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# Histopathological Evaluation of Periodontium after Repairing Furcation Perforation with MTA and Biodentine

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## INTRODUCTION

Primary teeth are involved in mastication, speaking, esthetics and preserving space for the erupting permanent teeth therefore, keeping them till permanent teeth eruption is unavoidable [1]. Technical problems occur occasionally during endodontic treatment, among which furcal perforations have the worst prognosis [2].

Perforations are pathologic or iatrogenic communications between the root canal system and the attachment apparatus. If a perforation occurs, the tooth will not necessarily lost, in fact, it can be treated successfully in a conservative manner and continue to function as it did before the perforation till the time of shedding [3].

Despite the numerous favorable properties of MTA that support its clinical use when compared with the traditional materials, there are several critical drawbacks such as the prolonged setting time, difficult handling characteristics, high cost, and potential of tooth discoloration [4].

A variety of new calcium silicate–based materials have been developed aiming to improve MTA shortcomings. Biodentine TM is a high-purity calcium silicate based dental material that is recommended for use as a dentine substitute under resin composite restorations and an endodontic repair material because of its good sealing ability, high compressive strengths, short setting time, and biocompatibility, bioactivity, and biomineralization properties [4].

The aim of this study was to investigate the histopathology of periodontium to experimentally induced furcal perforations in dogs' primary teeth repaired by Mineral Trioxide Aggregate (MTA) and Biodentine.

## MATERIALS AND METHODS

### Experimental animals

A total of 96 primary molars teeth from 12 healthy dogs approximately 2 months age were used. Bilateral sides of both maxillary and mandibular second and third primary premolars were used. The teeth were randomly divided into 2 experimental groups of 24 teeth each, and 2 control groups with 24 teeth each.

### Methods

Anesthesia administered by respiratory anesthetics. Then, a bite block had been fitted on the molars opposite to the working site.

After preparing the access cavity, furcal perforations were created one millimeter in diameter using a round bur.

**The samples were randomly divided into two experimental groups (n=24 each) and two control groups (24 each).**

**Group A:** MTA

**Group B:** Biodentine

**Group C,D:** The second and third mandibular left primary molars and the second and third maxillary left primary molars were not repaired with any material as they were used as control for the MTA group and Biodentine group respectively.

Finally the tooth was sealed with IRM restoration.

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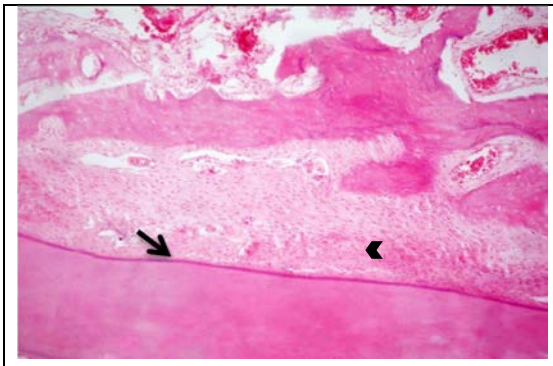
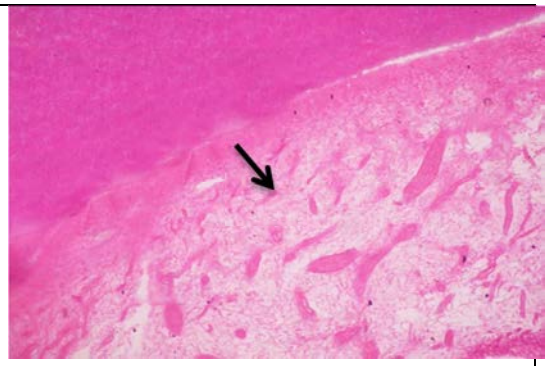
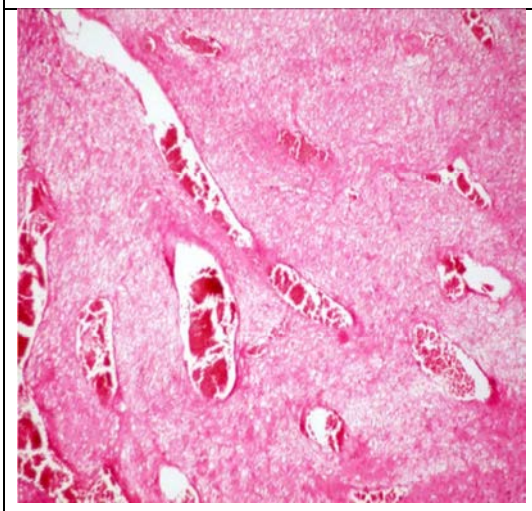


