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Clinical Tech/Case Report

Multidisciplinary Approach for the Treatment of Extensive External Cervical Resorption After Dental Trauma

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Clinical Relevance

The prognosis of severe cases of external cervical resorption is normally unfavorable due to the injury location and treatment difficulty, and in most cases, the injured tooth is indicated for extraction. It is extremely important to preserve the injured tooth in young patients both for the psychologic aspect and for maintaining function and esthetics.

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SUMMARY

External cervical resorption (ECR) is a sequela of dentoalveolar trauma that may cause functional, esthetic, and psychologic alterations. The aim of this study was to report a successful multidisciplinary treatment approach performed in a 12-year-old patient who presented with posttraumatic ECR associated with extensive opened cavity, pulp necrosis, and periapical lesion of tooth number 9, with an initial unfavorable prognosis. Crown lengthening was done to enable restoration of vestibular surface with resin composite, forming a barrier that allowed endodontic treatment. Afterwards, a prefabricated fiberglass post was cemented and esthetic restoration was performed using the adhesive technique and direct composite veneer. Reconstructive periodontal surgery was performed to correct irregular gingival contour. After treatment and successive follow-up sessions, it was concluded that although the

tooth had been indicated for extraction, low invasive direct techniques were effective to recover function and esthetics and to maintain the tooth in the oral cavity.

INTRODUCTION

Dental trauma is considered an emerging public health problem that normally affects children and adolescents,[1] and it has a strong negative impact on their quality of life.[2] The main challenge of treating traumatized permanent teeth is related to preserving the tooth and minimizing possible clinical and radiographic sequelae.[1] This frequently requires careful multidisciplinary planning associated with follow-up sessions.

There is a consensus that dental trauma occurs more frequently in children, particularly boys, and in the anterior region of the maxilla,[3] most commonly affecting the central incisor teeth.[4] Overjet above 5 mm and inadequate lip sealing are significant risk factors for traumatic lesions.[2,3] The most common causes are related to falls, collisions, sports activities, violence, and road traffic accidents.[1,5,6] Several sequelae are associated with dental trauma, and their severity is directly related to the force and direction of the impact.[7] Studies have shown a prevalence of posttraumatic injuries to permanent teeth that range from 3.9% to 58.6%.[8] Among the types of injuries, the most frequent are pulp necrosis, internal and external resorption, calcific metamorphosis, and ankylosis.[1]

External dental resorption is characterized as an irreversible loss of cementum, dentin, and bone, which may be classified according to the location of the injury.[9,10] When this affects the cervical portion of the tooth it is called external cervical resorption (ECR). In some cases, restorative and endodontic treatment may be performed effectively using composites that satisfactorily restore patient esthetics.[11]

The prognosis of severe cases of ECR is normally unfavorable due to the location of the injury and difficulty of treatment, and in most cases, the injured tooth is indicated for extraction.[9] Therefore, the aim of this study was to report the success of a conservative multidisciplinary treatment approach with a patient who presented severe ECR associated with pulp necrosis, periapical lesion, and gingival retraction due to anterior dental trauma.

CASE REPORT

A 12-year-old girl was referred to the Dental Trauma Surveillance Center of the School of Dentistry of the Federal University of Rio de Janeiro. The history comprised the report of "a hole in the front tooth" and an injury to the tooth as a result of a bicycle accident one year earlier.

Immediately after the accident, the patient underwent treatment by other professionals to restore the fractured tooth without taking any radiographs. However, the restoration fractured one week later and it had to be redone. Three months after the injury, the patient had pain and edema in the region and was taken to an emergency service where endodontic access was performed to alleviate the symptoms. The patient's guardian was instructed to seek an endodontist in order to continue treatment. However, treatment was not immediately performed. Instead, orthodontic treatment began 4 months after the injury, which had to be interrupted due to the appearance of cervical resorption in the vestibular face of the traumatized tooth (Figure 1A,B).

