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Multidisciplinary solution for an avulsed upper central incisor: case report

CASE REPORT

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Abstract – This case report refers to an 18-year-old female who suffered from dental trauma when she was 7 years old caused by a bicycle accident. Her maxillary right central incisor was avulsed, and the left one was extrusively luxated. The left central incisor was correctly repositioned and immobilized with a semi-rigid splint. The right one could not be found. She presented with class II malocclusion and severe negative arch-length discrepancies in both arches. The treatment objectives were the following: recover smile esthetics by replacing the maxillary right central incisor, correct the class II relationship, and optimally reduce mandibular and maxillary crowding. Extractions of the maxillary left lateral incisor and the lower right first bicuspid were performed; thus, the maxillary right lateral incisor would function as a maxillary right central incisor, the canines would function as lateral incisors, and the first bicuspids would function as canines. This allowed for the malocclusion to be corrected while simultaneously reestablishing the smile esthetics, without the use of an osseointegrated implant. A good occlusion with coincident upper and lower midlines was achieved. After orthodontic therapy, the patient underwent periodontal surgery to improve her gingival margins. Subsequent teeth bleaching was performed, and the patient received six porcelain veneers. A combination of orthodontic space closure and prosthetic rehabilitation may be the best treatment option after severe traumatic tooth loss.

Most traumatic dental injuries occur in childhood and adolescence. Avulsion of teeth mainly occurs in the maxillary central incisors, and it generally happens in children from 7 to 9 years of age, when vigorous play and sports activities become more regular. A single tooth is frequently involved, but multiple avulsions can also happen (1).

One of the most challenging problems in dentistry is the choice of treatment for the replacement of one or more maxillary incisors that have been lost as a result of traumatic injuries. An optimal outcome frequently involves an interdisciplinary team of experts, including pedodontists, endodontists, oral surgeons, orthodontists, periodontists, and prosthodontists. The treatment is typically complex, and the prognosis is often uncertain.

There are multiple solutions available to treat this kind of problem. These solutions include fixed or removable partial dentures, osseointegrated implants, orthodontic space closure, and autotransplanted permanent teeth (2). The ideal treatment is the most conservative option that satisfies individual esthetics and functional requirements.

Case report

An 18-year-old female was referred to the orthodontics department at the State University of Rio de Janeiro in Rio de Janeiro, Brazil. Her dental history revealed dental trauma caused by a bicycle accident when she was 7 years old. At that time, her maxillary right central incisor was avulsed, and the left one was extrusively luxated. She had her left central incisor correctly repositioned and immobilized with a semi-rigid splint. The right central incisor could not be found. Intraoral radiographs did not show any need for endodontic treatment at the time.

She had not previously received any orthodontic treatment. Her chief complaint was severe crowding in both arches. Intraoral examination revealed an Angle Class II malocclusion with the upper midline deviated 4 mm to the right and the lower midline deviated 2 mm to the left. The maxillary left central incisor did not present any changes in color or sensitivity. Negative arch-length discrepancy was −10 mm in the maxillary arch and −6 mm in the mandibular arch (Figs 1 and 2).

Her periodontal health was good, with no recession or gingival bleeding. Both panoramic and periapical radiographs revealed a calcification in the dental pulp of the maxillary left central incisor. A non-cavitated carious lesion was detected on the distal surface of the lower left second bicuspid (Fig. 3). Because the patient was going to be on a constant monitor, it was decided to follow up the lesion according to Sbairaini & Evans (3) protocol.

Treatment objectives

The aim of the treatment was to reestablish smile esthetics by correcting the Class II relationship,

Fig. 1. Pretreatment facial photographs.

Fig. 2. Pretreatment intraoral photographs.

optimally reduce maxillary and mandibular anterior crowding, center the dental midlines, and establish a stable occlusion.

