

# Combined orthodontic, surgical, and restorative approach to treat a complicated crown-root fracture in a maxillary central incisor

Eva Scholtes,<sup>a</sup> Christiaan M. Suttorp,<sup>a</sup> Bas A. Loomans,<sup>b</sup> Pieter Van Elsas,<sup>c</sup> and Jan G. Schols<sup>a</sup>  
 Nijmegen, Bloemendaal, and Amsterdam, The Netherlands

This case report shows the treatment of a severe traumatic tooth injury. For the maxillary right central incisor, the trauma was considered a complicated crown-root fracture. The level of the fracture line, the length of the remaining root segment, and the presence and condition of the tooth fragment determined the type of therapy. Traumatized teeth with fractures below the alveolar crest are often considered hopeless. As this report shows, the treatment of a complicated crown-root fracture in the esthetic region can be challenging. Orthodontic extrusion and crown-length surgery were performed to bring the fracture line above the alveolar bone crest. A multidisciplinary approach was required for complete rehabilitation of the traumatized maxillary incisor. Suggestions are made to improve treatment planning of complicated crown-root fractures. (*Am J Orthod Dentofacial Orthop* 2018;154:570-82)

**T**raumatic tooth injuries cause function and esthetic problems and damage that may range from minimal enamel loss to complex fractures involving pulp tissue and even loss of the tooth crown.<sup>1</sup> Dental trauma affects the maxillary central incisors in 80% to 83% of the patients.<sup>2-5</sup> Falling is the major cause of dental trauma.<sup>4-6</sup> This case report shows the treatment of a severe traumatic tooth injury. The maxillary right central incisor had a fracture involving enamel, dentin, and cementum with loss of tooth structure and exposure of the pulp. According to the classifications of Andreasen et al,<sup>7</sup> the trauma was considered a complicated crown-root fracture. The maxillary left lateral incisor demonstrated

a complicated crown fracture, whereas the maxillary left central incisor suffered from subluxation. Crown-root fractures account for up to 5% of all traumatic injuries.<sup>8</sup> The incidences of crown-root fractures have been reported to be 2% in the deciduous dentition and 5% in the permanent dentition.<sup>6</sup> These are usually the result of a direct impact.<sup>9</sup> The level of the fracture line, the length of the remaining root segment, and the presence and condition of the tooth fragment determine the type of therapy.<sup>10</sup> Traumatized teeth with fractures below the alveolar crest are often considered hopeless.<sup>11</sup> For the proper emergency treatment, the guidelines of the *Dental Trauma Guide* were followed.<sup>7</sup> As this case report shows, the treatment of a complicated crown-root fracture in the esthetic region can be challenging. The diagnosis, emergency treatment, follow-up, and definitive treatment of the dental trauma are described. A multidisciplinary approach was required for complete rehabilitation of function and esthetics of the maxillary front teeth. Complications after emergency treatment are discussed, and suggestions are made to improve treatment planning of complicated crown-root fractures.

## DIAGNOSIS

A 28-year-old woman's facial trauma was caused by an accidental fall in the street at night. It was

<sup>a</sup>Department of Orthodontics and Craniofacial Biology, Radboud University Medical Center, Nijmegen, The Netherlands.

<sup>b</sup>Department of Dentistry, Radboud University Medical Center, Nijmegen, The Netherlands.

<sup>c</sup>Private practice, Bloemendaal, The Netherlands; Department of Oral Implantology and Prosthetic Dentistry, Academic Center for Dentistry, Amsterdam, The Netherlands.

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Address correspondence to: Jan G. Schols, Department of Orthodontics and Craniofacial Biology, Radboud University Medical Center, 309 Tandheelkunde, PO Box 9101, 6500 HB, Nijmegen, The Netherlands; e-mail, [Jan.Schols@radboudumc.nl](mailto:Jan.Schols@radboudumc.nl).

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immediately clear that the dental trauma was quite extensive. Large enamel-dentin fragments were missing from the mesial corners of the crowns of both maxillary central incisors and the left lateral incisor. These tooth fragments were found on the street and were totally crushed. Also, crown fragments of the maxillary right central incisor and left lateral incisor appeared to be mobile. A dentist (PvE) was contacted, and an emergency appointment was made for the next morning.