During the clinical examination at the Dental Trauma Surveillance Center, an extensive cavity on

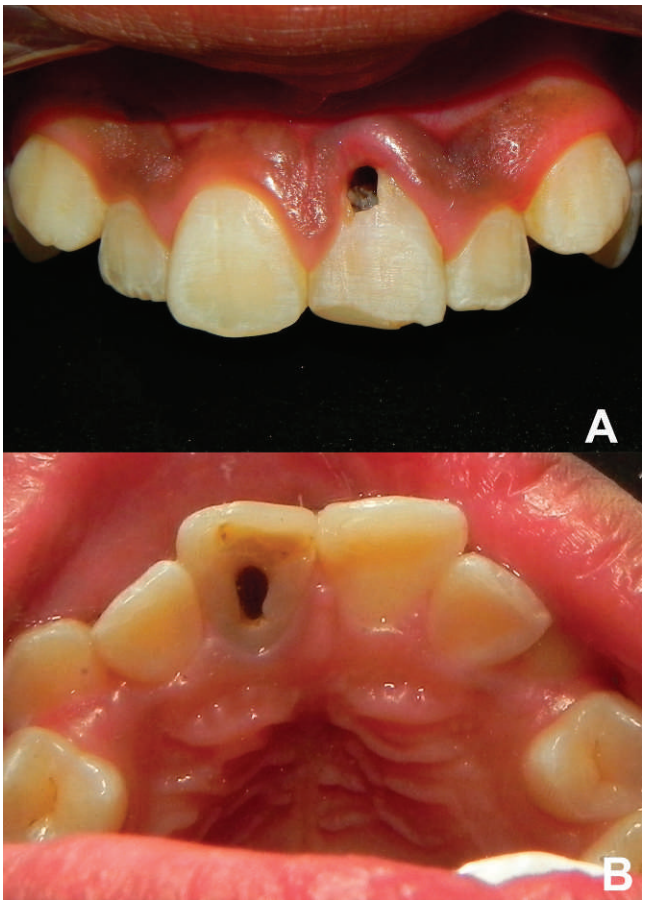

Figure 1. *Initial photos: external cervical resorption associated with caries. (A): Frontal view. (B): Occlusal view.*

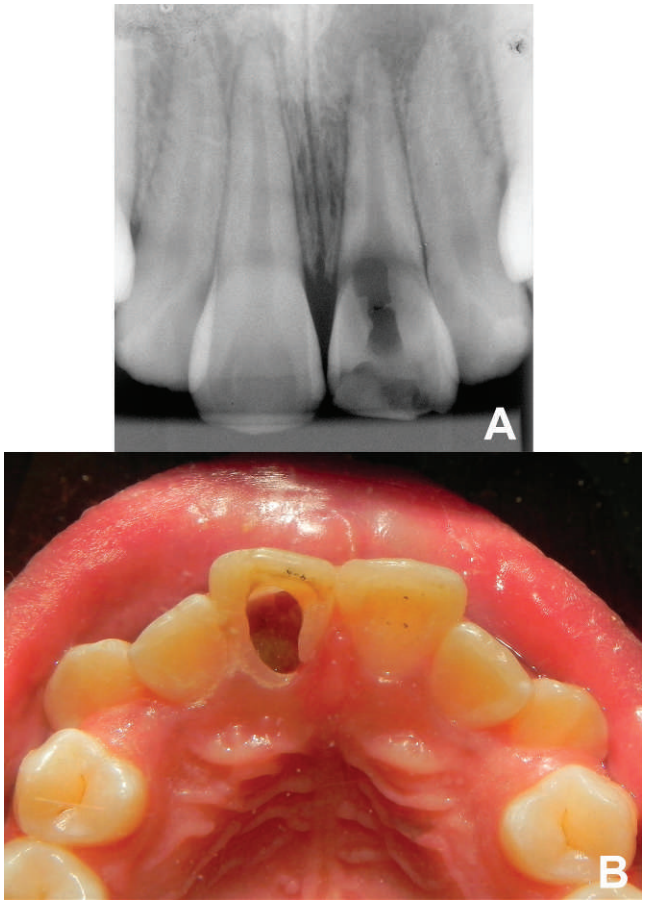

Figure 2. *(A): Initial radiograph. (B): Occlusal view after removal of decayed tissue.*

the vestibular surface in the cervical third was found on the upper left central incisor (tooth number 9) as well as gingival retraction associated with subgingival caries, which made the tooth very fragile. On the lingual surface, endodontic access without temporary sealing material was found in addition to the presence of a carious lesion (Figure 1A,B). The presence of an extensive carious lesion in the coronal region was seen in the radiograph, as well as extensive areas of ECR and a radiolucent image in the periapex suggesting a periapical lesion (Figure 2A). The extensive treatment of this case was carried out by a multidisciplinary team, which included professionals specialized in pedodontics, endodontics, restorative dentistry, and periodontics.

