A Simplified Method for the Restoration of Severely Decayed Primary Incisors

Maryam Talebi¹, Iman Parisay², Fatemeh Khorakian², Elham Nik³

¹Associate Professor, Department of Pediatric Dentistry, Dental Material Research Center, School of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran
²Assistant Professor, Department of Pediatric Dentistry, Dental Material Research Center, School of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran
³Assistant Professor, Department of Pediatric Dentistry, School of Dentistry, Bandar Abbas University of Medical Sciences, Bandar Abbas, Iran

Abstract

Objectives: Caries and dental trauma are common reasons for primary anterior teeth restorations in children. This non-control clinical trial was designed to evaluate crown restorations reinforced with a sectioned file post for the restoration of severely damaged primary maxillary incisors.

Materials and Methods: Thirty-eight primary maxillary incisors of 12 children (3-5 years old) with early childhood caries (ECC) received composite restorations with a custom made post. The restorations were evaluated using the modified United State Public Health Service (USPHS) criteria. The results were statistically analyzed by descriptive – analytical tests.

Results: In this trial, the quality of marginal adaptation decreased after three and 12 months intervals. Recurrent carious lesions were observed during intervals. In terms of restoration retention, only one patient lost both the post and the restoration at the 12-month follow up.

Conclusion: The sectioned file post technique showed good retention and aesthetics for restoring severely damaged primary maxillary anterior teeth.

Keywords: Dental caries; Tooth, Deciduous; Incisor; Dental restoration

INTRODUCTION

Caries and dental trauma are common reasons for anterior primary teeth restorations in children [1]. Severely damaged incisors may lead to difficulty in speech, decreased masticatory efficiency, abnormal tongue habits, subsequent malocclusions and psychological and self-esteem problems [2]. In addition to problems for the patient, the restoration of severely decayed primary maxillary incisors poses a challenge for pedodontists. These teeth usually have short and narrow crowns, thus, only a small surface is available for bonding and the enamel is inherently difficult to acid etch due to its aprismatic nature [3].

There are several methods mentioned in the literature for the restoration of severely decayed primary anterior teeth, such as direct and indirect techniques, use of metal posts [4,5], biological posts [6,7], resin composite posts and core restorations [8], reinforced composite and glass fiber posts [9-12] and custom made orthodontic wire posts [13,14]. These methods have several advantages and disadvantages.
For example, prefabricated posts and omega–shaped stainless steel orthodontic wires are simple, quick and cheap, but their adaptation is not always ideal. Polyethylene fiber and glass fiber-reinforced composite posts have optimal properties in terms of elasticity, translucency and adaptation. Biological posts are natural but they require creation of a tooth bank [5, 9–12, 15, 16]. In the present study, we introduce a custom made sectioned endodontic file post as the retentive part of the restoration of severely damaged anterior primary teeth because of its accessibility and simplicity of fabrication for dentists as well as its affordability. A 12-month clinical follow-up of this method was also conducted.

MATERIALS AND METHODS
For this non-control clinical trial, 12 healthy children (five boys and seven girls), who were referred to the Pediatric Dentistry Clinic of Mashhad University of Medical Sciences, were selected. They were between 3-5 years old with no history of mental or medical disorders. Furthermore, the selection of teeth was based on the following criteria:
1-Primary maxillary anterior teeth with ECC or fracture due to trauma involving more than three-fourths of the crown
2-Sound root structure and no caries in the root dentin
3-No mobility
4-No trauma from the occlusion, as in cross bite, deep bite, etc.
5-No abnormal oral habits
6-Normal root formation, with a sufficient amount of root structure present (at least two-thirds)
7-No subgingival caries

The ethics committee of Mashhad University of Medical Sciences approved the study protocol. Full detailed treatment plans were explained to the parents or guardians of each child and then a written consent was obtained. During the process, uncooperative children with poor oral hygiene were excluded from the research. Subsequently, periapical radiographs of the teeth to be treated were obtained. During the study, a total of 38 primary maxillary incisors of the selected 12 children received composite restorations with a custom made intracanal post. The teeth were endodontically treated and then the canals were obturated with zinc oxide eugenol cement (ZOE, Golchay, Iran). Afterwards, they were temporarily restored with reinforced zinc oxide eugenol cement (Zonalin, Kemdent, UK)(Figure 1).

