Iran J Orthod. 2023 June; 18(1):e1104. doi:10.22034/IJO.2023.1989084.1104.
Published online 2023 June 1
Research Article **Open Access**

Traction of Impacted Central Incisor in an Adult Patient: Case Report

Gregório Bonfim Dourado[1*], Ester Andrade Souza Neta[2], Marcelo de Castelucci e Barbosa[3], Thais Maria Freire Fernandes[4], Ricardo Alves Souza[5], Ana Claudia de Castro Ferreira Conti[4]

[1] Ph.D. Student, UNIDERP, Campo Grande, MS, Brazil
[2] Private practice, Innovare, Salvador, BA, Brazil
[3] Ph.D., Professor of Orthodontics, UFBA, Salvador, BA, Brazil
[4] Ph.D., Professor of Orthodontics, UNIDERP, Campo Grande, MS, Brazil
[5] Ph.D., Professor of Orthodontics, UESB, Jequié, BA, Brazil

***Corresponding author:** Gregório Bonfim Dourado

Address: Presidente Vargas Avenue, 90 – Center Livramento de Nossa Senhora, Bahia,Brazil.

E-mail: drgregoriodourado@outlook.com
Received: 2023 February 09; **Revised:** 2023 May 07; **Accepted:** 2023 May 19

Abstract

Aim: We have reported a case of a 17-year-old patient with impaction of element 2.1 and severe incisors crowding and the treatment plan involved traction of the impacted teeth.
Methods: First, rapid maxillary expansion was performed. Then elements 1.4, 2.4, 3.4, and 4.4 were extracted to dissolve the crowding, and the fixed appliances were bonded. A NiTi coil spring was used to open the needed space for traction, and surgical exposure of the tooth for bonding a traction device was done. After the tooth erupted in the oral cavity, overlay mechanics was used to align and level it.
Results: Despite being challenging, the conservative treatment resulted in satisfactory outcomes, and the objectives were achieved, restoring the patient's aesthetics and function.
Conclusion: After correct planning of the case, the impacted central incisor was pulled, restoring the patient's function and aesthetics, with good preservation of the supporting structures.

Keywords: Orthodontics, Orthodontic Fixed Appliances, Impacted Teeth

Background

Orthodontists should suspect tooth impaction when the tooth cannot erupt into the dental arch after its ideal age, and the homologous tooth erupts. The impaction of an anterior tooth affects function, aesthetics, phonetics, and psychological aspects. Despite the canine being the most frequently affected tooth, the absence of maxillary central incisors is easily perceived by parents and children themselves because of the negative impact on esthetics (1).

Prevalence of maxillary central incisor impaction occurs in around 0.06% to 0.2% of the general population (2). Bishara reports that the etiopathogenesis is multifactorial, as there are several reasons why a tooth cannot erupt into the oral cavity, dividing it into two main groups:
1) Local factors - supernumerary teeth; the presence of odontomas that can be induced by trauma or infections; trauma to primary teeth; dental arch discrepancy; high bonecondensation; tough and thick mucosa; trauma;dental ankylosis; prolonged retention or premature loss of primary teeth. 2) General Factors - hereditary factors, endocrine disorders, cleft palate, irradiation, febrile illnesses, cleidocranial dysostosis, Gardner syndrome, and Down syndrome (3).

The best approach is conservative and depends on the early diagnosis of incisorimpaction, because when providing enough space in the dental arch in cases where the tooth root is not complete, there is a chance of spontaneous eruption. When this conservative approach is not possible, traction of the impacted tooth is a treatment option, which has the advantage of improving the patient`s aesthetics and psychological state, in addition to

Copyright © 2023, Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (http://creativecommons.org/licenses/by-nc/4.0/) which permits copy and redistribute the material just in noncommercial usages, provided the original work is properly cited.

maintaining the length of the dental arch, preventing harmful habits and malocclusions. However, orthodontic traction can also cause some damage. Some complications involve treatment failure and the possibility of the tooth not moving due to ankylosis (4). Other risks that should be discussed with the patient include the possibility of root resorption of adjacent teeth due to the trajectory of eruption, coronary discoloration, pulp devitalization, periodontal problems, bone loss, and tooth mobility (5).