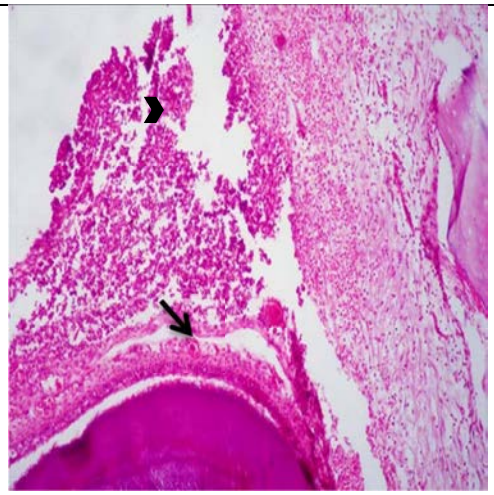
a)MTA group after one month with cementum formation (arrow head) and normal epithelium (arrow)



b)Biodentine after one month with normal epithelium and bone deposition (arrow)



a)Group (C) with severe congestion after three months



**b**)Group (D) with destruction of epithelium and cementum (arrow) and abscess formation at three months

**Figure 1.** Comparison

**Histopathological Examination**

1-The animals were divided into three groups and sacrificed with vital perfusion at one,
two, and three months intervals
2-The healing process, presence of inflammatory cells, vasodilatation and abscess
formation were assessed by a pathologist.

**RESULTS**

The results showed that no statistically significant difference was observed between MTA and Biodentine group regarding tissue inflammation, where in ***MTA group*** at one, two and three months intervals no abscess or bone resorption were observed, also bone apposition was observed in all teeth at two months interval and epithelium and granulation tissue were formed in all teeth at three months interval, on the other hand in ***Biodentine group*** no abscess was found in the three time intervals, however one tooth showed bone resorption at two months interval, bone and cementum was observed in 7 teeth at the three time intervals, and epithelium and granulation tissue were found in all teeth at three months interval.

However there was a significant different between the two groups and their control, where in both control groups there was abscess formation and bone resorption in addition to moderate to severe inflammation that was observed in the furcation area as shown in **Figure 3.**

