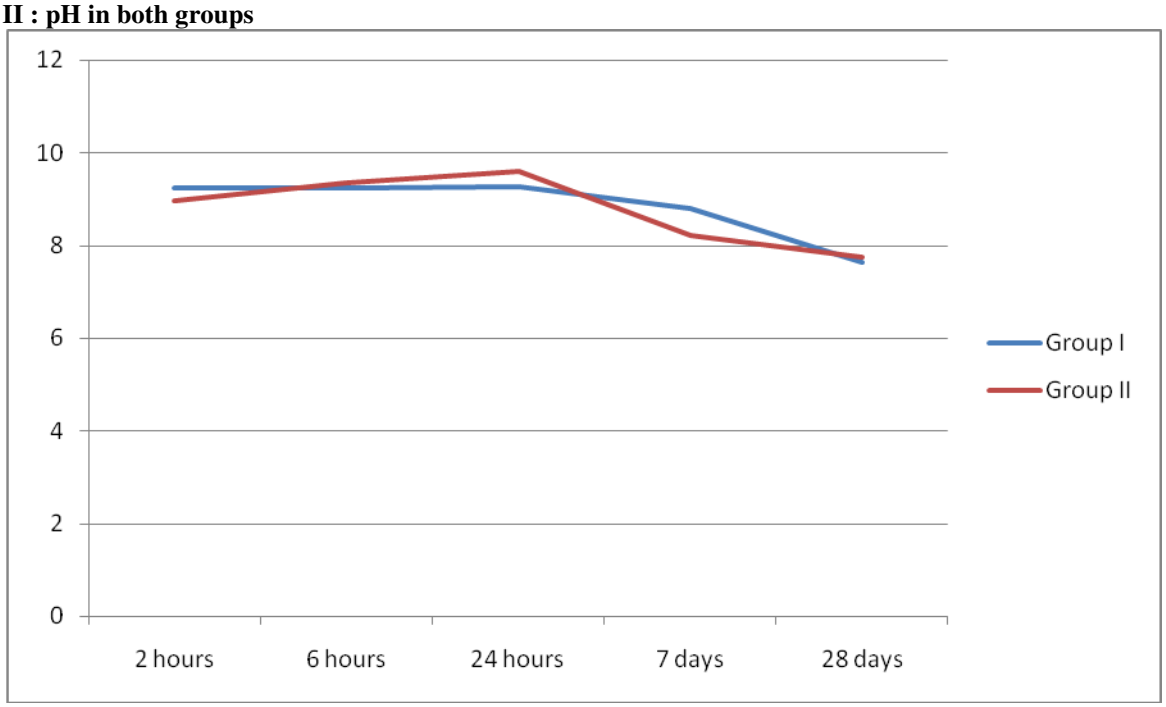


Table III: pH in both groups

Time	Group I	Group II	P value
2 hours	9.24	8.97	0.01
6 hours	9.24	9.34	
24 hours	9.28	9.60	
7 days	8.82	8.21	
28 days	7.65	7.75	

Table III, graph II shows that in group I, pH at 2 hours was 9.24, at 6 hours was 9.24, at 24 hours was 9.28, at 7 days was 8.82 and at 28 days was 7.65. In group II, it was 8.97 at 2 hours, 9.34 at 6 hours, at 24 hours was 9.60, at 7 days was 8.21 and at 28 days was 7.75. The difference was significant (P< 0.05).

Graph II : pH in both groups



DISCUSSION

MTA is a complex blend of hydrophilic tricalcium silicate, tricalcium oxide, and tricalcium aluminate with added oxides (bismuth oxide). However, it has revealed specific drawbacks of extended setting time and challenging handling properties. So as to recover some MTA drawbacks, numerous new calcium silicate-based materials have been invented. Biodentine is one of these materials. Biodentine is a calcium silicate-based material introduced in 2010 by Giillies and Olivier.[6]

Zaroret al[7] has performed a study in which 7 pulpotomies were performed with MTA and 6 with ferric sulphate (FS), the included patients had primary teeth with accidental exposure of the pulp during caries removal in the absence of clinical signs and symptoms and/or radiographic evidence of pulpal pathology. The treated teeth were restored with preformed stainless steel crowns and controlled clinically and radiographically every 6 months. The average follow-up was 15.6 months for both groups, with clinical success of 100% for both treatments. Radiographic success was 85.71% for the MTA and 83.33% for SF. Similar results were found in a Randomized Clinical Trial (RCT) comparing MTA and FC in pulpotomies of 64 molars that were pulpotomized equally and randomly with MTA and Formocresol.