The first stage of the treatment consisted of exposing and removing the carious lesion (Figure 2B) and restoring the vestibular area of the transfixed tooth number 9. First, a periodontal flap procedure was carried out to expose the affected area, and a rubber dam was used to facilitate visualization without interfering with the biologic space (Figure 3A,B,C). After complete removal of the caries, a physical barrier was made with restorative composite resin (NT premium, Vigodent, Rio de Janeiro, RJ, Brazil) on the vestibular wall, which allowed the necessary sealing to perform endodontic treatment. Since the tooth was fragile, the use of a clip was not indicated, and so, the rubber dam was used with the aid of a light-cured gingival protector Top Dam (FGM, Joinvile, SC, Brazil) (Figure 3D).

For the endodontic treatment, chemical-mechanical preparation with 5.25% hypochlorite and hand files was used to dissolve and remove the necrotic tissues. After removing the smear layer with 17% EDTA, obturation was performed using the lateral condensation technique (Figure 4A,B), and a plug was made below the cervical resorption area with gray MTA-Angelus (Angelus, Londrina, PR, Brazil) leaving sufficient space for the cementation of a glass fiber-reinforced No. 1 (Exacto, Angelus) using self-curing resin cement (Fill Magic Dual, Vigodent).

Fifteen days after the canal was obturated, the tooth became darkened in comparison with its homologue (Figure 5A), and professional external dental bleaching was applied using 35% carbamide peroxide gel (Whiteness, FGM) (Figure 5B) in two sessions with an interval of seven days between them (Figure 5B). After waiting 15 days for complete elimination of all residual oxygen, the esthetic restorative process was begun, through selective wear of vestibular enamel in order to perform a composite veneer. The resins A3.5, A3, and A2, transparent incisal with opaque incisal halo B1 resin, and dentin A2 resin, (NT Premium, Vigodent) were used to reconstruct the dental esthetics according to the treatment plan (Figure 6). After restoration was finalized and occlusion was assessed, occlusal wear, finishing, and initial polishing were carried out (Figure 7).

When the patient returned for reassessment, a need for mucogingival surgery was indicated due to the irregular gingival contour and disharmonious esthetics (Figure 8a). Therefore, a free connective tissue graft obtained from the mucosa portion of the palate measuring 5 mm $\times$ 10 mm was enveloped in the gingival contour of tooth number 9 (Figure 8B,C). The patient returned one week later to have the sutures removed and returned again after one month for gingival contour reassessment. Two weeks after the reassessment, finishing and final polishing of the restoration was done.

