

Case Report

Esthetic and endodontic management of a deep crown-root fracture of a maxillary central incisor

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Abstract: Treatment of trauma to anterior teeth should aim at preserving the affected teeth so as to restore function and esthetic appearance. Recently, patients have come to expect adequate esthetics immediately after trauma. In the present case, a deep crown-root fracture compromised the pulp and extended subgingivally on the palatal aspect. After using the fractured fragment as a provisional crown, the patient received conventional root canal treatment, which provided immediately satisfactory esthetic results and reliable short-term restoration of the crown-root fractured tooth. Rehabilitation of the fractured central incisor was performed with a post-core-supported prosthetic restoration. (*J Oral Sci* 54, 359-362, 2012)

Keywords: crown-root fracture; esthetic treatment; original fragment; provisional crown; root canal treatment.

Introduction

Traumatic dental injuries cause damage ranging from minimal enamel loss to complex fractures involving pulp tissue. Treatment of fractured teeth depends on the level of the fracture line and the amount of remaining tooth

(1). Conventional approaches to rehabilitating fractured anterior teeth include composite restorations (2) and post-core-supported prosthetic restorations (3). Recently, it has become possible to use reattachment technique to preserve the fractured segment of a tooth, which offers better short- (4) and medium-term (5) results as compared with resin composite restorations.

Crown-root fractures extend below the cemento-enamel junction and require a multidisciplinary treatment approach (5). If pulpal exposure is extensive in permanent anterior teeth with complete root development, the fractured segment is usually removed and post-core and crown restoration is done after root canal therapy (6). Furthermore, patients often wish to recover their smile as soon as possible and maintain it throughout subsequent treatment (7).

The fracture fragment has been proposed as a favorable crown repair material due to its superior morphology, conservation of structure, and patient acceptance (8). In addition, use of such fragments can create an environment conducive to periodontal healing. The present report describes a case of immediate esthetic resolution by using a fractured crown fragment and endodontic treatment of a deep crown-root fracture of a central incisor, which resulted in periodontal health. Rehabilitation of the fractured central incisor was accomplished by post-core-supported prosthetic restoration.

Case Report

A 58-year-old man was referred to the Endodontic Department at Nihon University School of Dentistry for evaluation and treatment of his maxillary left central

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Fig. 1 Preoperative clinical view; note lip laceration and swelling.



Fig. 2 Preoperative radiograph showing two horizontal fracture lines.



Fig. 3 Clinical view immediately after removal of fractured crown.



Fig. 4 Palatal view showing subgingival fracture site of maxillary left central incisor.



Fig. 5 Provisional crown showing the fractured crown and screw-post.



Fig. 6 Palatal view of maxillary left central incisor after root canal filling.



Fig. 7 Radiograph immediately after obturation of root canal.



Fig. 8 Radiograph after placing provisional crown on tooth.

incisor (tooth 21), which had been fractured during a fall from his bicycle on the previous day. At his first visit, he had undergone emergency treatment for soft-tissue wounds at the Department of Oral Surgery. The patient's medical history was noncontributory.

Extraoral investigation revealed heavy swelling of the upper lip and slight swelling of the lower lip (Fig. 1). No further damage to extraoral tissues was seen. No pathologic findings were noted during investigation of the temporomandibular joint and potentially affected osseous structures.

Intraoral investigation revealed that the maxillary left central incisor had a crown-root fracture extending subgingivally on the palatal aspect. The tooth fragment was mobile but remained in place. Radiographic examination showed clear horizontal fracture lines at both proximal sites (Fig. 2). The neighboring teeth had

no clinical or radiographic evidence of damage due to trauma. A clinical diagnosis of irreversible pulpitis was established. After administering local anesthesia, the horizontally fractured crown was separated from the remaining tooth (Fig. 3), and the fractured crown was preserved in physiologic saline solution. After extracting the coronal fragment, the fracture extending subgingivally on the palatal aspect was noticeable (Fig. 4). Pulpal exposure was seen on the palatal aspect of the tooth, close to the gingival margin. A #4 round bur was used with 2.6% sodium hypochlorite irrigation to prepare an approximately 3-mm-deep access cavity into the pulp. The area was rinsed with saline solution until pulpal hemorrhage was controlled. Temporary filling was then used to fill the cavity, and the tooth was treatment planned for conventional root canal therapy.

After 3 days, the tooth 12 was anesthetized and extir-



Fig. 9 Labial view of provisional crown, showing excellent adaptation between the crown fragment and tooth.



Fig. 10 Lingual view of provisional crown.



Fig. 11 Six-month follow-up radiograph of maxillary central incisor.