We found in group I, MTA and in group II, biodentine material was used. Each group had 15 teeth sample. The mean solubility value of MTA in group I at 1 day was 1.65, at 3 days was 1.68, at 10 days was 2.10, at 30 days was 2.50 and at 60 days was 2.63. The mean solubility value of biodentine in group II at 1 day was 1.99, at 3 days was 2.14, at 10 days was 2.84, at 30 days was 3.64 and at 60 days was 5.40.

Jabbarifar et al[8] conducted a study to evaluate and comparison of solubility, pH, and calcium ion release of calcium-silicate based root-end filling materials mineral trioxide aggregate (MTA) and biodentine. They found significantly higher solubility was exhibited for biodentine for 30 and 60 days than MTA. Statistical difference was

observed between the solubility, pH, and calcium ion release values of MTA and biodentine.

We found that in group I, pH at 2 hours was 9.24, at 6 hours was 9.24, at 24 hours was 9.28, at 7 days was 8.82 and at 28 days was 7.65. In group II, it was 8.97 at 2 hours, 9.34 at 6 hours, at 24 hours was 9.60, at 7 days was 8.21 and at 28 days was 7.75.

Caicedoet al[9] performed a study of MTA for direct pulp capping and pulpotomy in 21 carious primary molars reported success rates of 80% (8 of10) in directly pulp-capped molars, and 91% (10 of 11) in pulpotomized molars after 6 months. Although histological evaluation of teeth extracted at 6 months showed pulp necrosis, inflammation, bridging and intrapulpal calcifications, the clinically-favorable pulpotomy response was attributed to bacteria removal, sealing, and low toxicity of MTA.

Cuadros-Fernandez et al[10] performed a randomized clinical study in children of 4-9 years of age. 84 pulpotomies were performed and attributed to MTA or Biodentine. All teeth were restored with stainless steel crowns. Clinical and radiographic evaluations were performed after 6 and 12 months. Data showed that one molar of the MTA group had an internal resorption while 1 molar of Biodentine treated group had internal resorption and another showed a radiographic radiolucency. Over all, both materials had a very high clinical success rate and the overall clinical success after 12 months is reported.

CONCLUSION

Authors found that Biodentine exhibited higher solubility and pH as compared to MTA at different interval of time.

REFERENCES

1. Thomson TS., et al. Cementoblasts maintains expression of osteocalcin in the presence of mineral trioxide aggregate. Journal of Endodontics 2003; 407-412.
2. Yaltirik M., et al. Reactions of connective tissue to mineral trioxide aggregate and amalgam. Journal of Endodontics 2004; 95- 99.
3. Saidon J., et al. Cell and tissue reactions to mineral trioxide aggregate and Portland cement. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology 2003; 483-489.
4. Dammaschke T, Gerth HU, Züchner H, Schäfer E. Chemical and physical surface and bulk material characterization of white ProRoot MTA and two Portland cements. Dent Mater 2005;21:731-8.
5. Asgary S, Shahabi S, Jafarzadeh T, Amini S, Kheirieh S. The properties of a new endodontic material. J Endod 2008;34:990-3.
6. Duarte MAH, Demarchi ACCO, Yamashita JC, Kuga MC, Fraga SC. pH and calcium ion release of 2 root filling materials. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2003; 95:345-7.
7. Zaror SC., et al. Ferric Sulfate and MTA Pulpotomies in Primary Teeth: A Case Series. International Journal of Odontostomatology2011; 77-82.
8. Jabbarifar SE., et al. Success Rate of FormocresolPulpotomy versus Mineral Trioxide Aggregate in Human Primary Molar Tooth. Journal of Research in Medical Sciences 2004; 304-307.
9. Caicedo R., et al. Clinical, radiographic and histological analysis of the effects of mineral trioxide aggregate used in direct pulp capping and pulpotomies of primary teeth. Australian Dental Journal 2006; 297-305.
10. Cuadros-Fernandez C., et al. Short-term treatment outcome of pulpotomies in primary molars using mineral trioxide aggregate and Biodentine: A randomized clinical trial. Clinical Oral Investigation 2016; 1639-1645.