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Uncomplicated crown fracture: A biological management option

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Abstract

Dental trauma often results in a fractured anterior tooth crown. The conventional management of these cases involves a direct composite resin restoration, which is riddled with disadvantages. More recently, reattachment of the fractured segment has been suggested as a treatment modality. The present article reports a case of uncomplicated crown fracture of an incisor tooth managed by reattachment, with a 12-month follow-up.

Keywords: trauma, uncomplicated crown fracture, reattachment.

1. Introduction

Fracture of an anterior tooth due to trauma is a common occurrence, with an incidence of 18-22% of all injuries to the dental hard tissues [1]. About 28-44% of these cases are uncomplicated fractures, i.e. they do not involve the dental pulp [1]. The primary considerations for the management of these cases include restoration of the normal function as well as aesthetics. With the exhaustive research on adhesive technology, providing the clinician a number of alternatives to choose from, a direct composite resin restoration is a simple, cost-effective treatment option. However, a resin restoration has major disadvantages. High failure rates of 19-25% have been reported, with bond failure and fracture of composite, marginal failure, and marginal discoloration being the most common causes [2]. In an attempt to overcome these problems, treatment modalities such as reattachment have been explored. Most case reports of reattachment involve complicated crown fractures with the fractured segment, reinforced by a bonded post system. The reattachment of a fractured segment without an invasion on the integrity of the pulp is, on the other hand, rare. This article details such a case with a successful 18 months follow-up.

2. Case report

A 38 year old male patient reported to the Department of Conservative Dentistry and Endodontics, Amrita School of Dentistry, Kochi following trauma to his maxillary left central incisor, sustained on the previous day. The patient had brought the fractured segment stored in a bottle of sterile saline. His medical history was non-contributory.

On clinical examination, tooth 21 was seen to have a clean oblique fracture involving enamel and dentin, with no other craze lines and there was a single intact fragment (Fig.1, 2). The tooth tested normal to electrical and thermal pulp testing. No mobility of the injured tooth was recorded and the surrounding soft tissues were healthy. An intraoral periapical radiograph showed sound periodontal structures. As the adaptation of the fragment was seen to be acceptable, it was decided to reattach the tooth fragment.

After isolation of the fractured tooth, acid etching of both the remaining tooth surface and the fragment was carried out for 15 seconds using 37% phosphoric acid (DPI Tooth conditioner gel, Dental Products of India, Mumbai, India). Both were then rinsed thoroughly with water and excess water was removed with a cotton pellet. Next the adhesive (Prime & Bond NT, Nanotechnology Dental adhesive, Dentsply, St. Paul, MN, USA) was applied on the etched surfaces, air-thinned and light-cured for 10 seconds. The composite resin (Ceram. x mono⁺ Nanoceramic restorative, Dentsply, Konstanz, Germany) was applied to the fragment and tooth surface. The fractured fragment was then aligned on the tooth and held in position under mild pressure and light-cured at different angles for a total of 60 seconds.



Fig 1: Pre-operative view



Fig 2: Fractured tooth segment

Later the restored surface was finished and polished (Sof-Lex™ disks 3M ESPE, St. Paul, MN, USA). The aesthetic result was excellent, with the line of attachment barely visible (Fig. 3). Occlusion was checked and post-operative instructions were given to the patient to minimize direct masticatory loading of the anterior teeth. The patient has since been under review with regular detailed clinical evaluation including assessment of pulp vitality. Through this 18 month period, the tooth and surrounding tissues have remained healthy and functional. Clinical photographs at the 12 month and 18 month review reveal the preserved aesthetics and function (Fig. 4, 5, 6).



Fig 3: Immediate post-operative view

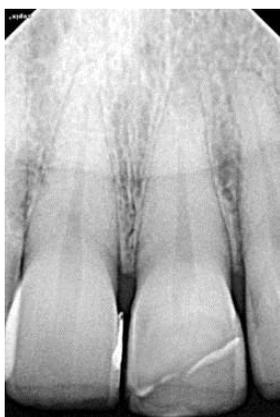


Fig 4: 12-month follow-up radiograph



Fig 5: 18-month follow-up photograph



Fig 6: 18-month follow-up photograph extraoral view

3. Discussion

The prognosis of a tooth with uncomplicated crown fracture is determined by the pulpal response to the injury. This involves two mechanisms, namely, the outward flow of the dentinal fluid and also the pulpal response to any potential inflammation enabled by an intact pulpal circulation [2]. Thus, the primary objective in the management of such cases is to limit the pulpal inflammation to a transient level and prevent bacterial ingress. This is best achieved by an efficient dentin seal [2].

