

Case report

Interceptive orthodontic traction of impacted maxillary incisors: clinical cases



Teresa Pinho^{a,b,*}, Viviana Carvalho^a

^a Instituto Universitário de Ciências da Saúde (IUCS), CESPU Instituto de Investigação e Formação Avançada em Ciências e Tecnologias da Saúde, Gandra, Portugal.

^b Instituto Biologia Molecular Celular, i3S – Instituto de Investigação e Inovação em Saúde. Universidade do Porto, Porto, Portugal.

ARTICLE INFO

Article history:

Received 25 February 2018

Accepted 27 July 2018

Available online 19 September 2018

Keywords:

Impacted tooth

Interceptive orthodontic treatment

Maxillary incisors

ABSTRACT

Impaction is a tooth's partial or total lack of eruption once the normal age for eruption has passed. It has a multifactorial etiology, and the most common factors are trauma, supernumerary teeth, and odontomas. In particular, the absence of a maxillary central incisor (MCI) due to impaction can pose several consequences for a person's facial aesthetics, chewing ability, and phonetics, thereby making the diagnosis and early treatment of MCI impaction are imperative. A primary approach to such treatment involves surgical exposure, orthodontic space opening, and the posterior traction of the incisor to its normal position, all of which benefits tooth maintenance and possibly even alveolar bone maintenance. As a contribution to clarifying those benefits, this article analyzes three clinical cases of individuals with impacted MCIs due to different causes—supernumerary teeth, root dilaceration, and eruption deviation—all of whom were submitted to treatment emphasizing orthodontic traction. (Rev Port Estomatol Med Dent Cir Maxilofac. 2018;59(2):107-114)

© 2017 Sociedade Portuguesa de Estomatologia e Medicina Dentária.

Published by SPEMD. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Ortodontia interceativa com tração de incisivos maxilares impactados: casos clínicos

RESUMO

A impactação é uma condição que descreve a falta total ou parcial de erupção de um dente após a idade normal para o efeito. É um distúrbio de etiologia multifatorial, sendo o trauma, os dentes supranumerários e odontomas os fatores etiológicos mais comuns. A ausência de um incisivo central maxilar pode acarretar várias consequências ao nível da estética, fonética e mastigação da criança. Assim, o diagnóstico e subsequente tratamento precoce tor-

Palavras-chave:

Dente incluído

Tratamento ortodôntico interceativo

Incisivo maxilar

* Corresponding author.

E-mail address: teresa.pinho@iucs.cespu.pt (Teresa Pinho).

<http://doi.org/10.24873/j.rpemd.2018.09.230>

1646-2890/© 2017 Sociedade Portuguesa de Estomatologia e Medicina Dentária. Published by SPEMD.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

nam-se imperativos. Uma das principais abordagens passa pela exposição cirúrgica, abertura ortodôntica de espaço e tração do incisivo para a sua posição normal, o que acarreta benefícios como a manutenção do dente e a possibilidade de manutenção do osso alveolar. Este artigo apresenta a análise de três casos clínicos de indivíduos portadoras de um incisivo central maxilar impactado com causa de impaction distinta nomeadamente dente supranumerário, dilaceração da raiz e desvio de erupção, submetidos a tratamento e destacando a tração ortodôntica. (Rev Port Estomatol Med Dent Cir Maxilofac. 2018;59(2):107-114)

© 2017 Sociedade Portuguesa de Estomatologia e Medicina Dentária.

