THEMISEAL IN DENTISTRY

Clinical, radiographic and histological observation of the radicular pulp following “feracrylum” pulpotomy

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The purpose of this study was to assess the pulpal response following application of 1% Feracrylum (Hemolok) to arrest hemorrhage during pulpotomy procedure on 26 sound primary molars. They were filled with ZnOE cement and later restored with silver amalgam. The teeth were followed for clinical, radiographic and later histological success for various intervals of time up to 5 months. Asymptomatic clinical and radiological finding and histological evidence of healing in the form of reparative dentin and fibrous tissue formation the deeper zones of the radicular pulp was observed. The hemostatic and non-toxic nature of feracrylum makes it a promising medicament for pulpotomy procedures.
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INTRODUCTION

No area in the field of pediatric dentistry has been more controversial than pulp therapy. In particular, the vital pulpotomy procedure has always been the topic of debate. While the technique of pulpotomy therapy evolved slowly and steadily over the first 40 years, the pace of change since the 1960s has continued to accelerate. Formocresol introduced by Buckley early in the century has been the most commonly used medicament. The use of this solution has undergone changes both in protocol as well as in its concentration.

In spite of all these changes, recent studies have indicated that formocresol is toxic and causes immunologic, biochemical, mutagenic and teratogenic changes in the host. Moreover several authors have found a relationship between primary teeth treated with formocresol and enamel defects in the permanent teeth. All these factors make it imperative to find a biologically viable substitute to formoresol. Although glutaraldehyde is gaining increasing attention as a substitute for formocresol due to its low diffusion potential and high protein binding effect. There have been conflicting results regarding it replacing formocresol.

Lack of adequate hemostasis before placement of the medicament affects the treatment outcome and contributes to the failure of the failure of the pulpotomy procedure. The blood clot so formed on the wound surface lowers the frequency of complete histological healing as was seen when calcium hydroxide was used as pulpal dressing. The success of pulpotomy would therefore be enhanced by promoting hemostasis and maintaining the vitality of the remaining pulpal tissue. A study was therefore warranted to observe the effects of a hemostatic agent on the radicular pulpal tissue after pulotomy procedure.

MATERIALS AND METHODS

Fifteen children from about 8 to 9 years of age requiring interceptive orthodontic treatment were the subjects of this study. The patients had to undergo extraction of primary mandibular first molars as a part of serial extraction procedure. Teeth

selected for the procedure were free from dental caries and did not show any mobility or tenderness to percussion. Radiographically there was no evidence of caries. Internal and/or external resorption and no abnormal intraradicular or periapical radiolucency. In all, 26 teeths were available for evaluation at timely intervals after the pulpotomy procedure was performed.

After the administration of a local anesthetic and isolation with a rubber dam, a routine pulpotomy procedure was performed. A number 330 bur was used to remove the roof of the pulp chamber. A sharp sterile spoon excavator was used to remove the coronal pulp tissue. Initial pulpal bleeding was arrested by the application of pressure with cotton pellets onto the root canal orifices. A sterile cotton pellet moistened with 1% feracrylum was applied onto the root canal orifies for 3 min. The pulp chamber was filled with ZnOE and the tooth was later restored with amalgam. All the teeth were radiographed immediately after the procedure.

Clinical radiographic and histological evaluation of the teeth were done at 1,2,3,4,5,6 and 9 monthly intervals respectively. The teeth were judged to be clinically successful if they had no symptoms of pain or tenderness to percussion, swelling or fistulation.

Radiological successful required a normal periodontal ligament space, absence of any pathological internal or external resorption and no intraradicular or periapieal radiolucency.

RESULTS

Clinical Examination – The success rate was 100% in all cases evaluated.

Radiographic Examination – Internal resorption was noted in one tooth after one month, and additional tooth after five months.

Histological Examination

One moth

Four distinct zones were seen

1. Eosinophilic zone
2. Zone of ghost cells. In this zone the cells had retained their periphery, but lost their cellular contents
3. Inflammatory zone with dilated blood vessels and inflammatory exudates within the radicular pulp.
4. Normal radicular pulpal tissue

Two Months

Resolution of the one of ghosts cells. Extensive eosinophilic material was seen peripherally with pulp inflammation. This was further surrounded by an amorphous mass of cells. The deeper zones showed areas of reparative dentin and fibrous tissue formation.

Three months

Mild inflammatory infiltrate was seen towards the orifices of the root canals. In one of the cases, in one region which showed internal resorption gradual changes of repair with osteodentine formation were seen. Moderate amounts of pulpal fibrous tissue were seen to be associated with some extravasated and engorged blood vessels. Areas of reparative dentin foci were also evident.

Five months
Pulp tissue close to the orifices were filled with amorphous eosinophilic mass containing large vacuolated areas with a reticular center. The root canals adjacently showed minimal amount of inflammation and further apically there was an increase in fibrous tissue and reparative dentin, some of which was of the osteodentine type.

Six months
There was a further resolution of the eosinophilic zone. Radicular pulpal contents showed very mild inflammatory cells and fibrosis. The radicular pulp walls showed reparative dentin which had tinetorial properties of cementum-like tissue. Further apically viable pulp tissue was seen with cellular contents.

Nine Months
Normal radicular pulpal tissue was seen.

DISCUSSION

Pulpotomy may be defined as the removal of the coronal part of the pulp followed by placement of a suitable dressing or medicament that promotes healing and preserves the vitality of the remaining pulp. An effective pulpotomy medicament must result in clinical and radiographic success. Biologic compatibility of the pulp and surrounding tissue allow for the continuity of the normal pulp physiology. The main objective of the pulpotomy procedure in primary teeth is to preserve them until their exfoliation.

A nonaldehyde hemostic chemical ferrie sulfate has received attention recently as a pulpotomy medicament and it was observed to function solely in a passive manner. A 12 month clinical evaluation of this agent showed favorable results. However, we have not come across any studies in the dental literature where hisotological observation on the dental pulp were made following the use of hemostatic agents.

In this study, 1% feracrylum (pH 3.4) which is an incomplete iron salt of polyacrylic acid containing 0.05 to 0.5% iron was used. It has a unique mechanism of action where it binds with the plasma proteins and forms a clot. In addition, it has bactericidal properties is devoid of any systemic toxicity and has been successfully used in the medical field for various surgeries. Use of hemostatic agents prevents the problems encountered from excessive bleeding, thereby minimizing the changes for inflammation and internal resorption.' The metalprotein clot so formed at the surface acts as a barrier to the irritative components of the subbase.' In this study. ZnOE was used as a base which was in direct contact with the pulpal tissue and played its role in the healing process. The zone of inflammation was apical to the eosinophilic zone and did not spread apically. This suggested poor penetration of feracylum due to its large molecular size (5,000,000 dalton units) and effective plasma protein binding property. This zone later gradually resolved producing favorable pulpal healing and maintaining the vitality of the tooth. Healing was evident in the form of fibrous tissue formation along with foci of reparative dentin.

CONCLUSION

From the observation noted in this study. It can be concluded that feracrylum has shown promising result in fulfilling its role as a pulpotomy medicament. Larger sample, size and longer follow-up periods are required to determine the effects of this material on the pulp and underlying permanent teeth. It must be remembered that the pulpotomy procedure was done on sound primary molars. The possibility of a different sequence of events following pulpotomy is a deeply carious tooth or traumatically exposed permanent tooth needs to be investigated.

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