Case Report

Predictable esthetic treatment of fractured anterior teeth: a clinical report

Sakai VT, Anzai A, Silva SMB, Santos CF, Machado MAAM. Predictable esthetic treatment of fractured anterior teeth: a clinical report.

Abstract – Dental fractures of the permanent maxillary anterior teeth are relatively frequent accidents during childhood. Placement of direct composite restorations allows clinicians a conservative method of restoring fractured anterior teeth to the original shape and color. A methodical protocol for the restoration of a fractured maxillary left central incisor of a 7-year-old girl is presented. As a temporary treatment, pulpal protection and the use of an acetate crown with glass–ionomer cement were performed. As a definitive treatment, diagnostic waxing and a silicone matrix formed the basis for successful reconstruction of the fractured tooth with composite resin. After finishing and polishing, an esthetic and natural-looking restoration was achieved, which completely satisfied the functional and esthetic expectation of the patient and dental team.

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Dental fractures of the anterior teeth are frequent during childhood (1–4), affecting about 13% of the population under 12 years of age. Of these fractures, 70% are maxillary incisor coronal fractures without compromising the root (1, 3).

Placement of direct composite restorations allows clinicians a conservative method of restoring fractured anterior teeth of children. A treatment in the anterior region is not considered a success when function and health of soft tissues are restored solely. Esthetics of the restoration is now placed on the same level of importance (5), both for the child and for his or her parents.

Advances in adhesive technology and properties of composite resin materials allow the creation of esthetically pleasing restorations. Using an incremental technique, a restoration can be sculpted to the desired morphology and color. Therefore, monitoring the esthetic outcome from shade selection to final polishing is possible (6).

In this article, a methodical protocol for the restoration of a fractured anterior tooth of a child is presented. It includes the pulpal protection and the use of an acetate crown with glass–ionomer cement as a temporary treatment followed by its reconstruction with composite resin as a definitive treatment. Diagnostic waxing and a silicone matrix (7) formed the basis for successful reconstruction of the fractured anterior tooth with composite resin.

Case report

A 7-year-old girl attended the clinic of Pediatric Dentistry, at Bauru School of Dentistry, University of São Paulo, Brazil, 2 days after a trauma that caused a fracture in the distal angle of the maxillary left central incisor, affecting enamel and dentin (Fig. 1). The girl reported pain when subjecting the tooth to thermal stimuli. After the general medical, dental and traumatic incident histories were reviewed and clinical and radiographic examinations were conducted (8). The periapical radiography revealed an intact periodontal ligament space and a solid cortical bone associated with the

Fig. 1. Fractured maxillary left central incisor. Preoperative view in a 7-year-old girl.

Fig. 2. Periapical radiograph revealing an intact periodontal ligament space and a solid cortical bone associated with the traumatized tooth.

traumatized tooth (Fig. 2). Initial alginate impressions were taken off the upper and lower arches and casts were fabricated with hard plaster. Taking into account the loss of tooth fragment and the great volume of the pulp chamber, a pulpal protection and a temporary restoration with glass–ionomer cement, followed by a composite reconstruction in the second appointment were considered as the best therapeutic approach.

In the first session, a calcium hydroxide liner was thinly applied on the exposed dentin surface to perform the pulpal protection (8, 9) (Fig. 3). Then, a cellulose acetate crown was selected to reproduce the original anatomy of the tooth, and the crown was customized to fit the remaining dental tissue (Fig. 4). The glass–ionomer cement was introduced into the crown, with care taken to avoid bubbles. Once the crown was adapted to the tooth, orientation and position were verified and excess ionomer

Fig. 3. Pulpal protection with calcium hydroxide liner applied on the exposed dentin surface of the fractured tooth.

Fig. 4. Cellulose acetate crown customized to fit the remaining dental tissue to reproduce the original anatomy of the fractured tooth.

was eliminated with a probe. The conditioning treatment of enamel and dentin was not performed, considering that this was a temporary treatment, which should be easily removed in the next appointment. The acetate crown was not removed either (Fig. 5).

After the child was discharged, the desired shape of the fractured tooth was waxed-up on the upper cast (7, 10–12) and a silicone matrix was made to accurately reproduce its palatal anatomy and incisal edge (5, 7, 10–12) (Fig. 6).

Fig. 5. Temporary treatment performed with the use of a cellulose acetate crown and glass–ionomer cement.

Fig. 6. Fractured tooth was reshaped with wax (blue color) on the upper cast, and a silicone matrix (yellow color) was fabricated.

Fig. 7. The silicone matrix is a practical adjunct in aiding to foresee the amount of composite to be built.

Fig. 8. A 1-mm bevel was made on the facial surface of the fractured tooth with diamond bur.

Fig. 9. Palatal face reconstructed with an incisal resin and with the aid of the silicone matrix.

In the second session, the patient returned with no complaint of pain, and the ionomer restoration and the crown were removed to allow the construction of definitive composite restoration. Prior to any restorative procedure, general operating field rubber dam isolation was performed (13), and the silicone matrix was assessed for accuracy of fit and also to assess the three-dimensionality of the restoration to be built (Fig. 7). Composite resins that mimic the enamel and the dentin of the comprised natural tooth structure were selected, with special attention to the incisal third and to the presence of an opalescent halo at the incisal edge (7, 14).

A bevel was made on the fractured tooth with a diamond bur in an extension of approximately 1 mm, restricted to the facial surface (Fig. 8). The fractured tooth was etched with a 37% phosphoric acid gel for 30 s. The acid was rinsed off thoroughly for 30 s using an air and water spray. Excess water was blotted with a cotton pellet to avoid desiccation. To ensure proper enamel and dentin bonding, the adhesive system was applied according to the manufacturer's instructions.