Fig. 12 Postoperative clinical view 1 year after trauma.



Fig. 13 Fourteen-month follow-up radiograph of maxillary central incisor.



Fig. 14 Postoperative labial view 1 year after insertion of permanent porcelain crown.



Fig. 15 Postoperative lingual view 1 year after insertion of permanent porcelain crown.

pated with the use of a Hedstrom file (Mani Inc, Tochigi, Japan). A working length was established using an apex locator (APIT 7, Osada Co, Tokyo, Japan) and radiography. The root canal system was thoroughly debrided and prepared by step-back technique to an ISO size 40 master apical file. Copious irrigation with 2.6% sodium hypochlorite solution was used throughout the procedure. At the same time, electrosurgery was performed to re-establish the gingival margin and convert the subgingival fracture site to a supragingival one. During endodontic treatment, a provisional crown was fabricated using a screw-post (Dentatus, New York, NY, USA) and the natural fractured crown (Fig. 5). A hole was made in the coronal fragment to receive the head of the screw-post. After etching the coronal fragment with 37% phosphoric

acid gel for 20 s, dentine adhesive was applied according to the manufacturer's instructions and the hole was filled with a composite resin placed over the screw-post. Then, the provisional crown was fitted against the fractured surface. Excess material was removed, and the resin was light-cured for 40 s buccally and lingually.

Two weeks later, the root was symptom-free and was obturated with gutta-percha and zinc oxide-eugenol sealer (Canals, Showa Yakuin, Tokyo, Japan), using the lateral condensation method (Fig. 6). A postoperative radiograph was obtained (Fig. 7), and the provisional crown was then accurately placed on the remaining root (Figs. 8-10). Occlusion was carefully checked and adjusted. Four months later, the root was prepared for a cast palladium post and core, and the porcelain crown was cemented with glass-ionomer cement (Fuji Lute, GC, Tokyo, Japan). The patient returned for periodic checkups, which confirmed satisfactory healing (Figs. 11 and 12). At a follow-up examination at 14 months, he was asymptomatic and his periodontal health was good (Figs. 13-15).

Discussion

Achieving and maintaining satisfactory treatment results for a traumatically fractured incisor is challenging for clinicians. Esthetic and functional outcomes

must be considered when determining the proper treatment method. Treatment modalities for crown-root fractured teeth can change depending on the level of the fracture line and the amount of remaining root (1). In cases where the fracture line extends along the long axis of the root, extraction of the tooth is indicated. If the fracture involves the coronal third of the root, and the remaining root structure is long enough to support the subsequently applied restoration, only the fractured portion is extracted and root canal therapy is performed for prosthetic restorations (3). In cases of subgingival fracture, gingivectomy and surgical or orthodontic extrusion of the root is necessary to convert the subgingival fracture to a supragingival one, to allow restoration of the fracture with prosthetic restorations (9). In the present case, there was no need for additional extrusion of the tooth because subgingival involvement of the fracture site was present only at the palatal aspect of the tooth. In maxillary incisors, crown-root fractures have a characteristic fracture line: on the facial side, the fracture is localized paragingivally or supragingivally, while palatally the defect often extends far into the root region (6). At the palatal site, gingivectomy with electrosurgery was straightforward. This procedure allowed the fracture line to be moved supragingivally, which optimized marginal sealing (9). The main advantage of using electrosurgery for gingivectomy is hemorrhage control, which can be easily established soon after injury (10).

If pulpal exposure is extensive in permanent anterior teeth with complete root development, the fractured segment is usually removed and a post-core and crown restoration is done after root canal therapy (6). In the present case, we selected a provisional crown using a fracture fragment to restore the fractured tooth. To our knowledge, this is the first case in which a provisional crown was fabricated using a screw-post and natural fractured crown. The patient was very happy with this procedure because the initial damage to his dentition could be repaired soon after the accident. Use of an original tooth fragment instead of a provisional resin crown before performing permanent fixed prostheses has many advantages: shade, morphology, translucency, patient acceptance, conservation of structure, and lower cost (8). During this period, adequate root canal system cleaning, shaping, and filling procedures are performed to ensure successful endodontic treatment outcomes. In addition, a healing period of 4 months is needed for recovery of the periodontium, which can be affected by dental trauma.

Esthetics, function, and patient expectations must be considered when selecting treatment. In this case, the

patient desired nonsurgical treatment and to retain the tooth with a permanent esthetic porcelain crown.

The present case illustrates immediate esthetic and functional rehabilitation of a fractured tooth, leading to conservation and permanent restoration of the tooth.

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