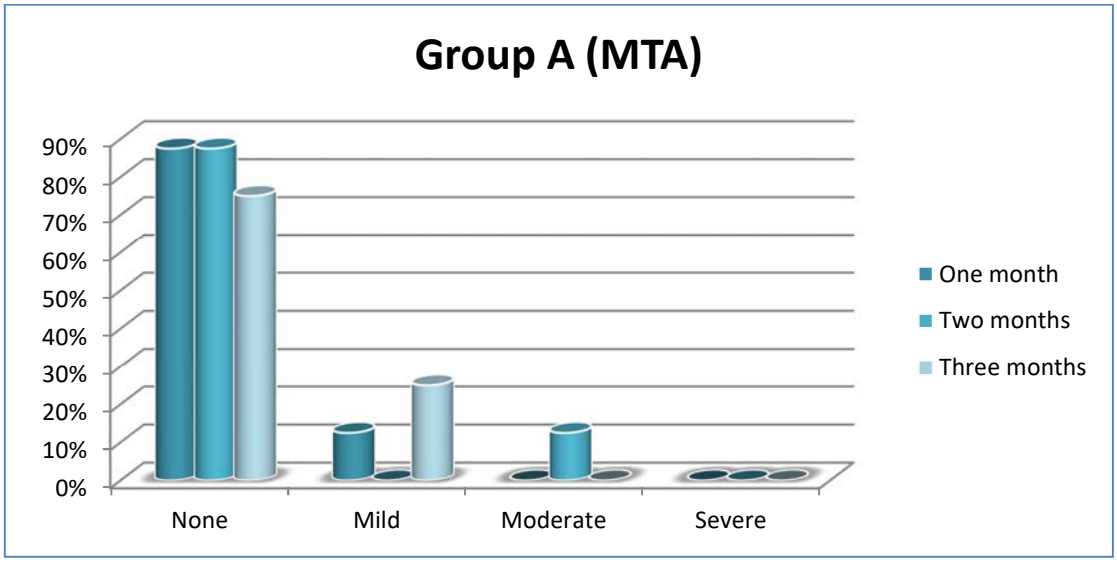



**Figure 2.** Severity of tissue inflammation in MTA group at the three follow up periods

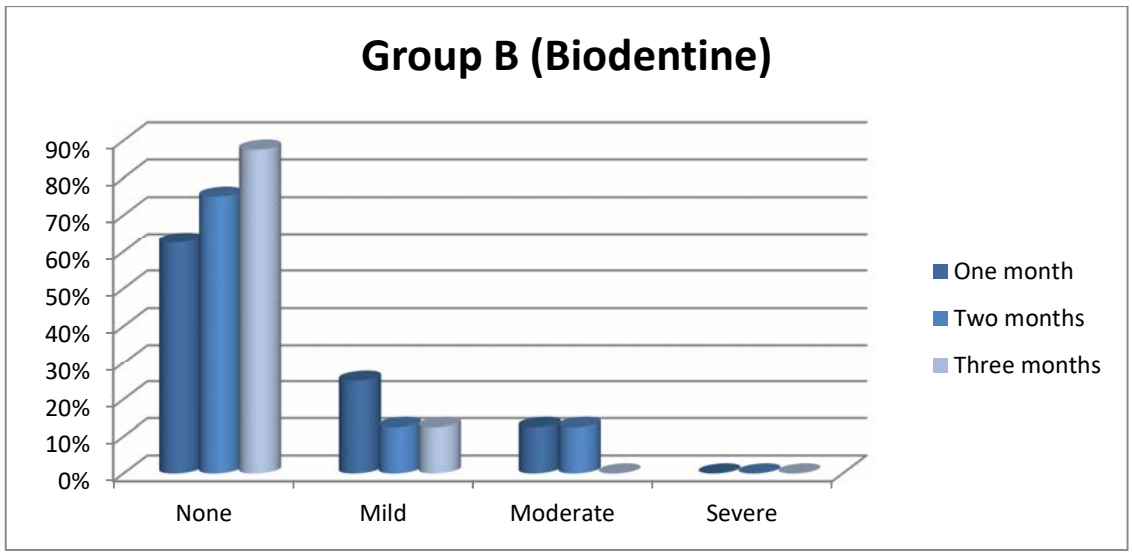



**Figure 3.** Severity of tissue inflammation in Biodentine group at the three time follow up periods

## DISCUSSION

Materials used in endodontics should preferably be biocompatible when they are placed in direct contact with living tissue such as in pulp capping, perforation repair, or when used as a retrograde filling [5].

Dogs were used in this study because dog is a demanding experimental model, having primary molars that have successors, also having two rooted lower molars that often furcate as close as 1 to 2 mm from the cemento enamel junction. As a result, epithelialization and the formation of connective tissue at a furcation perforation should be more likely than in humans, where the furcation lies deeper within the alveolus [6].

The size of perforations in this investigation was standardized at 1.4 mm, which is similar to several previous studies [6-9]. The bur was allowed to penetrate 2 mm into the alveolar bone to enhance the inflammatory response [9]. Several studies have reported the ability of MTA to prevent leakage in a variety of applications [10,11]. Moreover, they reported its superiority compared to other dental materials. For this reason, we included MTA as a standard perforation repair material for better comparison with Biodentine.

In our study Biodentine showed comparable favorable results in repairing furcal perforation compared to MTA without showing any statistically significant differences and this was in agreement with an in vivo study performed by De Rossi et al. [12].

Deposition of hard tissue over MTA was observed in 87.5% at one and three months and 100% at two months, also was observed in 87.5% at the three time follow up over Biodentine. In addition, new cementum was fused to the original cementum on the root surface. This supports earlier reports of repair when using MTA [6,13,14].

In clinical situations of perforations caused by caries, the pulp tissue is likely to be infected with bacteria at the moment of the treatment, which may lead to predominance of degenerative inflammatory response and affect the reparative response [15]. However, the present study used sound teeth to avoid the interference of confounding factors.

The high success rates observed with Biodentine and MTA could be attributed to several factors related to the host, the capping material, and the mechanism of operation. Also including the initial condition of the pulp tissue, the absence of microbial contamination, the only source of infection would be bacterial infiltration through the access cavity margins.

## CONCLUSIONS

Due to major advantages and appreciable properties and ability to achieve biomimetic mineralization and give successful outcomes of treatment of Furcal perforation, biodentine has great potential to revolutionize the management of affected tooth in endodontics. The easy handling and fast setting time are the major advantages in comparison to other similar materials available commercially. So Biodentine can be used as a potential alternative for the repair of furcation perforations due to its biocompatibility.

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