

Resin bonded metal plate as a splint for fractured restored teeth: a case report

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This article presents a case with traumatic tooth fracture that was treated by direct pulp capping followed by fragment restoration. The fixed parts were reinforced by resin bonded metal plates.

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INTRODUCTION

Traumatic tooth injuries in children are a common occurrence during playing. In some instances the permanent teeth are involved that can create a difficult situation for the child, his parents and the dentist in saving these teeth. Treatment of pulp exposure in permanent teeth followed by traumatic fracture can be performed according to clinical findings (i.e. pulp vitality, exposure dimension, exposure size, root maturity, and restorability of the crown. Restoration in these cases can be completed by fragment restoration, composite resin bonding restorations or full crown. Fragment restoration can be done when fractured parts of the tooth are saved and are available. They can be fixed by composite resin bonding, but restored parts may be dislodged especially when they are in a considerable bite force.

Bonding a metal framework to enamel by composite resins was introduced by Rochette in 1973 for splinting purposes. After that, many investigations have been done to evaluate and improve the bond strength between tooth, resin cement and the metal surface.^{3,4,5,6} Resin bonded fixed partial dentures (RBFDP) has been used for long term provisional restorations, intermediate replacement of a missing tooth or as a periodontal splint. This case study describes a helpful method that can improve strength of fractured restored parts.

CASE PRESENTATION

The patient, a 10 year old boy, came to my office with the chief complaint of fractured teeth during play. Left and right maxillary central and left lateral incisors were damaged, but pulpal exposure occurred in left maxillary central and lateral incisors from trauma.



Figure 1. Radiographic image of fractured teeth after direct pulp capping. Note the immature roots.

No systemic problem was found in the medical history. The patient was conscious and no evidence of head and neck trauma was present.

The elapsed time since the trauma was about two hours. Clinical and radiographic examination did not reveal any root fracture (Figure 1). Fortunately the patient had found and saved the fractured segments. Local anesthesia with lidocaine (2%) was used to control the pain. The teeth were isolated by cotton rolls and were rinsed with saline solution gently. Because the time elapsed after exposure was not long and the exposures were small, direct pulp capping was chosen to preserve vital pulp tissues, because the roots were not mature.

The exposed areas were covered with calcium hydroxide paste (CaOH-Plus, Roeko, Germany) and fractured parts were attached by Panavia EX (Kurary, Osaka, Japan) resin cement, but due to excessive bite force the fractured parts were detached 3 times during

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Figure 2. Radiographic image of anterior teeth after fractured restoration. (one month after fracture)



Figure 3. Radiographic image of restored teeth with metal plates. Note the root maturation. (23 months after fracture and 12 months after the metal plates were cemented)



Figure 4. Anterior view of restored teeth (11, 21 and 22). Note the fracture line (arrows) and the deep overbite.



Figure 5. Palatal view of cemented metal plates on teeth 21, 22.

1 year of follow up. Vitality tests revealed pulp vitality and root maturation was shown in radiographic examination. (Figure 2)

The parents agreed with fragment restoration treatment plan. Therefore, the decision for splinting of fractured parts was made. A cast metal plate was made to help the tooth withstand the deep bite occlusal forces. The procedure is as followed:

Technique

1. The fractured parts were attached by dual cure composite resin cement (Enforce, Dentsply Caulk, Milford, DE).
2. A circumferential bevel with 0.25-0.5 mm depth and 0.5-1 mm width on the fracture line (on both parts) was made by a bud shape diamond bur with 1.5-2.0mm head diameter. In most cases the proximal areas must be omitted because it can damage adjacent teeth.
3. The prepared groove was filled with a filling composite resin to enhance retention of the fractured parts, so during the clinical and laboratory procedures, the restored parts remained attached.
4. Palatal surface of the restored teeth were reduced 0.3-0.5mm to provide sufficient space for the metal plates and prevent over contouring and occlusal interference. A shallow chamfer gingival finishing line was placed 0.5mm supragingivally and a shallow groove was prepared all around the area that must be covered by the plate to determine the finishing line for the metal plate extension for the technician. Overextension in the incisal area must be avoided because the gray shade of metal will be shown through the transparent incisal enamel.

5. An impression was made by an elastomeric impression material (Impregum F; ESPE America Inc, Norristown, Pa.) and poured with stone die material. Wax patterns were made on the prepared dies and were cast in a base metal alloy (Supercast, Termabond Alloy Mfg.). The plates were sand-blasted, cleansed in an ultrasonic bath and etched with electrochemical etching for 3 minutes (300 mA/cm², 3 Volts) in a 10% sulfuric acid solution. They were cleansed with 18% hydrochloric acid (HCl) for 10 minutes. Finally the plates were rinsed with tap water and dried for cementation. One can utilize other metal surface treatment methods such as perforation, salt crystal, sand blasting and so on according to availability of equipments and materials.
6. The teeth were isolated with a rubber dam; pumice powder and alcohol mixture was applied with a prophylaxis brush on the prepared tooth surface for cleansing. The teeth were etched with 37% phosphoric acid gel (Tooth Conditioner Gel, Dentsply Caulk, Milford, DE) for 1 minute, dried with air gently. The prepared metal plates were cemented to the prepared teeth by a dual cure composite resin cement (Enforce, Dentsply Caulk, Milford, DE) as recommended by the manufacturer. The composite excessive cement was removed after curing was completed and the occlusion was checked for any interference. The final finishing and polishing must be accomplished after 24 hours for complete polymerization of the resin. (Figures 3, 4, 5)

DISCUSSION

Although fragment restoration can be a standard treatment plan in many cases, but it may fail due to the high bite force. It seems that fragment restoration can provide more psychological satisfaction for the patients and the parents. This technique can reinforce the restored parts and probably increase the durability and survival, but the technique has advantages and disadvantages:

Advantages of resin bonded metal plate

1. The procedure can be combined with a resin bonded bridge to splint the fractured parts and restore a missing tooth as well.
2. The tooth can be examined and observed for vitality and any discoloration during a long period of time.
3. If root canal therapy is needed, the access cavity can be prepared on the metal restoration.

Disadvantages of resin bonded metal plate

1. It requires more chair time and laboratory procedures that will increase the cost.
2. The gray shadow of the metal might display through the tooth especially when the tooth is thin buccolingually.
3. This technique can not be applied to the tooth that has lost palatal enamel due to fracture.

SUMMARY

This case report, presents a technique for reinforcing the fractured parts of fragment restored permanent teeth. This technique utilizes a metal plate that can be bonded to the tooth from the lingual aspect. The metal plate serves as a splint for the fractured part.

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