

ANTIMICROBIAL EFFICACY OF BIO DENTINE, MTA AND THERACAL LC AGAINST ENTEROCOCCUS FECALIS AND CANDIDA ALBICANS

Sanjeev Soni,¹ Ripujit Kaur,² Rajbinder Kaur³

Professor & Head, Department of Orthodontics & Dentofacial Orthopaedics, Desh Bhagat Dental College & Hospital, Mandi Gobindgarh, India¹

Assistant Professor, Public Health Dentistry, Desh Bhagat Dental College & Hospital, Mandi Gobindgarh, India²,

Lecturer, Public Health Dentistry, Desh Bhagat Dental College & Hospital, Mandi Gobindgarh, India³.

Abstract

Background: Microorganisms play an essential role in pulpal and periapical diseases. The present study compared antimicrobial efficacy of calcium silicate based material bio dentine, MTA and Theracal LC.

Materials & Methods: The present study comprised of three materials such as MTA (Group I), Biodentine (Group II) and Theracal LC (Group III). The antibacterial efficacy of these materials was evaluated and minimal bacterial count (CFU's) against Enterococcus fecalis and candida albicans was tested using tube dilution method.

Results: The mean CFU of candida in group I was 69.2, in group II was 70.4 and in group III was 76.3. The difference was significant ($P < 0.05$). The mean CFU of E. fecalis in group I was 46.5, in group II was 59.2 and in group III was 54.1. The difference was significant ($P < 0.05$).

Conclusion: Antibacterial activity of Biodentine was superior than anti-bacterial as compared to MTA angelus and theracal LC.

Key words: Bio dentine, E. fecalis, MTA

Introduction

Microorganisms play an essential role in pulpal and periapical diseases. Periapical pathosis is considered an endogenous infection caused by the oral microflora. Therefore, many investigators have attempted to isolate and identify various microorganisms from root canals or periapical regions.¹

Studies have shown that there is a difference between the microbial flora of root canal in cases of primary endodontic infection and in cases of reinfection. The microorganisms in retreatment cases possess greater resistance to intracanal medicaments. Also, it is found that microbes not only grow in planktonic cells or in aggregates but also forms biofilms. It was in 1894 when WD Miller first published his observations on microflora. Since then, studies have shown that the endodontic environment is selective and it supports the specific microorganisms to grow.²

The other common organism which persists in post treatment apical pathology is Candida albicans. These resemble Enterococci in some characteristics. Both these organisms can survive as mono-infection and invade dentinal tubules. Hence, amongst the 24 million endodontic treatment performed on an annual basis, 5.5% procedures involve endodontic surgery and

perforation repair.³

The hydraulic self-setting cements involve calcium silicate-based cements (CSC), such as mineral trioxide aggregate (MTA). Mineral trioxide aggregate (MTA) was introduced as a root-end filling material. Till date it is being used as a material of choice for root-end filling. MTA has wide applications in operative dentistry and endodontics.⁵ MTA has the disadvantages of long setting time and poor handling properties. The powdered form of CSC contains tricalcium and dicalcium silicate. Calcium hydroxide is most commonly used for the treatment involving direct and/or indirect pulp capping. The high pH (12.5) gives calcium hydroxide an important antimicrobial activity.⁵ The present study compared antimicrobial efficacy of calcium silicate based material bio dentine, MTA and Theracal LC.

Materials & Methods

The present study comprised of three materials such as MTA (Group I), Biodentine (Group II) and Theracal LC (Group III). One scoop of MTA BIODENTIN, AND THERMAL LC was taken. And all the procedure were done under sterilization protocol. The culture media used were Brain heart infusion broth, Mac Conkey's agar, sabouraud dextrose broth, and sabouraud

dextrose. Ten microliter of standardized *Enterococcus faecalis* was added to tubes. These tubes were then incubated at 37°C. Subcultures on MacConkey's agar were made on each of the tubes. Readings were noted at the end of 24 hours of incubation. The antibacterial efficacy of these materials was evaluated wherein ten different strains of *Enterococcus faecalis* and antifungal

efficacy were analysed. The Minimum Inhibitory Concentration (MIC) and minimal bacterial count (CFU's) against *Enterococcus faecalis* and *Candida albicans* was tested using tube dilution method. Results thus found were clubbed for statistical assessment using chi-square test, where p value less than 0.05 was considered relevant.

Results

Groups	Group I	Group II	Group III
Material	MTA	Biodentine	Theracal LC
Number	10	10	10

Table I: Distribution of materials

Table I shows distribution of materials in different groups.