Before the trauma, the patient had a Class I molar relationship with normal overjet (2 mm) and overbite (3 mm) and 5 mm of gingival exposure during smiling (gummy smile). There were distal crown angulations of both maxillary lateral incisors. In the past, she was treated by her orthodontist with functional appliance therapy followed by full fixed appliances. There was no previous history of dental trauma. Clinical (Fig 1) and radiographic (Fig 2) examinations were performed by the dentist approximately 5 hours after the trauma. In addition to the facial injuries to the soft tissues, there was severe dental trauma. The maxillary right central incisor had a complicated crown-root fracture with a mobile buccal crown fragment attached to the gingival fibers. The oblique fracture line was located 0 to 3 mm supragingivally on the buccal side and ran through the bottom of the pulp chamber and extended to the palatal side deep under the gingiva and just below the alveolar bone crest. There was wide exposure of the dental pulp. A large enamel-dentin fragment at the mesial corner was fractured.

The maxillary left central incisor had a complicated crown fracture and a small subluxation to the palatal side. Although the extent of the crown fracture was limited, a small exposure of the dental pulp was observed. This was explained by the relatively large pulp chambers of the maxillary front teeth.

The maxillary left lateral incisor had a complicated crown fracture with a mobile buccal crown fragment. The fracture line at the buccal side was located 5 mm supragingivally and ran through the top of the pulp chamber and extended to the palatal side just below the cingulum of the crown. A small exposure of the dental pulp was observed. A large enamel-dentin fragment at the mesial corner was fractured, and a wedge-shaped defect was present on the buccal side. No trauma to the alveolar process or mucosa was observed.

### Emergency treatment

The patient insisted on keeping her traumatized teeth in function by any means. Sensibility testing shortly after the trauma may give negative results

due to transient or permanent pulpal damage from the trauma.<sup>12</sup> As an emergency treatment, it was decided to cover the pulp exposure in all 3 incisors and stabilize both mobile tooth fragments to obtain acceptable esthetics until a definitive treatment plan could be made. Therefore, routine follow-up was required to monitor the pulpal status.<sup>13</sup> Treatment was performed under local anesthesia. Isolation of the teeth by rubber dam application was not possible because of the subgingival outline of the crown-root fracture. Therefore, the teeth were isolated by applying a putty agent (OraSeal; Ultradent Products, South Jordan, Utah). The crown fracture sites of the maxillary right central incisor and left lateral incisor were tilted palatally, for a good view of the cervical fracture sites. A cervical pulpotomy was performed in the maxillary right central incisor and left lateral incisor. A partial pulpotomy was performed in the maxillary left central incisor. Blood and pulpal remnants were removed with cotton pellets soaked in 3% sodium hypochloride solution and by irrigation with physiologic saline solution. The exposed pulp was covered with intracanal mineral trioxide aggregate.<sup>14</sup> Because of the subgingival extension of the fracture at the palatal side of the maxillary right central incisor, it was difficult to obtain strict moisture and bleeding control in the operating field. The crevicular fluid and blood in the subgingival area of the palatally located fracture line were dried with paper points and cotton pellets. The crown-fracture sites were etched for 30 seconds using 35% phosphoric acid gel, rinsed with water, and gently dried with air. Adhesive and a flowable composite resin were applied, and the buccal fragment was reattached. It was hard to fully control the flow of composite resin in the subgingival region at the palatal side. The composite was light cured for 60 seconds. The enamel-dentin crown fractures were covered with composite (Fig 3, A-C). Three days after the trauma, the missing enamel-dentin crown fragments were restored (Fig 3, D).

### TREATMENT PROGRESS

Ten days after the trauma, the maxillary front teeth were checked for signs and symptoms of pathology by her dentist (BAL). Sensibility of these teeth was monitored by ethyl chloride testing. Tooth mobility and crown discoloration were checked. The periodontium was examined by gentle probing. Periapical radiographs were taken to evaluate periapical pathology and root resorption. The maxillary left central incisor lacked sensibility and showed some tenderness to gentle pressure. Some dark yellow crown discoloration was noticed. It was concluded that the vitality of the

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