Adequate conditioning of the enamel and dentin and their subsequent hybridization provided this restoration with sufficient retention, seal, and reinforcement (12).

Considering that transparent (incisal) resins contain a larger amount of filler particles when compared with the equivalent pigmented shades from the same manufacturer, and that these resins are also more wear resistant (15), this kind of resin was used as the first layer to construct the palatine enamel. Incisal resin was squirted onto the palatal aspect of the tooth and a 1.5-mm-thick palatal shell of material was sculpted with a contouring instrument using the silicone matrix as a rampart (7, 11). Care was taken to leave enough space for the other layers of composite resin. The first increment was polymerized with the silicone matrix in the correct position. The matrix was removed (Fig. 9), and the polymerization was completed through the palatine face.

After the determination of cervico-incisal length, incremental application of layers of an opaque composite to replace the dentin was started (Fig. 10). A hybrid composite with milky coloration (high-opacity, high-value shade) was used to properly construct the translucent incisal edge (Fig. 11). To prevent overbuilding the composite layers, which would compromise the final esthetic result, contouring of the composite resin was constantly monitored from an incisal view through indirect vision. A microhybrid composite layer replacing the facial enamel was applied and properly cured (10) (Fig. 12).

Fig. 10. Incremental application of layers of an opaque composite to replace the dentin.

Fig. 11. Translucent incisal edge constructed with composite resin with milky coloration.

Fig. 12. Facial enamel constructed with a microhybrid composite layer.

The occlusion was checked through the evaluation of the maximum habitual intercuspation, protrusive, and lateral protrusive movements.

Three weeks later, after rehydration of the tooth, finishing and final polishing were performed (Fig. 13). Fine granulated diamond burs and polishing disks were used to create esthetic surface texture. Polishing paste was also used with the aid of a felt buff to provide final surface luster and shine (12).

An esthetic and natural-looking restoration was achieved, presenting total integration with the surrounding tooth structures, gingiva, and lips (Fig. 14). This restoration completely satisfied the functional and esthetic expectation of the patient and dental team.

Fig. 13. Fractured maxillary left central incisor restored with composite resin, after finishing and polishing.

Fig. 14. The esthetic and natural-appearing restoration presented total integration with the surrounding tooth structures.

Discussion

When restoring traumatized dentition, the extension of the fracture in a gingival direction, the loss of tooth structure, the existence of endodontic treatment, and the availability and possibility of utilizing the tooth fragment influence the clinician's ability to incorporate minimally invasive adhesive protocols. The quality of the remaining dental structure, occlusion, and the patient's esthetic demands further impact treatment selection (14).

Particularly in children, other factors must be taken into account when choosing a treatment for maxillary incisor coronal fractures. It is important to remember that the pulp chambers are occupying a greater volume (3), and that the fracture exposes a large number of open dentinal tubules to the oral environment, thus providing direct communication to the pulp (8). Moreover, the teeth are neither totally erupted nor in their final position (3). Additionally, right after the injury, the traumatized tooth should be managed with a minimal amount of manipulation to avoid more damage to the pulp or

periodontium (9). Therefore, the application of calcium hydroxide liner on the exposed dentin prior to the use of an acetate crown plenty of glass–ionomer cement is an appropriate option to temporarily restore class IV fractured teeth in children with complaint of pain to thermal stimuli. Thus, in the following appointment, a composite technique can be calmly used to restore the fractured incisor to the original shape and color.

Composite layering is the key to obtaining esthetically successful restorations. Esthetic dentistry demands keen observation, patience, and meticulous application of the existing technique protocols. Subtleties in color variation – generally not perceived from a conversation distance – are perhaps one of the greatest desires of the patients and their parents and have become a challenging objective when restoring the anterior teeth with fidelity (16). By using a methodical approach, natural-looking restorations can be achieved routinely and predictably (5, 7).

Resin stratification is best initiated from the palatal enamel, particularly when treating fractured anterior teeth, with a transparent composite to create the underlying structure for the subsequent layers. While the initial resin increment can be introduced using a spatula or the tip of the clinician's forefinger, this procedure is simplified by preparing a silicone matrix based on a diagnostic wax-up (12). Actually, an appropriate diagnostic waxing and the use of a silicone matrix are mandatory for the precise clinical reproduction of the ideal shape of the dentition obtained through the mock-up. They also aid in building each composite increment to its exact contour without trespassing the boundaries of the desired tooth form (7, 11). The matrix also reduces operating time, allowing the clinician to maintain support for the build-up of material from the palatal aspect while developing the occlusal anatomy and support, which resemble the anticipated restoration (7, 10).

Because of the fact that direct composite restorations, such as presented in this case report, require long appointments, it is usually advisable not to perform finishing and polishing in the same session. Therefore, another appointment is necessary to properly perform final anatomical refinements. The value of this action is twofold; it allows the patient time to subjectively evaluate the esthetic and functional results, while permitting the practitioner to perform the artistic refinement with better visual acuity and more accurate three-dimensional perception (7, 11, 15).

Periodic recall visits were advised to monitor oral hygiene, as well as the pulp vitality and the quality of the restoration of the traumatized tooth over time.

Conclusions

Predictable restorations of class IV fractured anterior teeth can be achieved by the establishment of a methodical protocol. Pulpal protection and the reconstruction with glass–ionomer cement with the aid of an acetate crown are appropriate approaches to temporarily restore anterior fractured teeth in children with complaint of pain. An appropriate diagnostic waxing and the use of a silicone matrix allow the clinicians to achieve an esthetic and functional result when performing restorations with composite resin in anterior teeth of children.

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