The conventional choice of treatment for these cases is a direct composite resin restoration. The recent advances in restorative materials and techniques facilitate a restoration with a conservative tooth preparation, design and secondary optical properties such as translucency, opacity, opalescence, fluorescence, and surface gloss. However, there is no synthetic restorative material that can replicate the aesthetic characteristics or colour stability of the natural tooth structure [3]. Composite restorations often require overlays for aesthetics, which can also cause marginal staining, incisal breakdowns and loss of retention [3].

Reattachment of the fractured segments is another option and has several advantages. It conserves sound tooth structure, is more aesthetic, maintains the original anatomy and translucency, and the rate of incisal wear also matches that of original tooth structure [4]. Chu *et al* have also reported that the use of natural tooth substance eliminates problems of differential wear of restorative material, unmatched shades, and difficulty of contour and texture reproduction associated with other restorative techniques [5]. Cost and chair-side procedures are also reduced, as against tooth build-up with resin composite or impression taking for cast restoration [5].

Various techniques have been suggested to improve the retention of the reattached fragment including post, pins, and undercut preparation in the pulpal chamber or preparation of enamel with circumferential external bevel or "intraenamel" V-shaped notches [5]. However, as there is no consistency in

the reports regarding any increase in the success rates following these steps, no such attempt was made in the case reported here. This represents the most conservative approach to the management of uncomplicated crown fractures, without any further reduction of tooth structure.

The storage conditions of the fractured segments also have gained much consideration in predicting the prognosis of reattached teeth. Sterile saline at 37 °C has been recommended as a suitable storage medium to prevent dehydration and collapse of the collagen in the fractured segment and any dimensional change [5]. Rinsing in 0.12% chlorhexidine has been suggested as a step for disinfection [3]. According to a study reported by Shirani *et al*, teeth whose fractured parts were kept hydrated in a storage medium had higher bond strength than those whose fractured parts were kept in a dry environment [6]. Milk, saliva, saline and water have been suggested as suitable storage media for fractured tooth segments [6]. In the case reported here, the patient had brought the separated fragment in saline, and this may have contributed to the success of the restoration.

Another consideration in reattachment of teeth is the adhesive material used. The initial reports on reattachment have suggested the use of an unfilled resin adhesive (dentin bonding agent). Studies comparing the different bonding agents have reported a high fracture resistance approaching that of intact tooth, in *in vitro* conditions [2]. Fractured segment retention was shown to be higher when reattachment was done with total etching technique and newer generation materials than with enamel etching alone [2]. Several reports have suggested the use of composite resin and its derivatives. In a study by Singhal *et al* [7], a comparison between Composite resin, Resin-modified Glass ionomer cement, compomer and Resin cement as adhesive material for reattachment of incisor tooth fragments, the former was shown to confer higher fracture resistance [7]. Pusman *et al* studied the effect of different bonding agents with or without a composite resin layer to reattach fracture segments following different crown preparation techniques [4]. It was shown that when reattachment was done with a no-preparation technique, a composite resin layer enhanced the fracture resistance. In the present case, a nano-filled composite resin was used as the adhesive agent.

Most of the reported cases of reattachment have described this technique as an interim measure or at best, an alternative in select situations, and long-term follow-up reports are few⁸. However, in recognition of the necessity for long-term follow-up of tooth reattachments, the case reported here has been placed on periodic recall.

4. Conclusion

The present case supports the plethora of reports of successful reattachment of tooth segment in uncomplicated crown fractures. The technique offers a simple, quick and effective treatment option that is also acceptable for the patients. However, the success of this technique beyond the scope of an intermediary procedure, can be accurately cited only after a longer period of observation.

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