The objective of this study was to report the case of traction of an impacted maxillary central incisor, as a result of trauma in the primary dentition phase, with a lack of space and severe crowding.

Case Description

Diagnosis and Etiology

A 17-year-old male patient presented with his main complaint being the absence of the upper left central incisor. On clinical examination that included facial symmetry, normal speech, swallowing, and breathing, permanent dentition with severe crowding, rotation of the right upper central incisor, and absence of the left central incisor were observed (Figure 1). In history, a trauma in the anterosuperior region was reported when he was five years old, which probably deviated the central incisor's path of eruption. His medical history did not reveal any contraindications for orthodontic treatment.

In the radiographic evaluation of the panoramic, periapical, and lateral cephalograms, it was noticed that the stage of root formation of the permanent teeth and the chronology of eruption were normal, except the left maxillary central incisor, which was missing, and the right one, which was rotated, but no alterations that would contraindicateorthodontic treatment were detected (Figure 2).

Cephalometric measurements showed good maxillary and mandibular positioning, with the SNA (80°), the SNB (78°), and the ANB (2°) being a skeletal pattern of class I. The incisor`s inclination angle, which is measured by the angle of the maxillary incisor to NA, is 30°, and the lower incisor to NB is 39°.

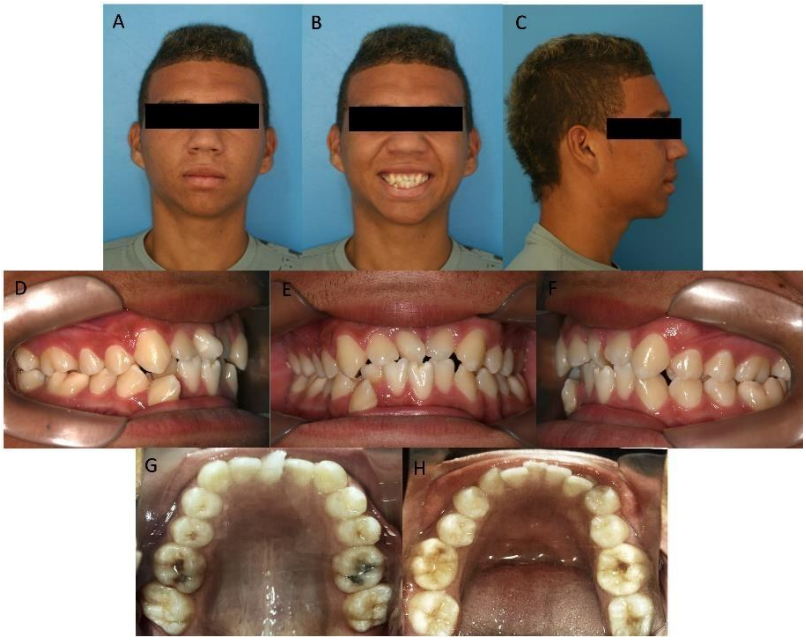


Figure 1. Initial extraoral and intraoral photographs of the patient.

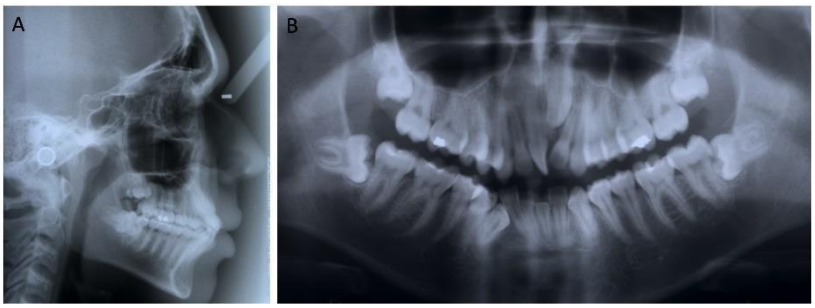


Figure 2. Initial lateral and panoramic radiographs.