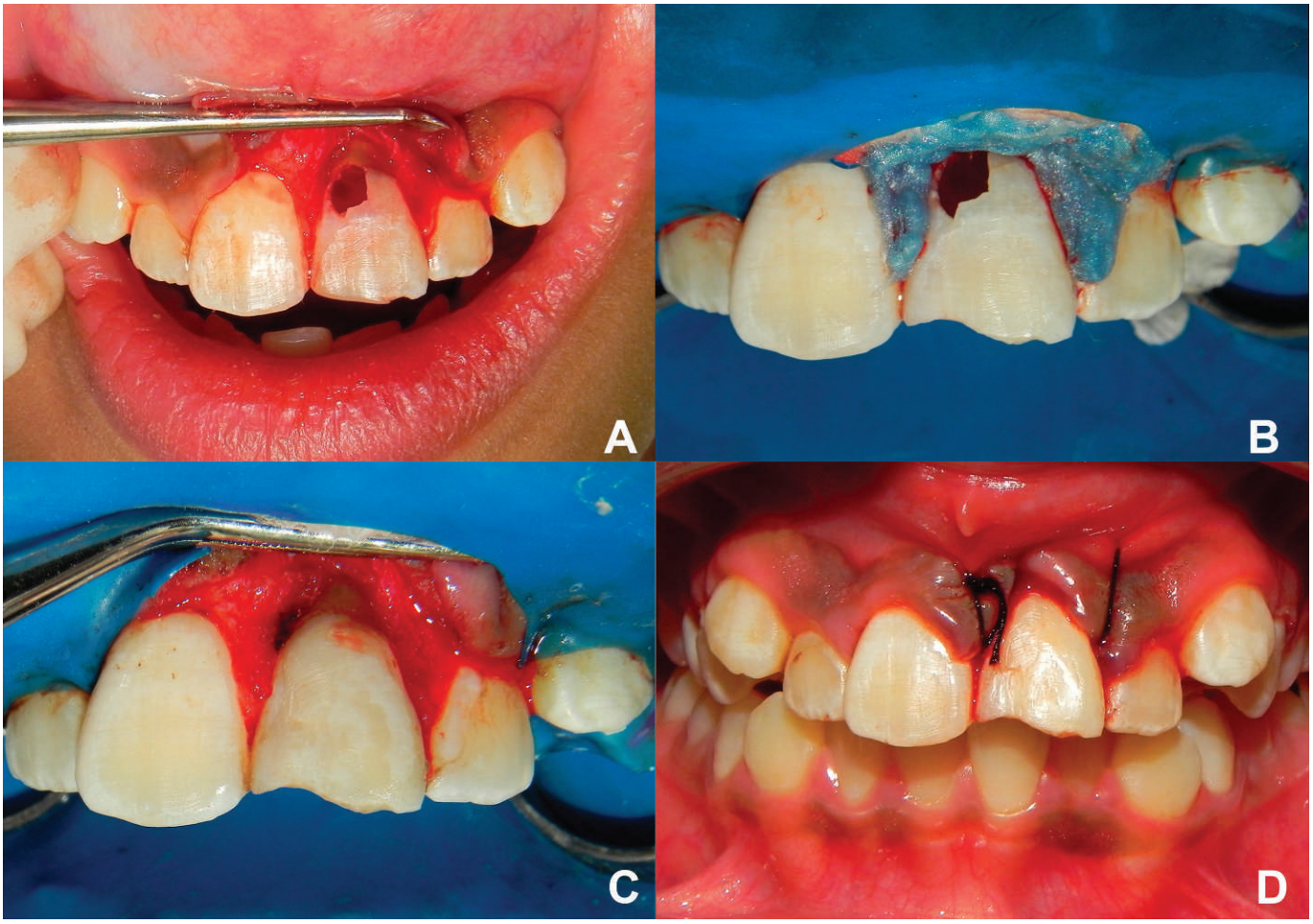

Figure 3. *(A): Surgical exposure to resorption. (B): Absolute isolation with rubber dam and gingival barrier. (C): Restoration with composite resin of the vestibular. (D): Repositioning gum.*

Along the treatment, the patient received instructions on basic care with hygiene and diet. Follow-up sessions with clinical and radiographic exams took place every three months. After one year of follow-up, no evidence of pulp or periapical pathoses or further resorption processes were found. Furthermore, the periapical lesion was regressing. The conservative multidisciplinary and low invasive treatment allowed preservation of the anterior tooth, which had been indicated for extraction by other professionals (Figures 9 and 10).

DISCUSSION

Significant structural loss of the dental crown associated with ECR in permanent maxillary anterior teeth may have functional and esthetic consequences that might lead to more severe psychologic problems.[2] Therefore, the need for an interdisciplinary approach for injured anterior teeth has been emphasized.[12] In the present case it became clear that without the participation of several specialists, the planned treatment would not have been possible.

Dental trauma is one of the main factors that predispose the development of ECR.[13] The etiology of resorption is possibly the result of an inflammatory response of the periodontal ligament to traumatic or bacterial stimulus.[14] In this case report, the development of ECR was possibly related to dental trauma associated with potential factors of orthodontic treatment. The difficulty of tooth brushing associated with a delay in the diagnosis and treatment of ECR favored the establishment and progression of a carious lesion leading to pulp necrosis and the development of a periapical lesion.

Invasive cervical resorption is difficult to diagnose, and it is even more challenging to identify the extent and nature of the process, especially in cases where the resorptive defect is buccal or palatine in

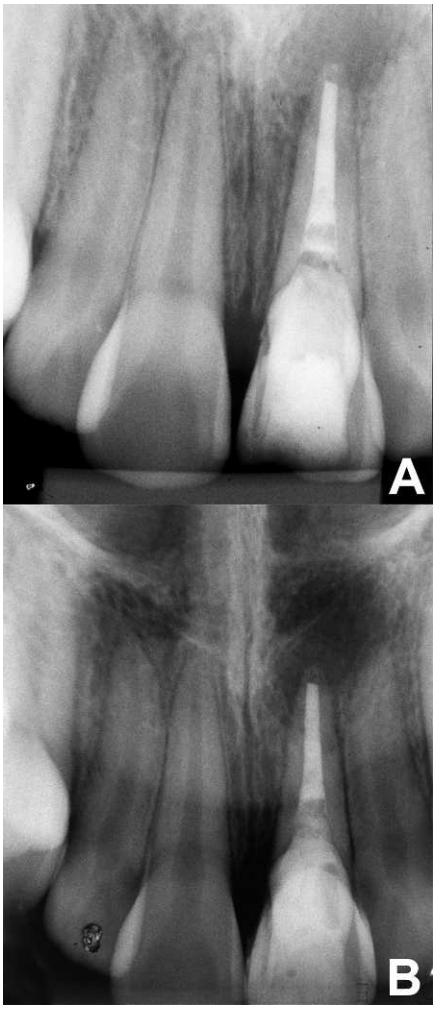

Figure 4. *(A): Radiograph after completion of endodontic treatment. (B): Radiograph after cementation of the glass fiber-reinforced.*