Publicado por SPEMD. Este é um artigo Open Access sob uma licença CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

The maxillary incisors definitively shape a person's smile, and their development affects children's facial aesthetics, chewing, phonetics, and, in turn, psychology.¹ Typically, the eruption of a maxillary central incisor (MCI) occurs at 7 years of age,² when half to three-quarters of the root's final length has already developed.³ If the tooth does not erupt during that period and the homologous contralateral has already been in the dental arch for about 6 months, then impaction becomes a possibility, as a radiographic control can suggest.⁴

According to the American Association of Orthodontists, impaction is a tooth's partial or total lack of eruption once the normal age for eruption has passed.⁵ Concerning the etiology of impaction, it is important to highlight the influence of hereditary and environmental factors. Whereas supernumerary teeth, odontomas, cleft palate, craniofacial syndromes, and gingival fibromatosis rank among factors with the greatest genetic components, environmental factors include trauma, cystic pathology, maxillofacial skeletal insufficiency, and the early extraction, loss, or retention of deciduous teeth.⁶

MCIs play a crucial role in several aspects of a person's functioning and, for that reason, the absence of either of them can pose several negative consequences, including poor facial aesthetics and speech difficulty, namely with the "s" sound.⁷ Eruption failure in those teeth can affect the eruption of other teeth on the anterior level as well, namely the canine, due to the loss of space, middle line deviation, or reabsorption of the adjacent tooth or alveolar bone in the anterior region of the maxilla.^{8,9} Therefore, the diagnosis and early treatment of MCI impaction are imperative.

The conservative approach to treat an impacted MCI consists of extracting any obstruction, followed by recovering the space to enable the tooth's spontaneous eruption.¹⁰ However, if that eruption is impossible, then another approach becomes necessary – one involving surgical exposition, orthodontic space opening, and the posterior traction of the incisor to its normal position, all of which can benefit tooth maintenance and even alveolar bone maintenance.^{11,12} If those techniques fail, then more aggressive treatments are available, including incisor extraction and restoration with a bridge or implant after growth is completed or incisor extraction and closure of the space using the lateral incisor with subsequent prosthetic rehabilitation.⁽¹¹⁾

Case report

Clinical Case 1

An 8-year-old female at an early mixed dentition phase complained mainly of a late eruption of her right MCI. Her dental medical history did not include any accident or trauma. Clinical examination revealed a slight deviation of the superior midline tooth and the inclination of the adjacent teeth to the edentulous space. Moreover, the patient presented a bilateral class I molar and right unilateral posterior crossbite in the maximum intercuspal position (Figure 1). Periapical radiographic examination further revealed an intraosseous impaction of her right MCI caused by the presence of a supernumerary tooth. Panoramic radiography and teleradiography confirmed the presence of all permanent teeth, with the im-



Figure 1. Clinical case 1: Photos before treatment; crossbite and right upper incisor inclusion

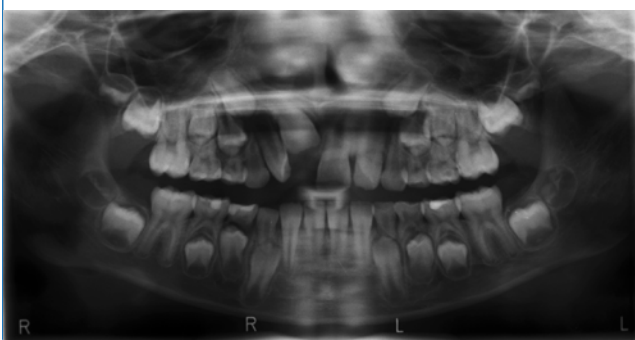
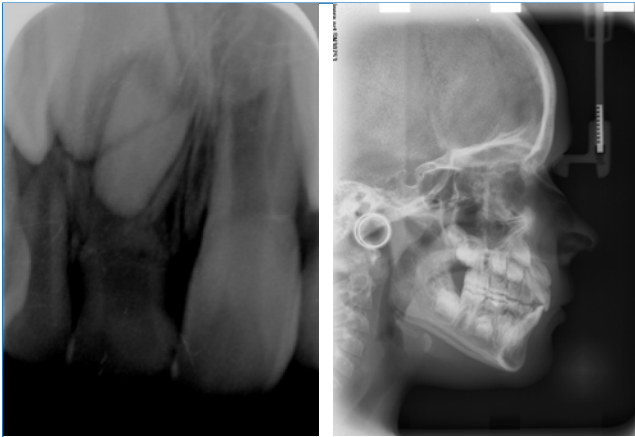