Treatment objectives

The treatment objectives were to reestablish function and esthetics by opening space for traction of the left central incisor, which was impacted, as well as correcting the severe crowding present in both arches, with a protocol of rapid maxillary expansion followed by the extraction of first premolars, and correction of class II left subdivision malocclusion.

Treatment alternatives

Treatment alternatives for an impacted central incisor, in addition to tooth traction, are less conservative and include (1) extraction of the impacted unit and space closure by replacing the central incisor with the lateral incisor and subsequent restorative reshaping; (2) extraction of the impacted tooth by the opening of the space for rehabilitation using an implant or prosthesis.

Treatment progress

Initially, the patient was referred for extractions of the upper and lower third molars. After that, rapid maxillary expansion was performed using the Hyrax appliance, with the activation protocol of one-fourth, twice a day, for seven days. Then the lower first premolars were extracted, and the fixed orthodontic appliance was installed in the lower arch with brackets prescription Roth 0.022" (Morelli, Sorocaba, SP, Brazil) (Figures 3 A-D). Alignment was performed by 0.012'', 0.014” and 0.016'' Niti archwires, after which the canine retraction started by using an elastic chain, followed by the 0.018” stain steel arch with class III elastics (3/16” light) supported by an expander device installed in the upper arch. After maxillary expansion was achieved, the extraction of the first upper premolars was done, and the braces were bonded (Figure 3). The right upper central incisor was aligned by means of mechanics using an overlay wire (Figure 4. A).

Two 8 x 1 mm orthodontic miniscrews (Morelli, Sorocaba, SP, Brazil) were installed between the roots of the first and second molars bilaterally for retraction of maxillary canines. Then, a Niti coil spring is between elements 1.1 and 2.2 was used to open the space for the missing incisor (Figure 4.B). At this time, surgical intervention was done for bonding the orthodontic device in the impacted incisor (Figure 4. C). After seven days, the traction protocol began using the 0.018 x 0.025'' steel arch with a bend to support the elastic and traction through a chain elastic (Figure 4.D). After three months of activation, another surgery was done to bond the bracket to the tooth. After seven activations on the upper incisor, it erupted into the oral cavity. At that moment, a binary force was performedwith two buttons, one on the buccal side and the other on the palatal, using an elastic chain segment to resolve the rotation. Then the button was replaced by a bracket on the upper incisor (Figure 4. E), using overlay mechanics with a Niti 0.012” archwire for alignment in the arch. In the following months, 0.014”, 0.016”, 0.018”, 0.020”, and 0.018x0.025” steel wires were used, associated with class II elastic mechanics.

During the finalization phase, a rectangular archwire was used to incorporate the torques in both arches, in addition to the elastic chain segment and the elastic to correct the midline (Fig. 4.F) An ideal intercuspation was obtained with molars and canines in the correct occlusion

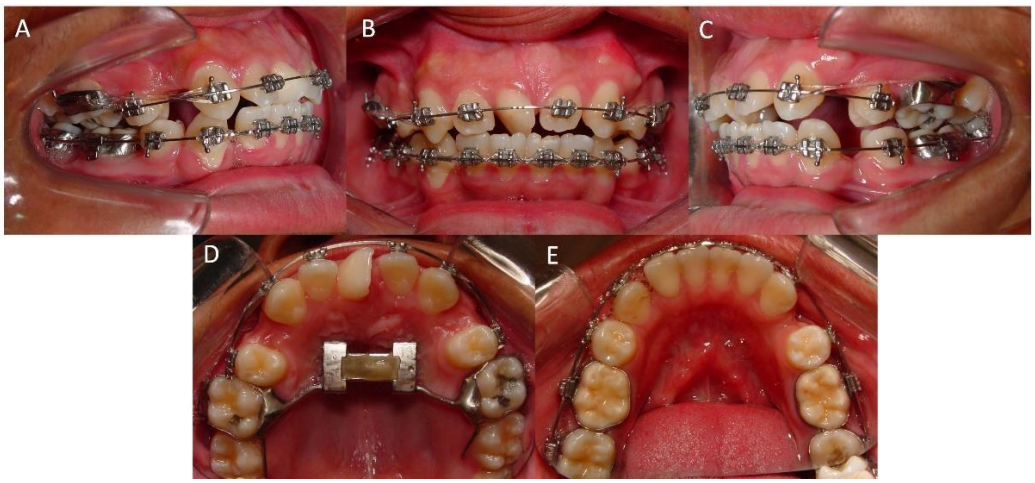


Figure 3. After maxillary expansion, elements 1.4 and 2.4 were extracted and braces bonded.