location.[15] When ECR is detected early, conventional and effective endodontic and restorative treatment is possible.[11] However, in severe cases of ECR associated with an extensive cavity, the clinical approach prior to endodontic treatment is complete removal of the existing carious tissue in order to make a more accurate assessment of the tooth. In cases of extensive destruction and lack of sustainable hard tissues, orthodontic traction or surgical exposure of the crown[16] is needed, such as the one performed in this case.

Pulp exposure caused by dentin resorption requires endodontic treatment,[11] which can be made by conventional therapy using gutta-percha filling or new materials such as mineral trioxide aggregate (MTA).[1,17] MTA presents biocompatible characteristics, bacteriostatic effects, and good sealing properties[18]; therefore, in the present case, we chose the

Figure 5. *(A): Darkening of the coronal portion after root canal filling. (B): Final appearance after bleaching.*

endodontic cement and gutta-percha with an MTA plug in the root middle third for the final obturation. Due to the properties of MTA and the fragile condition of the tooth, intracanal medication with calcium hydroxide was not used because it increases the length of clinical treatment and consequently the risk of fracturing the coronal portion.

Apical periodontitis is an inflammation and destruction of periradicular tissues caused by etiologic

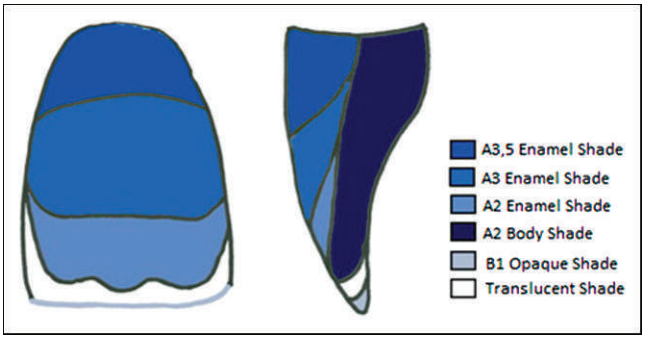

Figure 6. *Diagrams of the resins used.*

Figure 7. *Facet with composite resin.*

agents of endodontic origin. It is a sequel that is characterized by a radiolucent image in the root apex, similar to a periapical lesion. Its treatment consists of eliminating infection from the root canal.[19] This procedure was performed in the present case using the above-mentioned endodontic treatment with the purpose of reducing the lesion of the traumatized tooth.

One of the main causes of root canal treatment failure is associated with the contamination of the root system between the completion of endodontic treatment and the definite restoration.[20] However, in the present case, immediate restoration was not possible, so resin composite was used as a temporary restoration until completion of treatment. This choice was based on the characteristics of the material chosen, which in addition to presenting satisfactory sealing to infiltration from oral fluid contamination, also presented sufficient resilience and adhesiveness—desirable characteristics to prevent fracture of the coronal remainder. Maximum preservation of healthy tooth structures and the use of restorative materials with mechanical properties similar to the tooth favor greater longevity of complex tooth restorations.[21]