Due to extensive crown damage, it was necessary to use intracanal posts. Thus, at the second appointment, about 2 mm of the cement was removed from one-third of the coronal part of the canal. Next, a custom made post was fabricated using a 4 mm K-file (K-file, Mani, Tokyo, Japan)(Figure 2a); it was the largest file which was retained in the canal, and was then sectioned and inserted into the
canal, so that the incisal end of the sectioned K-file projected 2 mm above the CEJ. This K-file post was selected because it provided optimal mechanical retention and support for the restorative material. Shade selection of the composite was made during the daylight hours.

The root canal was conditioned with polyacrylic acid (Fuji, GC Corp., Tokyo, Japan) and then dried with high air pressure. The sectioned file was cemented into the canal with a resin modified glass ionomer (Fuji II, GC Corp., Tokyo, Japan) and was subsequently covered with the glass ionomer to mask its metallic shade (Figure 2b). After the setting of the cement, a celluloid strip crown (3M ESPE, USA) was adopted for the tooth and then the remaining coronal structure was etched with 35% phosphoric acid (Scotchbond etchant, 3M ESPE, USA) for 20 seconds, and then rinsed and dried for 30 seconds. Bonding agent (Single Bond Adper 2, 3M ESPE, USA) was applied and cured for 20 seconds with an LED light-curing unit (Blue phase, Ivoclar Vivadent, Schaan, Liechtenstein).

The celluloid crown was perforated at the lingual aspect with a round diamond bur (Jota, Switzerland) to discharge the excess composite. Then, the crown was filled with the previously selected shade of nanofilled composite resin (Filtek Z350, 3M ESPE, USA) and placed over the remaining tooth structure, and then the composite was cured with an LED light curing unit for 40 seconds from each aspect. The excess composite at the lingual and gingival margins was removed with finishing and polishing burs (Jota, Switzerland). Occlusion was checked and after the removal of interferences, the final finishing and polishing of the restoration was performed with a polishing disc (Soflex, 3M ESPE, USA) (Figure 3).

The patients and their parents were instructed on proper oral hygiene and emphasis was placed on follow up. Clinical evaluation for several parameters was done at baseline and intervals of 3 and 12 months in accordance with the modified USPHS criteria (Table 1).

In the modified USPHS criteria, the rating results of Alfa were acceptable, while the rating results of Bravo and Charlie were poor.

| Table 1. Modified United State Public Health Service (USPHS) criteria |
|---------------------|-----------------|----------------|
| Category            | Scores          | Criteria                   |
| Retention           | Alfa            | No loss of restorative material |
|                     | Charlie         | Any loss of restorative material |
| Secondary Caries    | Alfa            | No caries present          |
|                     | Charlie         | Caries present             |
| Marginal Adaptation | Alfa            | Closely adapted, no detectable margin |
|                     | Bravo           | Detectable margin, clinically acceptable |
|                     | Charlie         | Marginal crevice, clinical failure |

www.jdt.tums.ac.ir  March 2015; Vol. 12, No. 3
The descriptive-analytical tests were used for marginal adaptation and restoration retention and recurrent caries at 0, 3, and 12 months using the SPSS version 11.5 software and 95% confidence interval was calculated for success proportion.

RESULTS
In this open label clinical trial, the quality of marginal adaptation decreased after three and 12 months intervals. At the 3-month follow up, only four teeth had poor marginal adaptation that required correction; however, at the 12-month follow up, eight teeth had poor marginal adaptation. In terms of restoration retention, at the three-month follow up, 35 restored teeth remained intact and just two restored teeth were fractured, but the posts remained in the canals. Just one patient lost both the post and the restoration. At the 12-month follow up, only 30 teeth remained intact, six teeth had posts remaining, and two teeth had lost the posts and the restorations (Table 2).

Recurrent carious lesions were observed at three and 12 months.