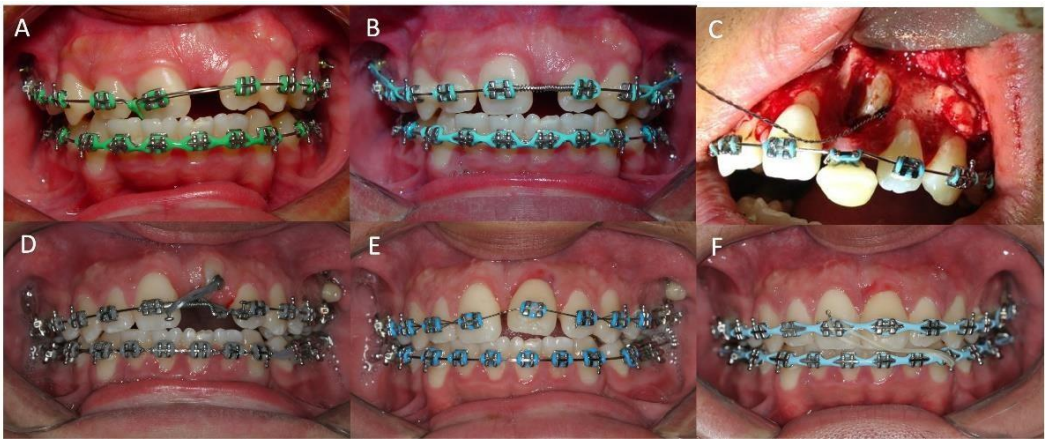


Figure 4. Space was opened using a coil spring between elements 1.1 and 2.2. After this, surgery was performed and traction of element. 2.1.

Results

At the end of the treatment, results were aesthetically positive. The patient exhibited a slight difference in the gingival contour of the impacted tooth in relation to its homolog. The 3x3 hygienic lower retainer was bonded, in addition to a removable wraparound retainer appliance (Figure 5), which was replaced after two years by a fixed retainer between the upper incisors, due to the request of the patient, who was tired of using the removable retainer. In the final radiographs, good root parallelism and no periodontal problems such as loss of supporting bone and root resorption were observed (Figure 6). After five years of follow-up, the results were maintained, showing good stability (Figures 7 and 8).

Comparing cephalometric analyses at the beginning and at the five-year follow-up, the maxilla and mandible were more retracted than at the beginning of treatment (SNA and SNB). Also, the maxillary and mandibular central incisors presented less buccal axial inclination than at the beginning of treatment, and the results were stable after five years of follow-up.