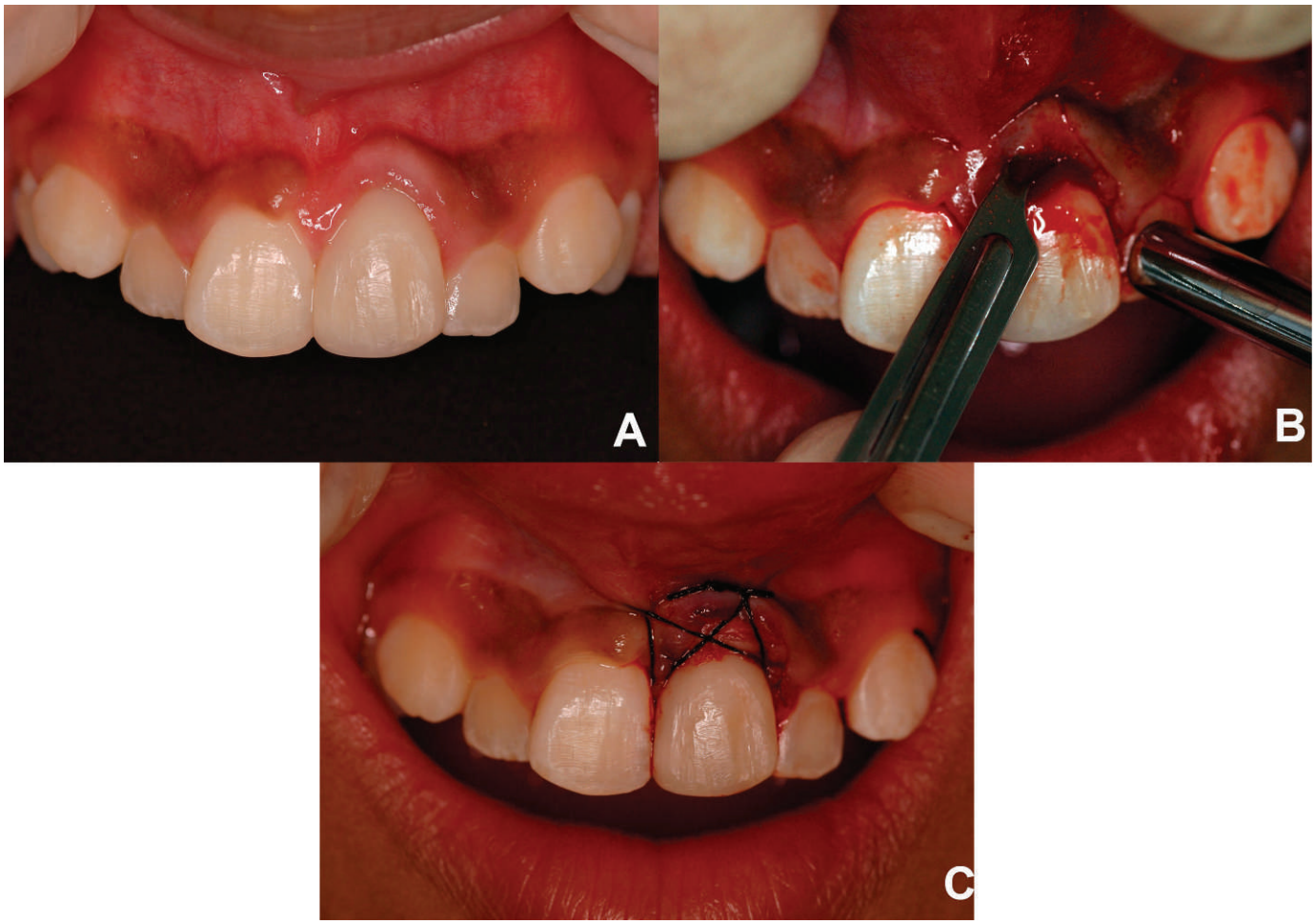

Figure 8. *(A): Irregular gingival contour upon returning for reassessment. (B): Periodontal surgery. (C): Replacement of the connective tissue graft removed from the palate.*

Figure 9. *Clinical aspect after one year of follow-up.*

The nano-composite selected to perform the final restoration had essential characteristics that enabled satisfactory esthetic results, provided high strength and consistency, and allowed ideal polishing to finalize the restoration. Moreover, a fluorescent agent is embedded in this material and so emits visible light when exposed to ultraviolet light. This gives a more natural shine and vitality under different lighting conditions, thus providing a satisfactory esthetic and harmonious smile. A radiopaque composite was chosen to improve the quality of the radiographic follow-up studies. The main purpose of the occlusal adjustment performed after the restoration was to control trauma resulting from the action of functional and parafunctional occlusal forces, eliminating interference, and favoring better long-term dental stability.[22]

After conservative treatment, the gingival contour of a traumatized tooth is usually altered, affecting esthetics. In the present case, the patient had gingival recession, and the recommended procedure was subepithelial connective tissue graft. The soft tissue grafts (gingival graft and subepithelial connective tissue graft) have been used successfully in periodontics for reconstructing areas showing gingival recession, loss of interdental papillae, and alveolar ridge-volume deficiency.[23] The connective tissue coming from the palate or gingiva is capable of inducing keratinization from epithelial cells proliferating on the subepithelial connective tissue graft at the receptor site.[24] However, for long-term success, it is important that there is adequate primary graft fixation, revascularization, and close contact between the graft and receptor.[25]

