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### Induction of Reparative Dentin Following Pulpotomy with Biodentine™ at Four Week Follow up visit: A Case Report

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#### Abstract

Pulpotomy materials have been used in dentistry with the expectation of induction of reparative dentin for maintain of pulp vitality in mature permanent premolar tooth. However, few histopathological studies have been performed *in vivo* with healthy tooth. This study was performed to examine whether pulpotomy with calcium-silicate based Biodentine™ could induce reparative dentin formation without eliciting adverse side effects of premolar teeth, *in vivo*. In this study, pulpotomy was performed on upper left

first premolar tooth (which is needed to extract for aesthetic reason) with Biodentine™ and then the quality and quantity of reparative dentin was assessed by histological analysis at 28 days. It was found that the thickness of reparative dentin formation was  $1.4 \pm 0.4 \mu\text{m}$  that completely covers the exposed pulp tissue. It can be concluded that Biodentine™ is capable to induce pulpal wound healing and reparative formation in the exposed teeth without affecting the normal function of the remaining pulp.

**Keywords:** Vital Tooth, Pulpotomy, Biodentine™, Reparative Dentin

#### Introduction

Dental caries is a major health problem still exhibiting a very high prevalence in all around the globe. Lack of proper dental education, lack of access to dental care, treatment is often initiated when the progress sign degree has reached a deep, cavity stage, often with pulp involvement. The main objective of pulp therapy in permanent dentition is promoting the health of the teeth and their supporting tissues to maintain the proper functions of the Oro-facial complex (mastication, speech, aesthetics) and ultimately to retain the teeth in their position to preserve arch length [1-3]. Pulpotomy is a conservative clinical procedure commonly performed in permanent teeth with extensive carries, which implies removal of the coronal pulp and preservation of the radicular pulp. The rationale is based on the healing ability of the remaining pulp tissue following surgical amputation of the affected or infected coronal pulp [4]. After having achieved hemostasis, the exposed pulp stumps are covered either with a pulp capping agent that promotes healing or with an agent to fix the underlying tissue [5].

#### Case Report:

A 15-year-old patient came to the department of Orthodontics, with the chief complaint of aesthetic. On extra oral examination no abnormalities were detected. On Intra oral examination revealed proclination of upper anterior segment of jaw. No swelling

was present and no pain on palpation and percussion. On vitality test tooth is vital. On radiographic examination no abnormal periapical pathosis were detected. He need extraction of his four upper and lower first premolar teeth for correction of aesthetic.

### Treatment Plan

For aesthetic correction, he needs extraction of his four first premolar teeth. For my study purpose intentionally full pulpotomy was done with Biodentine to see the amount of reparative dentin formation which covers the exposed pulp tissue.

### Treatment Procedure

Non-carious upper left first premolar tooth was selected from participants who need extraction of his teeth for Orthodontic reasons. This tooth was used for pulpotomy with Biodentine™ and examined after four weeks for reparative dentin formation. After mouth preparation of the patient, a round shape cavity (diameter: 2 mm) were prepared on the occlusal surface to expose the pulp by using a flat end fissure bur (Shofu Dental Corporation, Japan) with a high-speed hand piece under sufficient cooling arrangement. Following control of bleeding with sterile cotton pellets, the exposed pulp tissue was covered with



Figure: Biodentine™

### Discussion

Pulpotomy technique basically consists of removing the coronal pulp and fixing the radicular pulp with a medicament [6]. It is the most widely accepted clinical procedure for treating permanent teeth with coronal pulp inflammation caused by caries with no involvement of the radicular pulp. Over the years, many different medicaments, pulp dressings, and techniques have been used in pulp therapy procedures. Formocresol, ferric sulfate, calcium hydroxide, glutaraldehyde, mineral trioxide aggregate, laser therapy, and electro surgery have all been used with varying degrees of success. Recently, Calcium silicate based Biodentine has been introduced and its use in pulp therapy has been expected.

Numerous researches have been conducted to evaluate the dentin bridge formation in exposed pulp treated with calcium hydroxide paste and calcium silicate-based material. Tran *et al.* [7] suggested that the structure created by calcium hydroxide has several cells known as inclusions, which are also referred to as tunnel defects. These findings have also been published by Nakamura *et al.* [8] Cox *et al.* [9] and

Biodentine™ according to manufacturer's recommendations. The test material was applied after the cavity preparation and pulp capping has been performed.

### Assessment

#### Qualitative analysis:

At 4 weeks after pulpotomy, tooth was extracted under local anesthesia and fixed in cold 4% neutral buffered formaldehyde for 24 hours. The specimen was dematerialized and embedded in paraffin. After longitudinal serial sectioning (6µm), every section was stained with haematoxylin and eosin. Series of sections containing pulp tissue was observed by a blinded observer in a light microscope equipped with a digital camera and computer for histometry.

#### Quantitative analysis of new hard tissues:

The amount of new hard tissue formed was assessed from experimental tooth. The area covered by newly formed hard tissue in these sections was measured by using digital, histometry equipment.

### Results

The thickness of reparative dentin formation was  $1.4 \pm 0.4$  µm that completely covered the exposed pulp tissue (Fig 1).



Fig 1: Histology of reparative dentin

Hossain *et al.* [10] As unwanted locations, these faulty areas promote the migration of microorganisms to the pulp, which can result in endodontic infections. In contrast, unlike calcium hydroxide, the dentin bridge made of the calcium-silicate-based material (e.g. Biodentine) displayed a well-localized pattern in the afflicted area. Dentinal tubules could be clearly seen, and there was an improvement in dentin quality and odontoblast structure in calcium silicate. Moreover, a clinical study conducted by Jalan *et al.* [11] on 45 human premolar teeth revealed that following 45 days of direct pulp capping with calcium hydroxide and calcium silicate, the dentin bridge in the teeth coated with calcium silicate was consistently thicker and more continuous and showed less dentinal inflammation than the teeth coated with calcium hydroxide.

The current study does not provide an explanation for the mechanism of dentin bridge development. Shayengan *et al.* [12] investigated how pigs responded to calcium silicate pulpotomy at 7, 28, and 90-day intervals after the procedure. Their findings show that the calcium silicate-based substance Biodentine™ has bioactive properties; it does not

cause moderate to severe pulp inflammation while repairing hard tissues. They also mentioned that the material's capacity to generate hydroxyapatite crystals, which could improve sealing ability, allowed it to preserve a marginal integrity. Because of its superior sealing capacity, there is no chance of microleakage that could result in necrosis or infection of the pulp, jeopardizing the effectiveness of crucial pulp therapy.

### Conclusion

Calcium-silicate based Biodentine™ is capable to induce pulpal wound healing and reparative formation in the exposed teeth without affecting the normal function of the remaining pulp. More study was need for conclusive result.

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