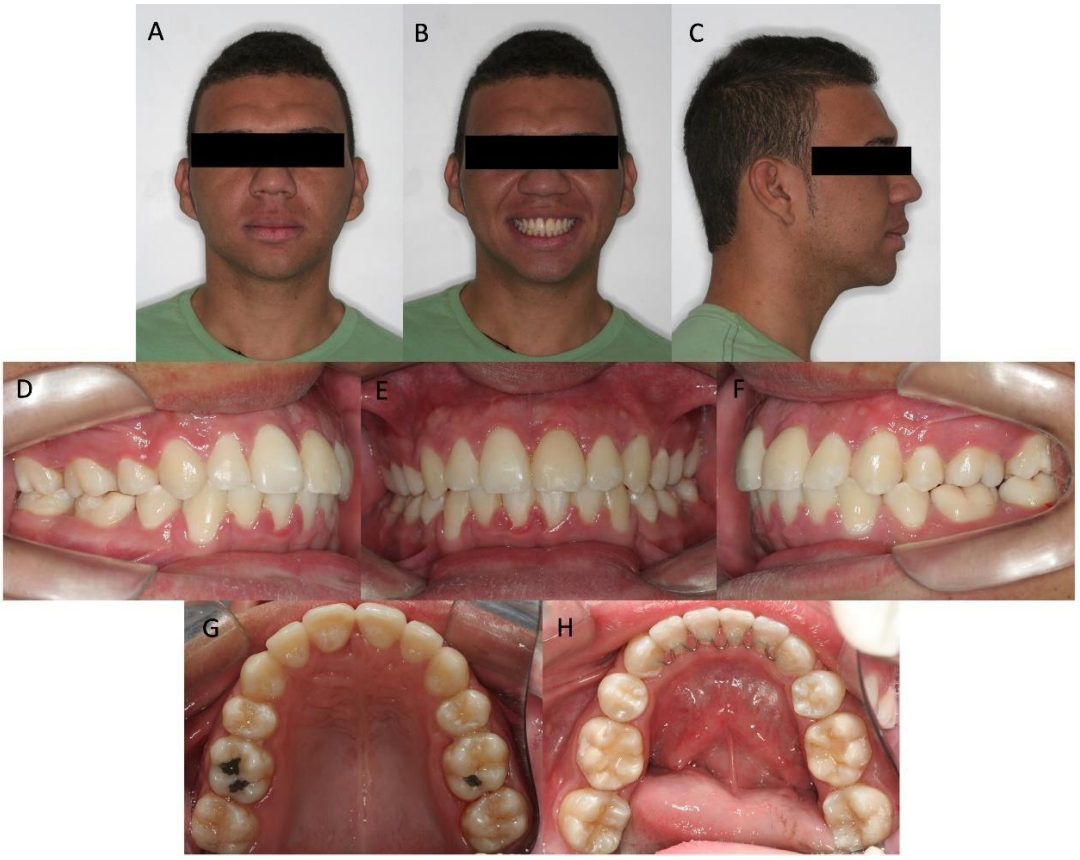


Figure 5. Posttreatment extraoral and intraoral photographs of the patient.

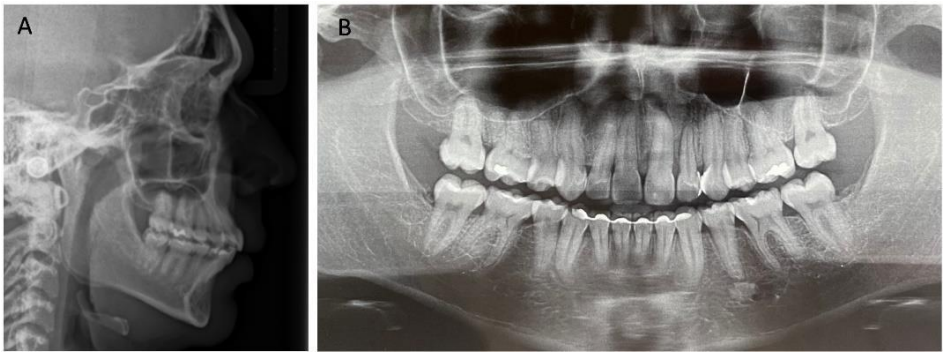


Figure 6. Posttreatment lateral and panoramic radiographs.