Groups	Mean	P value
Group I	69.2	0.05
Group II	70.4	
Group III	76.3	

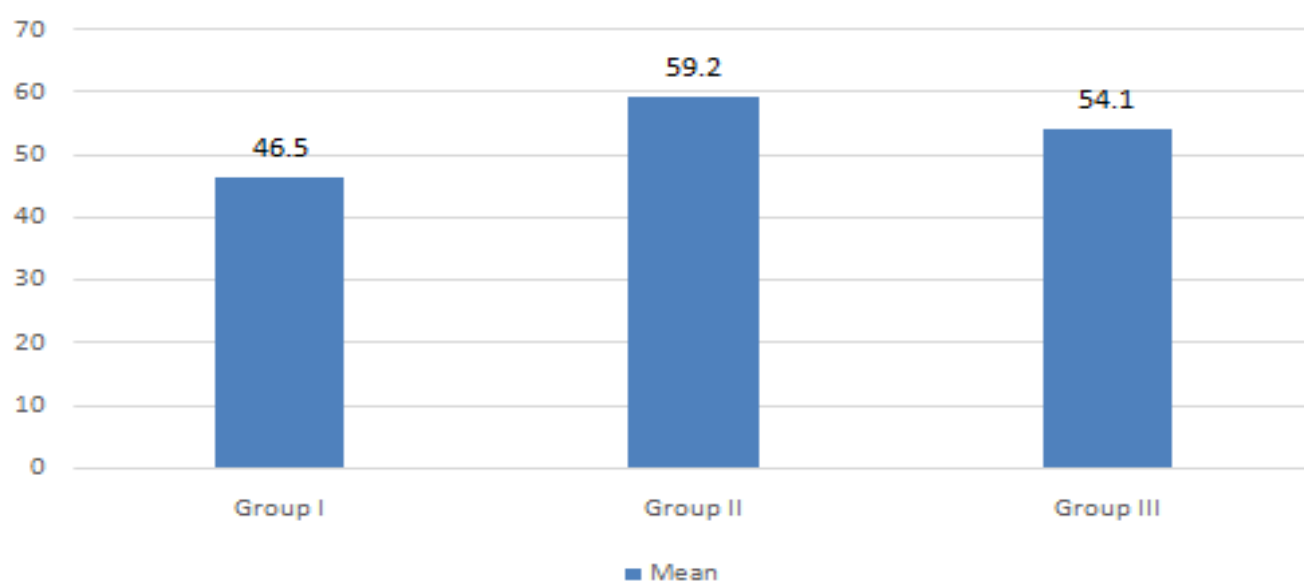
Table II: CFU counts of candida

Table II shows that mean CFU of candida in group I was 69.2, in group II was 70.4 and in group III was 76.3. The difference was significant ($P < 0.05$).

Groups	Mean	P value
Group I	46.5	0.04
Group II	59.2	
Group III	54.1	

Table III: CFU counts of E.fecalis

Table III, graph I shows that mean CFU of *E. faecalis* in group I was 46.5, in group II was 59.2 and in group III was 54.1. The difference was significant ($P < 0.05$).



Graph I: CFU counts of E.fecalis

Discussion

Microorganisms play a key role in the development of pulpal and periapical diseases. Pulpal diseases leading to inflammation of periapical tissues show the presence of bacteria in the root canal system.⁶ Teeth with pulpal or periapical pathology have a complex microbial flora consisting of cocci, rods, spirochetes, and fungi. *Enterococcus faecalis* can withstand high pH of intracanal dressings like calcium hydroxide, and is hence found in higher concentration in reinfection cases. Enterococci survive very harsh environments including extreme alkaline pH & salt conc.⁷ Other common organism identified in post treatment apical pathology is *Candida albicans*. Both survive as mono-infection and invade dentinal tubules. *Candida albicans* also showed the ability of colonization root canal walls and penetration into dentinal tubules. The colonization of fungi in the root canals and various other factors affecting this colonisation are not fully understood.⁸

MTA can be used in regeneration procedures and repair procedures like root-end filling, apexogenesis, pulpotomy, apexification, pulp capping and perforation repair involves usage of calcium silicate-based cements. Their biocompatibility and sealing ability synergistic to the physicochemical reaction and interaction with the surrounding local environment contribute to be the specific factors in achieving suitability in difficult clinical situations.⁹ Pulp-capping agents have been developed over the years. Most commonly used are calcium hydroxide-based materials. The antimicrobial efficacy of ProRoot MTA is due to release of calcium ions and hydroxyl ions which results in increase in pH. This release of calcium is when calcium silicate gets hydrated and calcium hydroxide is released as a byproduct. Also, the dissociation of calcium hydroxide leads to release of calcium ions¹⁰. The present study compared antimicrobial efficacy of calcium silicate based material bio dentine, MTA and Theracal LC.

In present study, we found that mean CFU of candida in group I was 69.2, in group II was 70.4 and in group III was 76.3. Kawle et al¹¹ evaluated and compared the antimicrobial efficacy of MTA Angelus, Biodentine and Theracal LC against *Enterococcus faecalis* and *Candida albicans*. Their antimicrobial efficacy was evaluated using Tube dilution method and their Minimum inhibitory concentration (MIC) and Bacterial

counts (CFU's) were assessed and compared. The MIC was highest and CFU's were lowest with Biodentine in comparison with other two materials. There were statistically significant differences noted between Biodentine and MTA angelus.

We found that mean CFU of *E. faecalis* in group I was 46.5, in group II was 59.2 and in group III was 54.1. MBC is defined as the lowest concentration of antimicrobial agent needed to kill 99.9% of the final inoculum after incubation for 24h under a Standardized set of conditions. Molander et al¹² stated that the predominant bacteria which are able to survive at high pH values are *Enterococcus faecalis* and thus treatment may require use of calcium hydroxide intracanal dressing.

Hiremath et al¹³ evaluated and compared the antimicrobial efficacy of two new materials MTA Plus and Biodentine with ProRoot MTA using tube dilution method.

Doubling dilutions of the material were prepared in Sabouraud's dextrose broth (SDB) and Brain Heart Infusion (BHI) broth for *Candida albicans* and *Enterococcus faecalis*, respectively. The minimal concentration at which inhibition of microorganism occurred was measured and noted as minimal inhibitory concentration (MIC) of the material.

There was no statistically significant difference between the materials against *C. albicans*. Biodentine was statistically significant than MTA Plus against *E. faecalis*. ProRoot MTA was statistically significant at different time intervals against *E. faecalis* (P-value-0.001). ProRoot MTA and Biodentine proved to have antimicrobial property. MTA Plus proved as a good antifungal agent. Gomes et al¹⁴ showed that *Enterococcus faecalis* was more frequently recovered from the canals in later appointments after biomechanical treatment procedures.

Conclusion

Authors found that antibacterial activity of Biodentine was superior than anti-bacterial as compared to MTA angelus and theracal LC.

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