Treatment alternatives

There were several treatment alternatives for this patient, including the following: opening space for an osseointegrated implant to replace the lost maxillary right central incisor, extracting the four first bicuspids to correct crowding in both arches, and extracting one mandibular incisor. The extraction of one mandibular incisor would only eliminate the crowding issue, thus leaving the patient in a class II posterior relationship. In addition, this alternative was also contraindicated because of the patient's Bolton anterior tooth size discrepancy, which in this case was almost zero. Another alternative was to extract the maxillary left lateral incisor and the lower right first bicuspid. By doing this, the maxillary right lateral incisor would serve as a maxillary right central incisor, the canines as lateral incisors, and the first bicuspids as canines.

The reasons behind ultimately choosing the last alternative were the following: the possibility of reestablishing the smile esthetics without the use of an osseointegrated implant, the ability to simultaneously treat the malocclusion, and the permanence of the treatment outcome. The approach was multidisciplinary involving orthodontic, periodontal, and prosthodontic treatment.

A diagnostic wax-up was created to visualize the esthetic result of this treatment alternative prior to the execution of treatment (Fig. 4).

Treatment progress

A preadjusted fixed appliance $0.022'' \times 0.028''$ in slot (Alexander prescription) was bonded to the maxillary and mandibular arches. A transpalatal bar was used as a temporary anchorage device. Conventional alignment and leveling were performed after the extractions.

During alignment, the patient was referred to the prosthodontist to reshape the maxillary right lateral incisor with resin composite to resemble a central incisor, respecting the mesiodistal crown diameter of the right central incisor (Fig. 5).

To obtain the desired esthetic result, a rectangular stainless steel archwire was bent to extrude the maxillary canines, thus moving the gingival margins incisally to resemble the natural gingival contour of the lateral incisor; the bicuspids were intruded to gain a higher gingival margin, like a canine has naturally. The cusps and palatal surfaces of the canines were ground and flattened. Stripping was also performed on the anterior maxillary teeth to create proper occlusion.