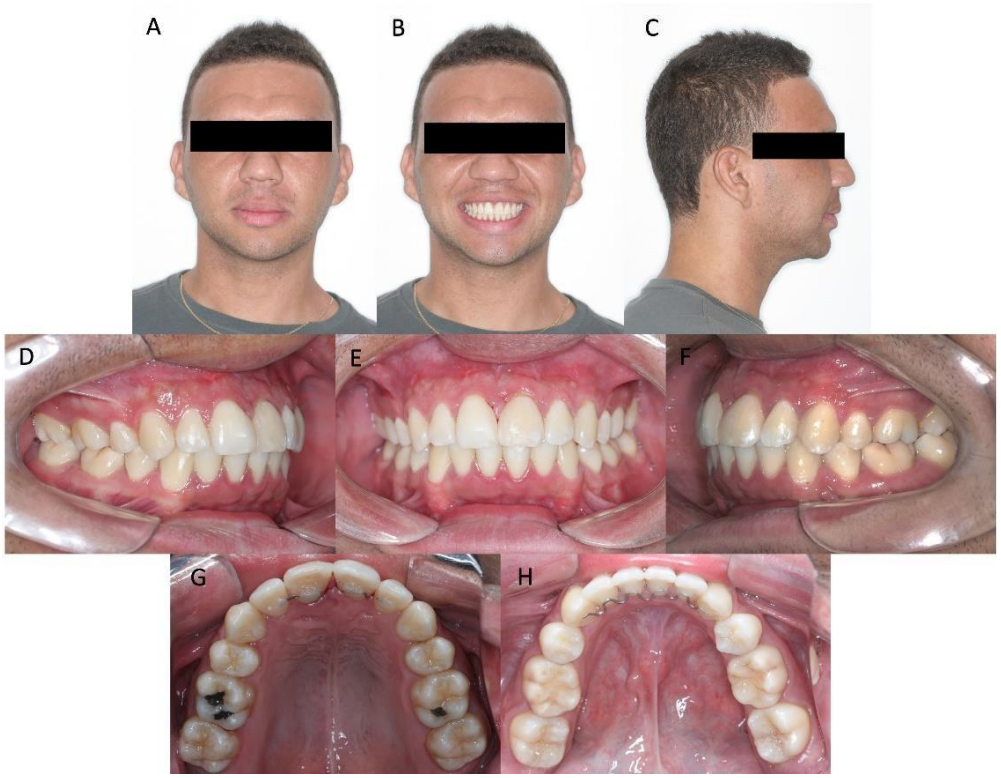


Figure 7. Five years follow-up extraoral and intraoral photographs of the patient.

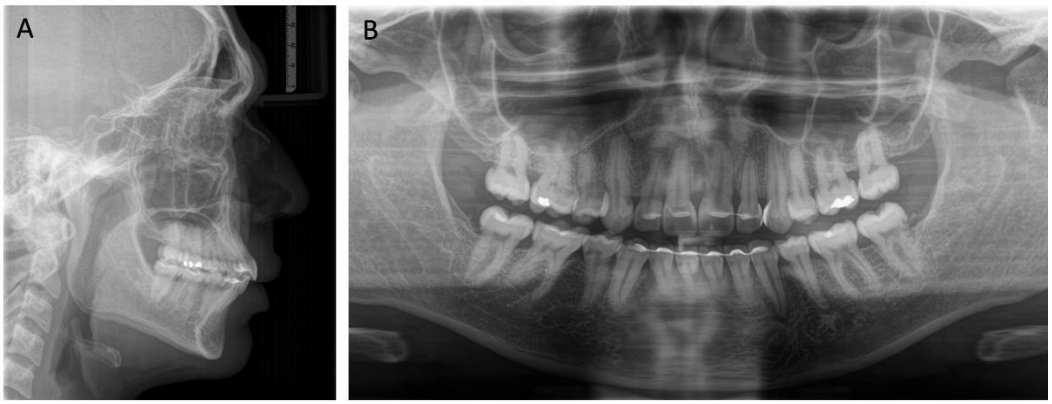


Figure 8. Five-year follow-up lateral and panoramic radiographs.

Discussion

The impaction of a maxillary central incisor represents a challenge for the orthodontist, since the traction or even the preservation of an impacted tooth can be harmful. According to Bishara, not pulling the impacted tooth would have the following consequences: movement of teeth close to the region of absence, cause space obliteration, possible resorption of adjacentteeth roots if they are in close contact, and possible formation of cysts around the crowns of impacted teeth, not to mention the negative aesthetic impact that the absence of an anterior tooth can cause (3). On the other hand, the attempt to move an impacted tooth involves arisk of ankylosis, pulp devitalization, discoloration, external root resorption, injuries to adjacent teeth, alveolar bone loss, gingival recession, clinical crown enlargement, and tooth sensitivity problems. Such complications are causing increased treatment time, aesthetic problems, or even loss of the dental element (6). The patient opted for treatment in the adult