Figure 2. Clinical case 1: Periapical x-ray with a mesiodens; teleradiography and panoramic x-ray after mesiodens extraction



Figure 4. Case 1: Photos and panoramic x-ray after treatment

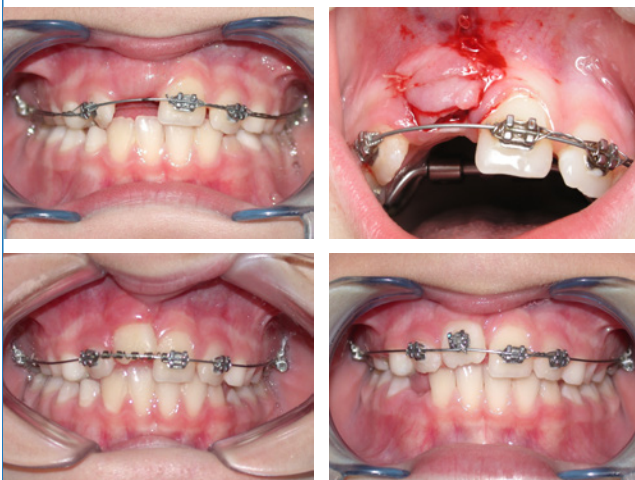


Figure 3. Clinical case 1: Orthodontic treatment with palatal disjunctor and partial upper fixed appliance; an apical repositioning of the flap in order to facilitate the auto-eruption.

paction of the right MCI vertically and over the dental arch line (Figure 2).

Treatment began with the extraction of the obstructive supernumerary tooth, which could have sufficiently enabled the impacted tooth's eruption. However, given the patient's right unilateral posterior crossbite in the maximum intercuspatal position, the correction required palatal disjunction. Space recovery and the vertical position of the impacted incisor provided accommodating conditions for a spontaneous eruption, particularly given the small incision in the mucosa that might have facilitated eruption. However, a sectional fixed appliance was used to control the adjacent tooth—the lateral incisor on the same side (Figures 3 and 4).

The orthodontic interceptive treatment took six months.

Clinical Case 2

A 9-year-old female at an early mixed dentition phase complained mainly of her right MCI not have erupted. When questioned about the patient's dental medical history, her parents reported a traumatic episode that had affected the deciduous



Figure 5. Clinical case 2: Photos before treatment; right upper incisor inclusion

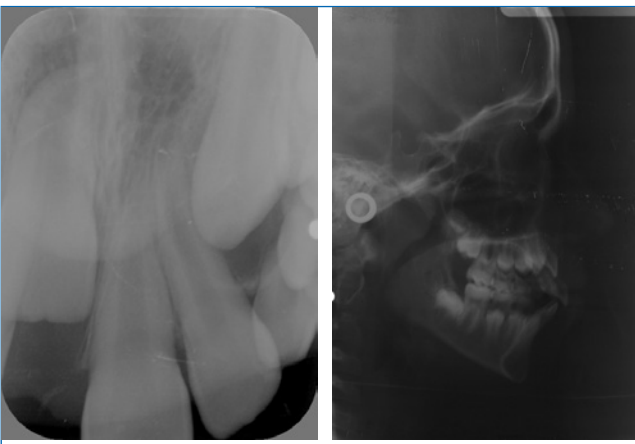


Figure 6. Clinical case 2: Periapical x-ray with right upper incisor root dilaceration; telerothography and panoramic x-ray before orthodontic treatment



Figure 7. Clinical case 2: Orthodontic treatment with partial upper fixed appliance



Figure 8. Clinical case 2: Photos and panoramic x-ray after interceptive treatment

incisors. Clinical and radiographical examination confirmed the right MCI's dilaceration and impaction. The patient exhibited a deviation of the upper dental line to the right considering the lower dental midline, a class I molar, and space in the dental arch for the incisor's eruption (Figure 5). Panoramic radiography and lateral telerradiography revealed the impacted right MCI with the evident root dilaceration (Figure 6).