DISCUSSION
Esthetic reconstruction of deciduous maxillary anterior teeth severely damaged by caries or trauma is challenging for pedodontics for several reasons such as loss of tooth structure, weak adhesion of the bonding agent to primary teeth and uncooperative children for whom these treatments are needed. However, retention of such restorations in endodontically treated teeth can be improved using an intracanal post [13] and different techniques and materials have been used to reinforce large root canals. Direct composite resin restorations reinforced with an orthodontic wire are simple and fast, but the wire adaptation into the canal is not sufficient [5,13, 15]. Metallic posts are not expensive but an additional laboratory stage and high cost are the two major disadvantages of this method [3,4,5]. It also requires the usage of an opaque resin to mask the post, which may in turn compromise the final appearance of the restoration. Furthermore, the use of metal posts in primary teeth could pose additional problems during the course of natural exfoliation [17]. Another aesthetic option could be using biological posts made from extracted primary teeth [6, 7]. The disadvantages of this technique include the need for a tooth bank and parental and...

Table 2. Evaluation of marginal adaptation, restoration retention and recurrent caries

| Category          | Modified USPHS criteria | 0 month | 3 months | 12 months |
|-------------------|-------------------------|---------|----------|-----------|
|                   | N(%)                    | N(%)    | %95 CI*  | N(%)      | %95 CI*  |
| Marginal Adaptation | Acceptable              | 38 (100)| 34 (89.5)| (79.7, 99.2)| 30 (79.0)| (65.9, 91.8)|
|                   | Poor                    | 0 (0)   | 4 (10.5) | -         | 8 (21.1)| -          |
| Restoration Retention | Acceptable              | 38 (100)| 37 (97.4)| (92.3, 100)| 36 (94.7)| (87.5, 100)|
|                   | Poor                    | 0 (0)   | 1 (2.6)  | -         | 2 (5.3) | -          |
| Recurrent caries   | Acceptable              | 38 (100)| 37 (97.4)| (92.3, 100)| 30 (78.9)| (65.9, 91.8)|
|                   | Poor                    | 0 (0)   | 1 (2.6)  | -         | 8 (21.1)| -          |

USPHS: United State Public Health Service
*Confidence interval
child donor consent as well as that of the recipients of such tooth fragments [6]. Moreover, this technique may not comply with today's cross-infection control policies [6]. The composite resin post method provides acceptable esthetic appearance, but the polymerization shrinkage of the composite may lead to retention loss of the post [7, 18]. The use of prefabricated nonmetallic posts has become a preferred treatment modality [7,17, 18]. The advantages of this technique are proper adaptation to the canal walls by the application of composite resin, adequate retention, and stability [5,9-12]. In this study, we introduced a simple and cost effective technique for restoring severely decayed maxillary anterior teeth. This method is affordable for patients, trouble-free for dentists and it does not require any laboratory work. Additionally, it can be done easily by sectioning a proper size endodontic K-file, which is available in any dental clinic. According to the results of this study, after 12 months of follow up, only two teeth lost post and restoration and in one case hard biting led to restoration fracture. Therefore, this method provides adequate retention for durable restoration of severely damaged primary incisors. In this study, the sectioned K-file was introduced 2 mm inside the canals until it reached the limit of the cervical third as described by Rifkin in 1983[19]. A longer file length is not preferred because it may interfere with the eruption of the underlying permanent tooth during the final stages of resorption of the primary roots. In addition, in this technique we applied glass ionomer for masking the sectioned K-file in the core part of the post system and since there was enough composite resin around the core, no metal showed through the composite restoration and thus favorable esthetics was achieved. However, based on the results of this study and with regard to marginal adaptation, this variable worsened during the follow up intervals, probably due to the lack of enamel for bonding to the composite in severely damaged incisors. Recurrent caries occurred in eight children with ECC, who had a high risk of dental caries. The absence of a proper preventive strategy could result in caries recurrence in this group. As oral hygiene and diet are critical factors in developing caries, one of the limitations of this study was that there was no control over the oral hygiene and diet of the children; thus, these factors could have influenced caries recurrence rates in our study. Another limitation was that no comparison was carried out between the type of teeth (central or lateral incisors), which may affect post retention because of differences in tooth morphology and tooth position in the dental arch; therefore, further investigational studies are recommended in this regard.

CONCLUSION
In this study, a strip crown restoration reinforced with a sectioned K-file intracanal post showed favorable retention and aesthetic results after 12 months of follow-up. Additionally, this method requires short chair time, which is ideal for pediatric patients, and no laboratory work and is cost effective as well.

ACKNOWLEDGMENTS
We would like to acknowledge the financial support of the vice president of the Research Center of Mashhad University of Medical Sciences.

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