phase (age: 17 years old), with the malocclusion already established. It is a consensus in the literature that early diagnosis and prompt care,in most cases, prevent malocclusion problems and allow for simpler orthodontic treatment.Patients in mixed dentition have a betterprognosis, with less loss of alveolar bone in the region of traction, as the spontaneous eruption is more likely to occur in young patients afterUlectomy and/or after opening the space with an orthodontic appliance. The use of removable appliances during traction can allow the movement of the impacted tooth over the roots of neighboring teeth, preventing root resorption and facilitating its movement. Traction with removable appliances can be planned (7).

Other professionals have evaluated the case presented and suggested the following therapeutic options: 1- canine-to-canine removal and rehabilitation with a removable prosthesis, 2- removal of the impacted unit and rehabilitation with a dental implant, and 3- tooth extraction and realignment of the lateral incisorto the position of the central incisor. The literature describes treatment alternatives for an impacted incisor as such: 1- extraction and recovery with a mobile prosthesis or an implant when growth ceases, 2- extraction and space filling by replacing the lateral incisor with the central incisor with subsequent restoration or prosthesis, and 3- surgical exposure, opening orthodontic space, and traction of the impacted incisor to its correct position. Treatment goals that minimize damage to teeth and periodontium should be considered (1,7-9).

After planning the treatment modality and exploring the various treatment alternatives, although it is generally considered that a deeply impacted incisor has a poor prognosis, it was decided to expose the tooth and bring it to occlusion. The patient did not choose an implant, so his opinion was respected. In addition, the loss of alveolar bone, a common consequence of extraction in the anterior region, wouldnegatively affect the patient's esthetics and impair the adaptation of a posterior prosthesis (7,10).

In the case reported, the closed surgery technique was used, repositioning the surgical flap to its original position after bonding the orthodontic button to the impacted tooth; only the ligature wire attached to the bracket was exposed in the oral cavity. The more traditional technique only exposes the crown, positioning the surgical flap more apically, inducing naturaltooth eruption of the impacted tooth. Vermette et al. compared the two surgical techniques: apical flap repositioning and closed eruption, and found much better results in gingival, periodontal, and pulpal terms with the closed eruption technique. The apical repositioning technique produces more unfavorable esthetic effects, such as clinical crown enlargement and gingival recession (11), unlike Suri et al. (2002), who believe that apical flap repositioning can prevent gingival detachment during toothtraction (12).

The traction of the impacted tooth was performed with the support of a fixed appliance because the patient had a complete permanent dentition and other orthodontic problems. The removable appliance is an alternative in the mixed dentition as long as there is space to position the tooth. After traction, the patient had a satisfactory periodontal pattern without significant loss of bone and attached gingiva. Due to the important role that the central incisor plays in esthetics, the option of orthodontic traction is often performed. However, gingival recession, tooth extrusion, and esthetic and periodontal problems are frequently seen in patients who underwent traction (13,14). The patient presented a slight difference in the gingival contour in the impacted unit in relation to the homologous tooth. This result corroborates the work of Becker et al., who reported an irregular gingival contour in one-third of the treated incisors (15). In contrast, inthe study by Vermette et al., none of the incisors treated using the closed eruption technique had gingival irregularity (11). After traction of the impacted unit, the patient had no other sequelae. Consolaro et al. state that the possible consequences do not arise specifically from traction, as it should be considered an induced tooth movement, like any other orthodontic movement (16).

In the post-treatment control, no recurrences of rotation and intrusion of the impacted unit were observed, confirming the study by Vermette et al. and Becker et al., who also did not report recurrences in their studies (11,15).

Conclusion

The traction of impacted teeth represents a clinical challenge, especially when associated with a lack of space and severe crowding in an adult patient. After correct planning of the case, the impacted central incisor was pulled, restoring the patient's function and aesthetics, with good preservation of the supporting structures.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship
Nil.

Conflicts of interest: None to declare.