Treatment involved a sectional fixed orthodontic appliance with bands at the level of the maxillary first molars and brackets over the other maxillary incisors, first with a round section arch and later with a rectangular one, all with the aim of distalizing the root of the lateral incisor on the same side and tractioning the impacted tooth. The surgical exposure of the impacted incisor was achieved via the closed eruption technique, after which an orthodontic accessory was applied (Figures 7 and 8).

The orthodontic interceptive treatment took fourteen months.

Clinical Case 3

An 8-year-old female at an early mixed dentition phase visited the dentist with her right MCI unerupted. Her dental medical history did not reveal any event or element that justified the absence of the tooth. Intraoral examination confirmed the presence of an edentulous space corresponding to the right MCI, with a mesialization of the adjacent teeth and a misalignment of the teeth at midline. The patient presented a class II right molar and a class I left molar, as well as a right unilateral posterior crossbite in the maximum intercuspatal position (Figure 9). Radiographic examination revealed a horizontal tooth with its incisal edge faced upward (Figure 10).

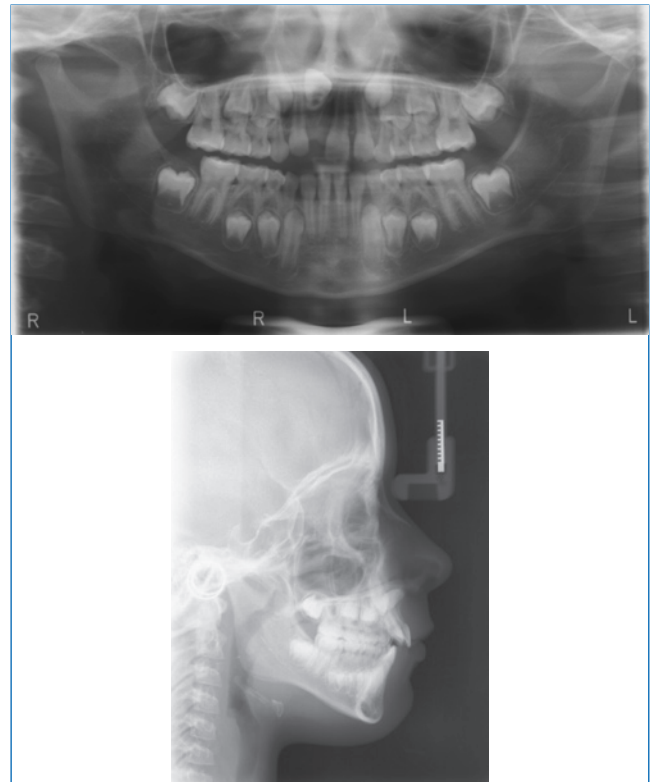


Figure 10. Clinical case 3: Panoramic x-ray with right upper incisor included horizontally in a high position; telerradiography before orthodontic treatment



Figure 9. Clinical case 3: Photos before treatment; right upper incisor inclusion



Figure 11. Clinical case 3: Orthodontic treatment with palatal disjunctur and partial upper fixed appliance; removal appliance to retain