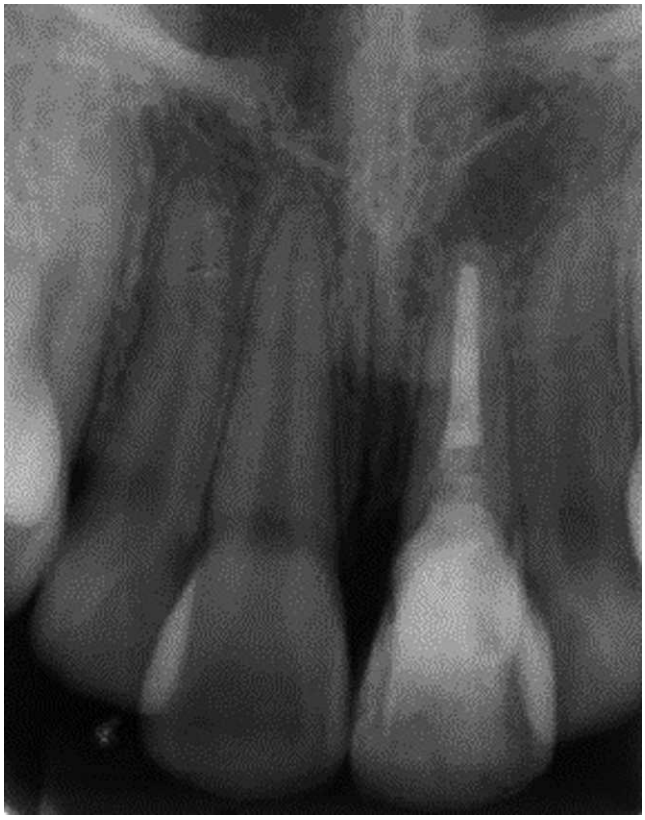

Figure 10. *Radiological aspect after one year of follow-up.*

Connective tissue graft has the same indications and predictability as free gingival graft. However, it has some advantages, mainly in relation to the postoperative period because it is more comfortable due to primary intention healing. In terms of esthetics, connective tissue graft is also superior because there is greater uniformity of color in relation to the tissues adjacent to the receptor site.[26] Therefore, due to those and other advantages, this was the technique chosen for the present case.

Children and adolescents who have suffered severe traumatic injuries in the anterior maxillary region with posterior injuries immediately suffer a decline in their quality of life and in their guardians' quality of life.[26] Therefore, strict criteria in planning and immediate procedures must be carried out effectively and satisfactorily to improve both the children's and guardians' quality of life. Clinical and radiographic follow-up sessions should be carried out periodically, and they are extremely important even after completion of treatment. Thus, future traumatic injuries may be avoided and a multidisciplinary team will be able to intervene efficiently at the right time.[27,28]

The multidisciplinary planning enabled successful esthetic rehabilitation of the smile in the patient with an anterior tooth with an unfavorable prognosis. This case followed conservative therapy for the tooth structure that remained after an extensive external cervical resorption and was associated with careful follow-up sessions. It is extremely important to preserve the injured tooth in young patients both from the psychologic aspect and to maintain function and esthetics.

Conflict of Interest

The authors of this manuscript certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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REFERENCES