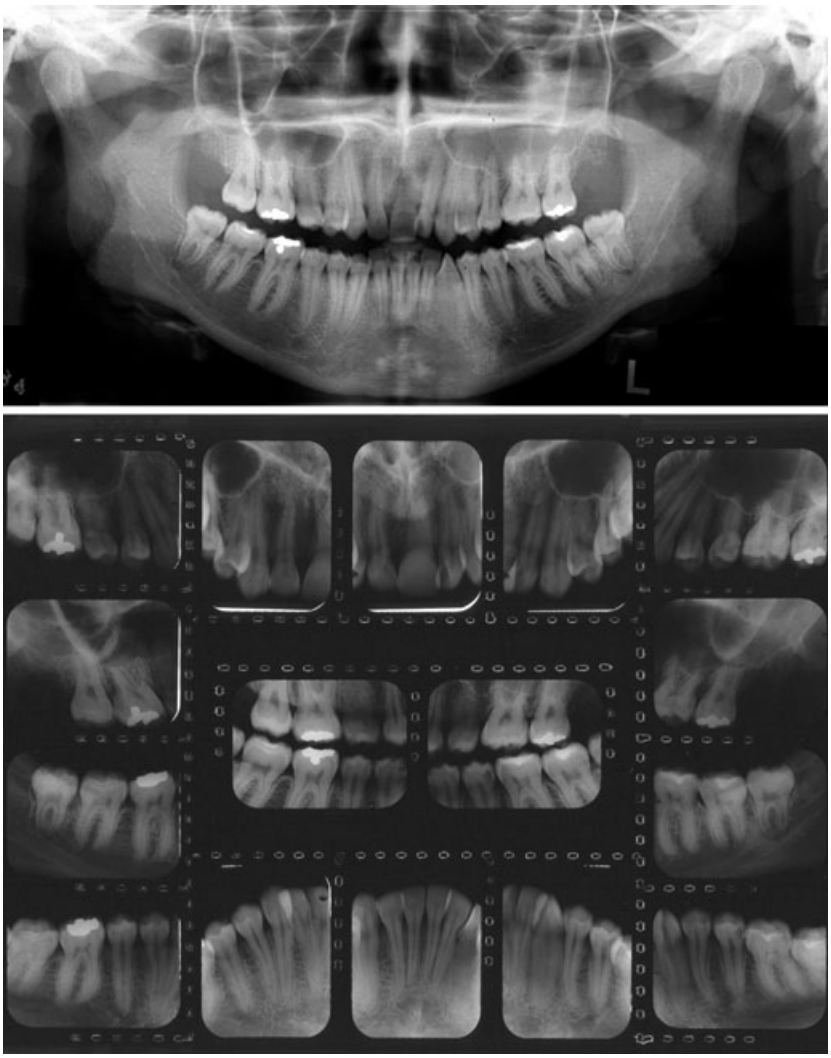

Fig. 3. Pretreatment radiographs.

Fig. 4. Diagnostic wax-up.

The orthodontic treatment took approximately 48 months. The result was the following: stable occlusion with a class II molar relationship and class I canine relationship; coincident upper and lower midlines, and adequate dental arch alignment (Figs 6 and 7).

Treatment results

The treatment goals were achieved by creating a pleasant smile for the patient without the use of an osseointegrated dental implant (Fig. 8). A lingual-bonded retainer was placed for retention in both arches, in addition to a wraparound retainer in the maxillary arch. The post-treatment panoramic radiograph showed overall root parallelism and slight root resorption in the upper and lower incisors; the amount of resorption in the maxillary left central incisor is comparable to resorption typically caused by orthodontic movement of traumatized teeth.

After orthodontic therapy, the patient was referred to the periodontist, from whom she received the following periodontal treatment to improve her gingival margins: gingivectomy, gingivoplasty, osteotomy, and

Fig. 5. Progress: Right maxillary lateral incisor before reshaping to a central incisor.

osteoplasty. She then went to the prosthodontist from whom she received a home bleaching kit and six porcelain veneers (Figs 9 and 10).

Because the patient would not have frequently appointments as she used to during the orthodontic treatment, it was decided to restore the lower left second bicuspid with resin composite at the end of the orthodontic therapy. (Fig. 11)

Fig. 8. Post-treatment panoramic radiograph.

Discussion

Creating and retaining a good treatment result for a traumatically avulsed incisor is not an easy situation for a clinician. Esthetic and functional outcomes should be taken into consideration when determining the proper treatment method (4). Selecting the appropriate treatment depends on occlusion, specific space requirements, tooth size relationships, and the shape and size of the canine (5).

Considering this patient's negative arch-length discrepancy, class II relationship, and shifted midlines, the treatment option chosen for this patient was orthodontic

Fig. 6. Post-treatment facial photographs.

Fig. 7. Post-treatment intraoral photographs.

Fig. 9. Final result, with the patient showing a pleasant smile.

Fig. 10. Final result: six porcelain veneers were placed on the maxillary anterior teeth. Note: natural tooth morphology and normal gingival condition.

treatment with extractions. According to Kokich & Crabill (6), the feasibility of a treatment plan is determined following the construction of a diagnostic wax-up. In this case, the wax-up revealed a satisfactory occlusion.

Esthetic and functional concerns may arise when a maxillary canine is moved mesially to substitute a lateral incisor, and the bicuspid takes the place of the canine. However, when careful orthodontic treatment is combined with esthetic clinical techniques, the outcome of space closure can be satisfying and almost indistinguishable from the natural dentition (7).

Several important steps will ensure an esthetic result. The gingival margins of the maxillary anterior teeth must be positioned properly. In this particular case, the orthodontist must disregard the incisal edges of the anterior teeth as a guide for final tooth positioning (8). Individualized extrusion and intrusion during mesial movement of the canine and bicuspid, respectively, is required to obtain an optimum level for the marginal gingival contours of the anterior teeth (9). In this case, the patient was ultimately referred for a gingivectomy after the removal of the appliance to ensure a perfect gingival contour.

Controlling torque of the roots also helps to obtain the required morphologic and esthetic results (4). To achieve this result, the canine roots were torqued palatally to diminish root prominence, whereas the bicuspid roots were torqued buccally to emphasize canine prominence.