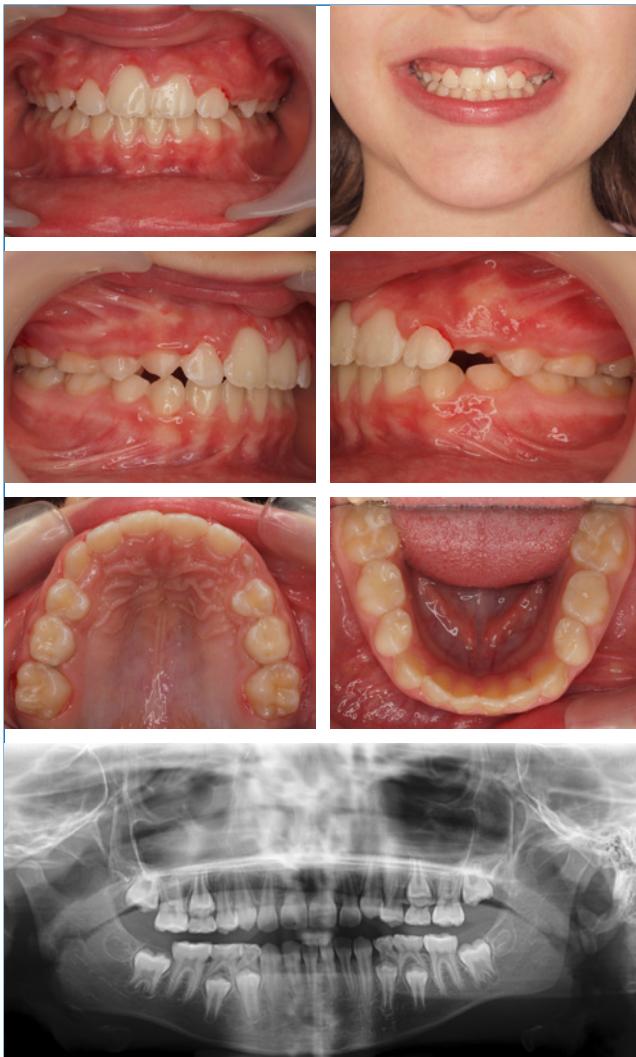


Figure 12. Clinical case 3: Photos and panoramic x-ray after interceptive treatment

To simultaneously gain space and correct the posterior crossbite, a palatal expander with a modified vestibular arch was used as an anchor for the traction of the impacted tooth. Using the closed eruption technique, surgical exposure of the impacted tooth and orthodontic accessory adhesion were achieved. The traction was made using an elastic chain replaced periodically (mostly monthly) that bonded the impacted incisor to the vestibular arch, after which a sectional fixed appliance was placed for leveling. However, due to the patient's poor hygienization, the fixed appliance was removed ahead of schedule and replaced with a removable retainer (Figures 11 and 12).

The orthodontic interceptive treatment time took eighteen months.

Discussion and conclusions

The absence of an MCI exerts a great negative impact on the dental functions and facial aesthetics of a child, as well as major repercussions on their self-esteem and social well-being.

Contrary to what occurs with other teeth, and as proven by the clinical cases here presented, eruptive disorders involving the MCI are frequently detected at the early mixed dentition phase.³ Detailed clinical history and both clinical and radiographic examinations are pivotal for making a correct diagnosis.² In particular, the clinical history is invaluable to screen for possible local or systemic pathologies or the occurrence of trauma during childhood.^{10,13} In Case 2, the patient's history prior to tooth impaction, in association with a traumatic episode involving the MCI's predecessor, demonstrates that traumatology is an important etiological factor of this pathology and is usually responsible for the dilaceration of MCIs that prompts impaction.^{14,15} Dilaceration refers to the displacement of a tooth's root in relation to its normal alignment with the crown.¹⁶ Such deformity can pose complications for impacted tooth treatment since the curved root can affect the adjacent teeth or enter the labial cortical bone, which causes pulp and periapical problems.^{17,18} Case 2 presented an MCI with an apical dilaceration of moderate severity, and its treatment was achieved without complications, probably because during traction the apex slipped into the bone marrow, despite being close to the intermaxillary suture.

When impaction of an MCI is suspected, it is essential to search for certain indications of impaction in clinical examinations – namely, an asymmetrical eruption with the homologous contralateral for roughly 6 months, the alteration of the sequence or chronology of eruption, deciduous tooth retention, midline deviation, loss of space, and elevations in the soft palatine tissue or labial mucosa.¹³ Following a careful clinical examination, it is imperative to use a complementary means of diagnosis. In all clinical cases presented, panoramic radiography and lateral telerradiography were important methods for studying the impacted MCI and general orthodontics.