1. Andreasen JO, & Andreasen FM (2001) Classificação, etiologia e epidemiologia In: Andreasen JO, Andreasen FM (eds) *Textbook and Color Atlas of Traumatic Injuries to the Teeth* 3rd ed Artmed, Porto Alegre 151-180.
2. Côrtes MIS, Marcenes W, & Sheimam A (2001) Prevalence and correlates of traumatic injuries to the permanent teeth of school-children aged 9-14 years in Belo Horizonte, Brazil *Dental Traumatology* **17(1)** 22-26.
3. Artun J, Behbehani F, Al-Jame B, & Kerosuo H (2005) Incisor trauma in an adolescent Arab population: Prevalence, severity, and occlusal risk factors *American Journal of Orthodontics and Dentofacial Orthopedics* **128(3)** 347-352.
4. Soriano EP, Caldas Ade F Jr, Diniz De Carvalho MV, & Amorim Filho Hde A (2007) Prevalence and risk factor related to traumatic dental injuries in Brazilian schoolchildren *Dental Traumatology* **23(4)** 232-240.
5. Celenk S, Sezgin B, Ayna B, & Atakul F (2002) Causes of dental fractures in the early permanent dentition: A retrospective study *Journal of Endodontics* **28(3)** 208-110.
6. Zuhal K, Semra OE, & Hüseyin K (2005) Traumatic injuries of the permanent incisors in children in southern Turkey: A retrospective study *Dental Traumatology* **21(1)** 20-25.
7. Kramer FP, Zembruski C, Ferreira SH, & Feldens CA (2003) Traumatic dental injuries in Brazilian preschool children *Dental Traumatology* **19(6)** 299-303.
8. Glendor U (2008) Epidemiology of traumatic dental injuries—a 12 year review of the literature *Dental Traumatology* **24(6)** 603-611.
9. Nikolidakis D, Nikou G, Meijer GJ, & Jansen JA (2008) Cervical external root resorption: 3 year follow-up of a case *Journal of Oral Science* **50(4)** 487-491.
10. Patel S, Kanagasingam S, & Ford TP (2009) External cervical resorption: A review *Journal of Endodontics* **35(5)** 616-625.
11. Bergmans L, Van Cleynenbreugel J, Verbeken E, Wevers M, Van Meerbeek B, & Lambrechts P (2002) Cervical external root resorption in vital teeth. X-ray microfocus-tomographical and histopathological case study *Journal of Clinical Periodontology* **29(6)** 580-585.
12. Jain v, Gupta R, Duggal R, & Parkash H (2005) Restoration of traumatized anterior teeth by interdisciplinary approach: Report of three cases *Journal of the Indian Society of Pedodontics and Preventive Dentistry* **23(4)**193-197.
13. Malikaew P, Watt RG, & Sheiham A (2006) Prevalence and factors associated with traumatic dental injuries (TDI) to anterior teeth of 11–13 year old Thai children *Community Dental Health* **23(4)** 222-227.
14. Gold SI, & Hasselgren G (1992) Peripheral inflammatory root resorption. A review of the literature with case reports *Journal of Clinical Periodontology* **19(8)** 523-534.
15. Silveira LFM, Silveira CFS, Martos, Piovesan, & Neto JBC (2011) Clinical technique for invasive cervical root resorption *Journal of Conservative Dentistry* **14(4)** 440-444.
16. Gulabivala K (2004) Restoration of the root-treated tooth. In: Stock CJR, Gulabivala K, Walker RT (eds) *Endodontics* 3rd ed Elsevier Mosby, Edinburgh 279-305.
17. Miller EK, Le JY, Tawil PZ, Teixeira FB, & Vann WF (2012) Emerging therapies for the management of traumatized immature permanent incisors *Pediatric Dentistry* **34(1)** 66-69.
18. Giuliani V, Baccetti T, Pace R, & Pagavino G (2002) The use of MTA in teeth with necrotic pulps and open apices *Dental Traumatology* **18(4)** 217-221.
19. Nair PN (2004) Pathogenesis of apical periodontitis and the causes of endodontic failures *Critical Reviews in Oral Biology and Medicine* **15(6)** 348-381.
20. Saunders WP, & Saunders EM (1994) Coronal leakage as a cause of failure in root canal therapy: A review *Endodontics & Dental Traumatology* **10(3)** 105-108.
21. Vârlan C, Dimitriu B, Vârlan V, Bosnar D, Suciu I, & Davila C (2009) Current opinions concerning the restoration of endodontically treated teeth: Basic principles *Journal of Medicine and Life* **2(2)**165-172.
22. Macedo A, Pinzan A, Miyashita E, Vellini-Ferreira F, & Feltri PP (2009) Ajuste oclusal na finalização do tratamento ortodôntico *OrtodontiaSPO* **42(1)** 74.
23. Maurer S, Hayes C, & Leone C (2000) Width of keratinized tissue after gingivoplasty of healed subepithelial connective tissue grafts *Journal of Periodontology* **71(11)** 1729-1736.
24. Edel A (1995) The use of a connective tissue graft for closure over an immediate implant covered with an occlusive membrane *Clinical Oral Implants Research* **16(1)** 60-65.
25. Khoury F, & Happe A (2000) The palatal subepithelial connective tissue flap method for soft tissue management to cover maxillary defects: A clinical report *International Journal of Oral & Maxillofacial Implants* **15(3)** 415-418.
26. Lindhe J (2003) Terapia mucogengival In: Lindhe J, Karring T, Lang N (eds) *Tratado de Periodontia Clinica E*

Implantodontia Oral 4th ed Guanabara Koogan, São Paulo 557-629.

27. Berger TD, Kenny DJ, Casas MJ, Barret EJ, & Lawrence HP (2009) Effects of severe dentoalveolar trauma on the quality-of-life of children and parents *Dental Traumatology* **25(5)** 462-469.

28. Mello-Moura ACV, Bonini GAVC, Suga SS, & Wanderley MT (2009) Multidisciplinary approach on rehabilitation of primary teeth traumatism repercussion on the permanent successor: 6-year follow-up case report *Journal of the Indian Society of Pedodontics and Preventive Dentistry* **27(2)** 125-130.