

## Research Article

# Antimicrobial Efficacy of MTAD and DMSA Against *E. faecalis* - A Comparative Study

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## Abstract

**Background:** The present study was conducted to determine antimicrobial efficacy of MTAD and DMSA (Di Mercaptosuccinic Acid) against *E. faecalis*.

**Materials and methods:** The present study was conducted on 90 extracted single rooted teeth. The teeth were divided into 3 groups of 30 each. Group I teeth were irrigated with MTAD, group II with 10% DMSA and group III with normal saline (control group). Samples were collected from the root canals, after 5 minutes and 48 hours of irrigation, with help of absorbent paper points. Occurrence of broth turbidity was indicative of the viable bacteria remaining in the root canal.

**Results:** There were 10 growths in group I, 25 in group II and 30 in growth III with growth 5 minutes after irrigation. The difference was significant ( $P < 0.05$ ). There were 12 growths in group I, 26 in group II and 30 in growth III with growth 48 hrs after irrigation. The difference was significant ( $P < 0.05$ ).

**Conclusion:** Antimicrobial efficacy of MTAD was superior as compared to DMSA against *E. faecalis*.

**Keywords:** *E. faecalis*; MTAD; Microbial

## Introduction

Bacteria play the primary etiological role in the development of necrotic pulps, periapical pathosis and post-treatment disease following root canal treatment. One of the crucial factors for the success of the treatment consists of the eradication of microorganisms and their by-products from the root canal system. Amongst the procedures involved in the control of endodontic infection, instrumentation and irrigation are important agents in eliminating the microorganisms from the root canal system. However, mechanical debridement alone does not result in total or permanent reduction of bacteria. The use of antimicrobial agents has been recommended as an adjunct to mechanical instrumentation to reduce the numbers of microorganisms [1]. Disinfection of the root canal is major determinant in the healing of periapical tissues. Though the chemomechanical preparation and use of antimicrobials are effective in reducing the bacterial load, some bacteria can still persist. *E. faecalis* is one among the facultative organism which is persistently found in root canal failures, and is resistant to various intracanal medicaments [2].

The most popular irrigating solution is sodium hypochlorite (NaOCl), MTAD, DMSA (Di Mercaptosuccinic Acid) and chlorhexidine. MTAD (A Mixture of a Tetracycline Isomer, An Acid and a Detergent), has been introduced as a final rinse for disinfection of the root canal system [3]. The present study was conducted to determine antimicrobial efficacy of MTAD and DMSA (Di Mercaptosuccinic Acid) against *E. faecalis*.

## Materials and Methods

The present study was conducted in the department of Endodontics. It comprised of 90 extracted single rooted teeth. The study was approved from institutional ethical committee and written consent was obtained.

In all teeth, access preparations were done and the canals were instrumented 1 mm beyond the apical foramen with K-files. Pure culture of *E. Faecalis* was grown in brain heart infusion broth and was set to 4 Mac Farland's standard. 5 micro-litre of the broth was used to infect root canal. The teeth were divided into 3 groups of 30 each. Group I teeth were irrigated with MTAD, group II with 10% DMSA and group III with normal saline (control group) (Table 1). Samples were collected from the root canals, after 5 minutes and 48 hours of irrigation, with help of absorbent paper points and were immediately transferred to test tubes containing brain heart infusion broth and incubated. Occurrence of broth turbidity was indicative of the viable bacteria remaining in the root canal. The test tubes where turbidity occurred were inoculated onto chocolate Agar plates to check for *E. Faecalis*. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

## Discussion

One of the main aims of root canal treatment is to eliminate the bacteria, their byproducts and the substrate from the root canal system. The use of irrigation solution in this process is essential to ensure bacterial elimination and eradication of organic tissue remnants [4]. Maximum antibacterial effect, maximum tissue dissolving effect on the necrotic tissues and the least toxic effect on the peripheral tissues are some important features of an ideal root canal irrigant. Torbinejad in 2003 introduced a new irrigant, Biopure

**Table 1:** Distribution of teeth.

Groups	Group I	Group II	Group III
Irrigate	MTAD	DMSA	Saline
Teeth	30	30	30

Table 1 shows that teeth were divided into 3 groups of 30 each. Group I teeth were irrigated with MTAD, group II with 10% DMSA and group III with normal saline (control group).

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MTAD, a mixture of Doxycycline, citric acid, and Tween-80, which is capable of safely removing the smear layer<sup>10</sup> and eliminating *E. faecalis*. He has shown that MTAD is able to safely remove the smear layer and is effective against *E. faecalis*, a microorganism resistant to the action of other antimicrobial medications [5]. The present study was conducted to determine antimicrobial efficacy of MTAD and DMSA (Di Mercaptosuccinic Acid) against *E. faecalis*.