References

1. Shi X, Xie X, Quan J, Wang X, Sun X, Zhang C, et al. Evaluation of root and alveolar bone development of unilateral osseous impacted immature maxillary central incisors after the closed-eruption technique. Am J Orthod Dentofacial Orthop. 2015;148(4):587-98. doi: 10.1016/j.ajodo.2015.04.035.
2. Tai K, Shin JW, Park JH, Sato Y. A modified palatal appliance for forced Eruption of Impacted Central Incisor. J Clin Pediatr Dent. 2019;43(6):424-31. doi: 10.17796/1053-4625-43.6.11.
3. Bishara, SE. Impacted maxillary canines: a review. Am J Orthod Dentofacial Orthop. 1992;101(2):159-171. doi: 10.1016/0889-5406(92)70008-X.
4. Shapira Y, Kuftinec MM. Treatment of impacted cuspids: the hazard lasso. Angle Orthod. 1981;51(3):203-7. doi: 10.1043/0003-3219(1981)051<0203:TOICTH>2.0.CO;2.
5. Manilla AE, Katagiri MK. Orthodontic-surgical treatment of an impacted central incisor. Case report. Revista Mexicana de Ortodoncia. 2017;5(3):e184-e9.doi: 10.1016/j.rmo.2017.12.018
6. Kajiyama K, Kai H. Esthetic management of an unerupted maxillary central incisor with a closed eruption technique. Am J Orthod Dentofacial Orthop. 2000;118(2):224-8. doi: 10.1067/mod.2000.10075.
7. Pinho T, Neves M, Alves C. Impacted maxillary central incisor: surgical exposure and orthodontic treatment. Am J Orthod Dentofacial Orthop. 2011;140(2):256-65. Doi: 10.1016/j.ajodo.2009.11.018.
8. Chang NY, Park JH, Kim SC, Kang KH, Cho JH, Cho JW, et al. Forced eruption of impacted maxillary central incisors with severely dilacerated roots. Am J Orthod Dentofacial Orthop. 2016;150(4):692-702. doi: 10.1016/j.ajodo.2016.04.018.
9. Chaushu S, Becker T, Becker A. Impacted central incisors: factors affecting prognosis and treatment duration. Am J Orthod Dentofacial Orthop. 2015; 147(3):355-62. doi: 10.1016/j.ajodo.2014.11.019.
10. Brand A, Akhavan M, Tong H, Kooka YA, Zernik JH. Orthodontic, genetic, and periodontal considerations in the treatment of impacted maxillary central incisors: a study of twins. Am J Orthod Dentofacial Orthop. 2000;117(1):68-74. doi: 10.1016/s0889-5406(00)70250-2.
11. Vermette ME, Kokich VG, Kennedy DB. Uncovering labially impacted teeth: apically positioned flap and closed-eruption techniques. Angle Orthodontist. 1995;65(1):23-32. doi: 10.1043/0003-3219(1995)065 <0023: ULITAP>2.0.CO;2.
12. Suri S, Utreja A, Rattan V. Orthodontic treatment of bilaterally impacted maxillary canines in an adult. Am J Orthod Dentofacial Orthop. 2002;122(4):429-37. doi: 10.1067/mod.2002.126406.
13. Lundberg M, Wennström JL. Development of gingiva following surgical exposure of a facially positioned unerupted incisor. J Periodontol. 1988; 59(10): 652-5. doi: 10.1902/jop.1988.59.10.652.
14. Rizzatto SM, de Menezes LM, Allgayer S, Batista Jr EL, Freitas MP, Loro RC. Orthodontically induced eruption of a horizontally impacted maxillary central incisor. Am J Orthod Dentofacial Orthop. 2015; 144(1):119-29. doi: 10.1016/j.ajodo.2012.08.028.
15. Becker A. Early treatment for impacted maxillary incisors. Am J Orthod Dentofacial Orthop. 2002; 121(6):586-7. doi: 10.1067/mod.2002.124171.
16. Consolaro A, Consolaro RB, Francischone LA. Orthodontic forced eruption: possible effects on maxillary canines and adjacent teeth. Dental Press J Orthod. 2010;15(6):18-24.