With all the requisite information, it is possible to establish a diagnosis and elaborate a treatment plan. Once complete, the symbiosis of several medical specialties may be necessary.^{19,20} In response to the situation, several treatment options are available.

In Case 1, the first step of treatment consisted of eliminating the supernumerary tooth, which was the obstructive element that had caused impaction. Following its removal and achieving space via palatine disjunction, a spontaneous incisor eruption was verified. However, the eventual spontaneous eruption will rely on several factors, including the initial localization and eruptive potential of the incisor, its axial tilt, the restrictions of space, the degree of root formation, and the patient's age.²¹ When those factors are not ideal, spontaneous eruption does not occur, thereby requiring orthodontic traction, which was the solution in Cases 2 and 3. The surgical orthodontic approach is a solution often used to save an impacted incisor, normally in three stages: recovery of the space in the arch, surgical exposure, and orthodontic traction. In the first stage, the surrounding teeth, which act as anchors, should be united using an orthodontic appliance and the necessary space for the impacted tooth eruption created. Surgical exposure in case of an impacted maxillary incisor should be very cautious due to its aesthetically strategic location, and the careful handling of the soft tissues can provide an aesthetically pleasing result in the long run.²² That intervention can be performed using three techniques: window excision of the soft tissues, apical repositioning of the flap, and the closed eruption

technique. The closed eruption technique is the preferred method, especially in cases in which the tooth is above the mucogingival line or deep in the alveolus.²³ Shi et al. concluded in their study that the closed eruption technique was the best option to save and treat impacted maxillary incisors, given results that showed several advantages associated with that technique. Those advantages included lack of discomfort, no wound infection and no need for a longer treatment, as well as the potential to use the root growth in full during treatment and reduce the tensile force exerted on the impacted incisors, which prevents negative effects in the adjacent anchoring teeth. Other benefits include the possibility of the impacted tooth erupting in its normal position and the rest of the root developing normally, which contributes to the development of a proper gingival contour.²⁴ Following the execution of the technique in 30 patients, another study found no radiographic signs of root reabsorption or periapical radiolucency on the impacted tooth. Furthermore, the alveolar bone crest contours on the lingual side or labial side presented a U shape without fenestrations or dehiscences.¹ Given those advantages documented in the literature on the topic, the closed eruption technique was the chosen approach in the clinical cases here presented that required traction (Cases 2 and 3) to obtain certain aesthetic results.

Above all, in such pathological situations, it is critical to warn the patient and their parents or guardians of the possibility of treatment failure before they engage in any kind of procedures to treat the impacted maxillary incisor.⁽²⁵⁾

The clinical cases here presented show that MCI impaction can be sustained by different etiological factors with distinct repercussions in the positioning of the affected tooth and adjacent structures. The cases emphasize the importance of orthodontics as a means of treating this pathology, provided that careful clinical and radiographic examinations be performed first. The cases show the efficiency of the surgical orthodontic approach as a treatment to achieve the best aesthetic and functional results, bearing in mind the distinct etiology of the impacted MCI and the clinical repercussions.

Ethical disclosures

Protection of human and animal subjects. The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

Conflicts of interest

The authors have no conflicts of interest to declare.