In this study, teeth were divided into 3 groups of 30 each. Group I teeth were irrigated with MTAD, group II with 10% DMSA and group III with normal saline (control group). There were 10 growths in group I, 25 in group II and 30 in growth III with growth 5 minutes after irrigation. The difference was significant (P<0.05) (Table 2).

Torabinejad et al. [6] conducted a study with the aim to compare the anti-microbial efficacy of four root canal irrigants, MTAD, 10% Di Mercaptosuccinic Acid (DMSA), 5.25% Sodium Hypochlorite and 2% Chlorhexidine gluconate against *E. faecalis*. It was found that viable bacteria were found in all the canals of the control and 10% DMSA group. No viable bacteria were remaining in canals after 5 min of irrigation with MTAD and CHX whereas 67% of the root canals irrigated with NaOCl showed growth (Figure 1). After 48 hours of irrigation only teeth irrigated with CHX were free from viable bacteria.

We found that there were 12 growths in group I, 26 in group II and 30 in growth III with growth 48 hrs after irrigation (Figure 2). The difference was significant (P<0.05) (Table 3). An irrigant can penetrate into the dentinal tubules; it does not mean that the concentration is sufficient to kill all types of bacteria present. It has been shown that bacteria may remain viable in tubules at great distances from the pulp. Studies have shown that disinfection of root dentin is not achieved by chemo mechanical preparation alone [7]. Bacteria deep in dentinal tubules are apparently protected from instrumentations and irrigation, making their removal or eradication difficult. It has been demonstrated that after three weeks incubation of root canals inoculated with *E. Faecalis* a dense infection reaching 300 micrometers to 400 micro-meters into the dentinal tubules was found. Prolonged incubation leads to more tubules being infected, whereas the average depth of penetration of the tubules by bacteria has been found to increase slowly with time [8].

One of the significant features of MTAD is its capacity to kill *E. faecalis* after a mere exposure of 5 minutes making it useful in the clinical situation. However this effect was not seen with NaOCl. Michael et al. [9] showed that MTAD inhibited most strains of *E. faecalis* growth when diluted 1:8192 times and killed most strains of *E. faecalis* when diluted 1:512 times. Thus MTAD has properties of an ideal root canal irrigant.

**Table 2:** Number of canals with growth 5 minutes after irrigation.

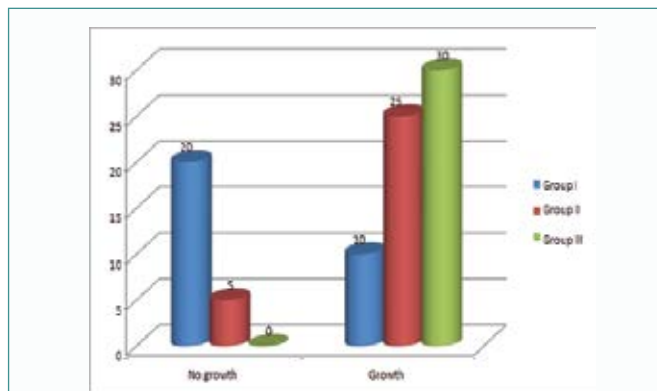
Groups	Group I	Group II	Group III	P value
No growth	20	5	0	0.01
Growth	10	25	30	

Table 2 shows that there were 10 growths in group I, 25 in group II and 30 in growth III with growth 5 minutes after irrigation. The difference was significant (P<0.05).

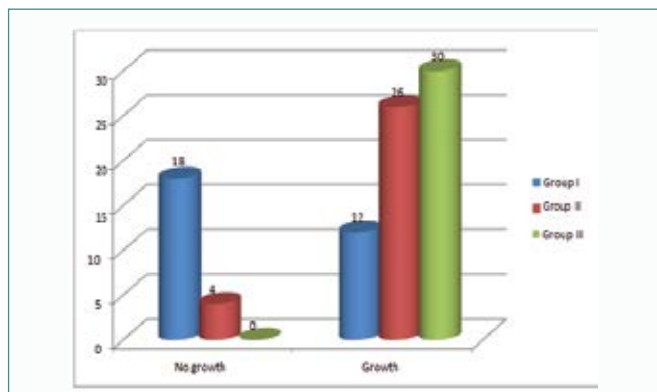
**Table 3:** Number of canals with growth 48hrs after irrigation.

Groups	Group I	Group II	Group III	P value
No growth	18	4	0	0.01
Growth	12	26	30	

Table 3 shows that there were 12 growths in group I, 26 in group II and 30 in growth III with growth 48 hrs after irrigation. The difference was significant (P<0.05).



**Figure 1:** Number of canals with growth 5 minutes after irrigation.



**Figure 2:** Number of canals with growth 48hrs after irrigation.

### Conclusion

Authors found that antimicrobial efficacy of MTAD were superior as compared to DMSA against *E. faecalis*.

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