

## Histological evaluation of primary teeth pulp following direct pulp capping with Bioactive Glass and Mineral Trioxide Aggregate

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### Abstract:

Direct pulp capping is a conservative vital pulp therapy which that has some limitations in primary dentition. The aim of this study was to evaluate pulpal response of primary teeth after direct pulp capping with two biocompatible materials, MTA and BAG. Total teeth of 22 healthy primary canines which were to be extracted for orthodontic reasons, were selected. The teeth were divided into 2 groups, each with 11 teeth and were treated with direct pulp capping. Then the exposure sites were randomly capped with MTA or BAG in the two groups. After 2 months the teeth were extracted and prepared for histopathologic evaluation. Data was analyzed by Fisher's exact test. This split-mouth clinical trial was conducted on eight pairs of primary canine teeth scheduled for extraction as part of orthodontic treatment. The teeth were randomly assigned to the intervention and control groups. In the intervention group, canine teeth were restored with amalgam after pulpotomy with formocresol. In the control group, zinc oxide eugenol paste was applied as the capping agent after pulpotomy with formocresol, and the teeth were then restored with amalgam. After 1 month, the teeth were extracted in both groups and stained with hematoxylin and eosin for histological analysis. Pulp reaction was assessed in terms of pathological parameters. Data were analyzed using the Mann-Whitney U-test and Fisher's exact test. The statistical analysis software was SPSS 16.

No significant difference was found between the two groups in terms of inflammation, vitality, internal resorption, bleeding, presence of osteoclasts and dentinoclasts, and internal regeneration. Dentinal bridge did not form in any group. According to the results of this study, formocresol pulpotomy of primary teeth can be completed without the application of a capping agent. Pulpotomy is defined as removal of the coronal pulp to preserve the vitality of radicular pulp. It is the treatment of choice for primary teeth with pulp involvement due to extensive caries. Pulpotomy is performed through three methods, namely, devitalization, preservation, and remineralization. Several materials are also used for pulpotomy of teeth in devitalization, the coronal pulp tissue is removed and the coronal third of the radicular pulp is devitalized. Formocresol is conventionally applied for pulpotomy of primary teeth using the devitalization.

After dental pulp devitalization by the use of formocresol, different materials may be used as pulp capping agents. Zinc oxide eugenol (ZOE) is the most commonly used pulp capping agent following pulpotomy. Considering the significance of decreasing the treatment steps for children, treatment time can be shortened by not applying the pulp capping agent after using

formocresol. However, it is important that omitting of one step of the treatment (placing of conventional capping material, ZOE) does not damage to the dental pulp. Based on the related studies, placing of amalgam on the pulp does not generate undesirable reaction. A previous study evaluated the biocompatibility of high-copper amalgam, intermediate restorative material (IRM), mineral trioxide aggregate (MTA), and MTA combined with chlorhexidine. The results showed that all these materials were well tolerated by the connective tissue. An animal study evaluated and compared the biocompatibility of amalgam and gray and white MTA and revealed no significant difference among the three groups after 3 weeks. Another animal study assessed the reaction of connective tissue to high-copper amalgam and ProRoot MTA and indicated that the connective tissue of rats well tolerated these materials.

Thus, according to the results of the aforementioned animal studies (no human studies have been investigated reaction of pulp following pulpotomy with formocresol with and without zinc oxide coverage) showing no significant difference in pulp tissue response to high-copper amalgam, IRM, and white and gray MTA, it may be presumed that amalgam may be applied directly after removing the coronal pulp without the application of ZOE. Based on literature, the efficacy of this method has not been tested in human studies.

This study aimed to histopathologically assess the pulp of primary teeth following pulpotomy with formocresol with/without the use of pulp capping agents.

Design of this study was parallel. This split-mouth clinical trial was conducted between March and June 2017 on eight pairs of primary canine teeth scheduled for extraction as part of orthodontic treatment (the reason for choosing a canine as sample size was that the canine that goes out of the orthodontic treatment process can be completely healthy). This sample size was selected based on pilot study (this pilot study was conducted for sample determination and has not been published), and considering this study was done as split mouth one, statistical consultant defined this sample size.

These teeth were sound and the children were systemically healthy and had no contraindication for anesthesia. The children were 7–8 years old and three of them were male and five were female. After obtaining written informed consent from the parents, dental treatments were performed. In this triple randomized clinical trial (participants, care providers, and those

assessing outcomes), the samples were randomly (using a coin) sorted into two groups. Randomization was done using a coin by a person who was blinded to the study design and each side of the coin identified a group. In each patient, canine teeth were randomly assigned to the intervention and control groups. In the intervention group, anesthesia was induced and pulpotomy was performed using diamond fissure bur. A cotton pellet dipped in formocresol was then placed in the pulp chamber and removed after 5 min. The cavity was then restored with amalgam (SDI, USA). In the control group, anesthesia was induced and pulpotomy was performed using a diamond fissure bur. A cotton pellet dipped in formocresol was then placed in the pulp chamber and removed after 5 min. Next, ZOE paste was applied in the cavity followed by amalgam restoration. All the procedures were done by a pedodontist. After 1 month, the teeth in the two groups were extracted, stained with hematoxylin and eosin, and prepared for histological analysis.