REFERENCES

- Shi X, Xie X, Quan J, Wang X, Sun X, Zhang C, Zheng S. 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;148:587-98.
- Mannathoko-Molefhe B, Hu R. Management of Impacted Maxillary Central Incisor: Modified Nance Arch Application. *J Contemp Dent Pract.* 2015;16:415-21.
- Becker A. Early treatment for impacted maxillary incisors. *Am J Orthod Dentofacial Orthop.* 2002;121:586-7.
- Manasse RJ, Atsawasuwan P, Conroy C. Treatment of Labially Impacted Upper Central Incisors. *J Clin Orthod.* 2015;49:701-10.
- American Association of Orthodontists. *AAO Glossary* 2012. [Accessed 3 March 2017].
- Yaqoob O, O'Neill J, Gregg T, Noar J, Cobourne M, Morris D. Management of unerupted maxillary incisors. 2010. [Accessed June 2017].
- Weinberg B. A cephalometric study of normal and defective/s/articulation and variations in incisor dentition, *J Speech Lang Hear Res.* 1968;11:288-300.
- Chausu S, Zilberman Y, Becker A. Maxillary incisor impaction and its relationship to canine displacement, *Am J Orthod Dentofacial Orthop.* 2003;124:144-50.
- Muthumani T, Rajasekaran M, Veerabahu M, Indra, R. Interdisciplinary management of impacted maxillary central incisor with dilacerated crown. *J Endod.* 2011;37:269-71.
- Huber KL, Suri L, Taneja P. Eruption disturbances of the maxillary incisors: a literature review. *J Clin Pediatr Dent.* 2008;32:221-30.
- Lin Y-TJ. Treatment of an impacted dilacerated maxillary central incisor, *Am J Orthod Dentofacial Orthop.* 1999;115:406-9.
- Rizzato SM, de Menezes LM, Allgayer S, Batista EL Jr, Freitas MP, Loro, RC. Orthodontically induced eruption of a horizontally impacted maxillary central incisor. *Am J Orthod Dentofacial Orthop.* 2013;144:119-29.
- Pavoni C, Mucedero M, Lagana G, Paoloni V, Cozza P. Impacted maxillary incisors: diagnosis and predictive measurements. *Ann Stomatol.* 2012;3:100-5.
- Chausu S, Dykstein N, Ben-Bassat Y, Becker A. Periodontal status of impacted maxillary incisors uncovered by 2 different surgical techniques. *J Oral Maxillofac Surg.* 2009;67:120-4.
- Cozza P, Marino A, Condo R. Orthodontic treatment of an impacted dilacerated maxillary incisor: A case report. *J Clin Pediatr Dent.* 2005;30:93-8.
- American Association of Endodontists. *Glossary of Endodontic Terms.* 2015. [Accessed at 10 March 2017]
- Uematsu S, Uematsu T, Furusawa K, Deguchi T, Kurihara S. Orthodontic treatment of an impacted dilacerated maxillary central incisor combined with surgical exposure and apicoectomy. *Angle Orthod.* 2004;74:132-6.
- Xue JJ, Ye NS, Li JY, Lai WL. Management of an impacted maxillary central incisor with dilacerated root. *Saudi Med J.* 2013;34:1073-9.
- Bayram M, Ozer M, Sener I. Maxillary canine impactions related to impacted central incisors: two case reports. *J Contemp Dent Pract.* 2007;8:72-81.
- Pavlidis D, Daratsianos N, Jager A. Treatment of an impacted dilacerated maxillary central incisor. *Am J Orthod Dentofacial Orthop.* 2011;139:378-87.
- Smaliene D, Sidlauskas A, Bucinskiene J. Impaction of the central maxillary incisor associated with supernumerary teeth: initial position and spontaneous eruption timing. *Stomatologija.* 2006;8:103-7.

22. Chandhoke TK, Agarwal S, Feldman J, Shah RA, Upadhyay M, Nanda R. An efficient biomechanical approach for the management of an impacted maxillary central incisor. *Am J Orthod Dentofacial Orthop.* 2014;146:249-54.
23. Sabuncuoglu FA, Olmez H. Orthodontic treatment of a patient with unerupted maxillary central and lateral incisors and canine: a case report. *Aust Dent J.* 2012;28:80-5.
24. Shi XR, Hu Z, Wang XZ, Sun XY, Zhang CY, Si Y, Zheng SG. Evaluation of the Effect of the Closed-eruption Technique on Impacted Immature Maxillary Incisors, *Clin J Dent Res.* 2015;18:111-5.
25. Brand A, Akhavan M, Tong H, Kooka Y, 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;117:68-74.