Fig. 11. Final panoramic radiograph.

With the mesialization of the teeth, a new alveolar process was established with attached gingiva and intact interdental papillae. The appearance of the soft tissue surrounding the tooth is able to be maintained, which may be difficult with prosthodontic rehabilitation or implants (10).

The restorative reshaping of morphology from a lateral incisor to a central incisor is difficult. During treatment, the patient had her lateral incisor restored to resemble a central incisor with bonded composite while the proper width of the homologous central crown was

respected. Resin composite restorations exhibit excellent physical properties, marginal integrity, and esthetics (11). Judging from both radiographic and clinical findings, the lateral incisor root was capable of supporting a crown the size of a central incisor (10).

It is possible to recontour most canines to a clinically satisfactory shape. The major concern is functional consideration because the replacement of upper laterals with canines usually creates an excess of maxillary anterior teeth (12). Furthermore, an extensive cuspal, lingual, and interproximal recontouring by grinding was performed on both maxillary canines for this patient.

Finally, the color of the teeth should be considered, especially when involving the misplaced canines and the adjacent teeth (13). When the canines are not yellow in color, the result is more esthetic. In a situation where the colors do not match, as in this patient, bleaching might be recommended as part of the treatment.

The necessity for an interdisciplinary approach to the treatment of anterior tooth injury has been emphasized for a long time. It is clear that without cooperation among the disciplines, the treatment of such cases is difficult (14).

Conclusion

A combination of orthodontic space closure and prosthetic rehabilitation may be the best treatment option following severe traumatic dental injury involving the avulsion of one or more incisors. Any concomitant malocclusion can be treated simultaneously, and the treatment outcome is permanent.

References

1. Andreasen JO, Borum M, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors, 2: factors related to pulpal healing. Endod Dent Traumatol 1995;11:59–68.
2. Zachrisson BU, Stenvik A, Haanaes HR. Management of missing maxillary anterior teeth with emphasis on autotransplantation. Am J Orthod Dentofacial Orthop 2004;126:284–8.
3. Sbaraini A, Evans RW. Caries risk reduction in patients attending a caries management clinic. Aust Dent J 2008;53:340–8.
4. Sayinsu K, Nalbantgil D. Orthodontic treatment of a patient with traumatic loss of maxillary incisors. World J Orthod 2008;9:43–7.
5. Closs LQ, Reston EG, Vargas IA, Figueiredo JAP. Orthodontic space closure of lost traumatized anterior teeth – case report. Dent Traumatol 2008;24:687–90.
6. Kokich VG, Crabill KE. Managing the patient with missing or malformed maxillary central incisors. Am J Orthod Dentofacial Orthop 2006;129:S55–63.
7. Zachrisson BU. Planning esthetic treatment after avulsion of maxillary incisors. J Am Dent Assoc 2008;139:1484–90.
8. Rosa M, Zachrisson BU. Integrating space closure and esthetic dentistry in patients with missing lateral incisors. J Clin Orthod 2007;41:563–73.
9. Rosa M, Zachrisson BU. Integrating esthetic dentistry and space closure in patients with missing maxillary lateral incisors. J Clin Orthod 2001;35:221–34.
10. Czochrowska EM, Skaare AB, Stenvik A, Zachrisson BU. Outcome of orthodontic space closure with a missing maxillary central incisor. Am J Orthod Dentofacial Orthop 2003;123:597–603.
11. Magne P, Besler UC. Porcelain versus composite inlays/onlays: effects of mechanical loads on stress distribution, adhesion and crown flexure. Int J Periodontics Restorative Dent 2003;23:543–55.
12. Zachrisson BU, Mjor IA. Remodeling of teeth by grinding. Am J Orthod Dentofacial Orthop 1975;68:545–53.
13. Varela M, Botella JM, Pereda JC. Traumatic loss of a central incisor: orthodontic treatment. World J Orthod 2002;4:47–54.
14. Polat ZS, Tacir IH. Restoring of traumatized anterior teeth: a case report. Dent Traumatol 2008;24:e390–4.