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INTERCEPTIVE RECOVERY OF IMPACTED MAXILLARY CENTRAL INCISOR WITH INCOMPLETE ROOT FORMATION IN THE EARLY MIXED DENTITION: A CASE REPORT

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ABSTRACT

Introduction: Impaction of a permanent maxillary central incisor is a rare condition with a reported incidence of around 0.06 –0.2%, caused by several etiological factors that results in compromised esthetics and speech. Management includes surgical removal of any physical obstruction in the incisor eruption path, followed by either spontaneous tooth eruption or actively erupting it with an orthodontic appliance. **Case Description:** This report describes the interceptive management of an impacted left maxillary central incisor (LMCI) in an eight-year-old girl with a history of an avulsion injury to its primary predecessor. Clinical assessment revealed an adequate space in the maxillary arch for the unerupted incisor and the radiographic assessment confirmed a labial impaction of the LMCI with a favorable position. The LMCI had an incomplete root and no obvious physical obstruction so was managed by surgical exposure and orthodontic traction. **Treatment results:** The LMCI was adequately aligned with normal periodontal tissues and there were no adverse effects on the maxillary dentition. **Conclusion:** Recovery of an impacted maxillary central incisor is crucial, as this tooth has an important role in facial esthetics and speech. The close collaboration of the orthodontist and the oral surgeon resulted in the successful recovery of the tooth. Cases of impacted maxillary incisors must be assessed individually, and the risks/benefits of treatment must be weighed carefully and clearly explained to parents/legal guardians before treatment.

KEY WORDS: Interceptive Orthodontics, Delayed Eruption, Dental Trauma, Incisor Eruption, Impacted Incisor

INTRODUCTION

Impaction of a permanent central incisor is considered when the contralateral central incisor has erupted more than six months prior[(1)]. It is a rare condition with a reported incidence of around 0.06 –0.2%, followed by third molars and maxillary canine impaction[(2,3)]. Traumatic dental injuries (TDIs) to maxillary primary incisors have been linked to the failed eruption of their permanent successors[(4)].

Upper incisors are usually on display during talking and smiling, as well as playing an important role in the pronunciation of certain letters, so conditions that result in the absence of any of these teeth will have a profound negative effect on facial esthetics and speech[(5)]. Therefore, it is important to manage the failure of these teeth to attain their normal position within the maxillary dental arch.

This case report presents the successful interceptive recovery of an impacted maxillary

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central incisor during early mixed dentition with a history of avulsion injury to its primary predecessor, that had failed to erupt spontaneously.

Case Description

An 8-year-old girl attended to the orthodontic clinic with a chief complaint of a gap in the upper front teeth area, and a front tooth that did not erupt. She had fallen on her mouth and lost the left primary maxillary incisor two and a half years ago while playing. The clinical examination revealed that the patient was in the early mixed dentition stage, with all the upper permanent incisors present except the left maxillary central incisor (LMCI). There was a 12mm gap related to the missing LMCI position and the maxillary left lateral incisor was excessively proclined compared to other incisors. On palpation, there was no noticeable pulge in the location of LMCI either labially or palatally. Also, the patient had suboptimal oral hygiene with stained teeth and generalized marginal gingivitis (Figure 1).

The initial radiographic assessment involved orthopantomography (OPG) showing normal anatomical and bony structures of the jaws, developing permanent teeth, and the LMCI within the maxilla. The LMCI crown was at the level of the middle third of the root of the right maxillary central incisor (RMCI) vertically, and the mesiodistal angulation of the LMCI to the midline was favorable (Figure 2). Cone beam computed tomography (CBCT) was performed to assess the three-dimensional position and root morphology of the LMCI. The sagittal view revealed that the LMCI was positioned labially and the root inclined towards the palate. The LMCI root had an open apex and measured 8.2 mm in length, 4 mm shorter compared to the RMCI root (10.2 mm). Also, CBCT showed a slight overlap of the LMCI with the mesial aspect of the root of the left lateral incisor from the labial aspect, which explains the proclination of the left lateral incisor. No root dilaceration of the LMCI or any sign of resorption of the roots of neighboring incisors was detected (Figure 3).

The patient was referred to an oral surgeon for assessment of the surgical approach to expose the LMCI. A closed exposure was performed from the labial side to ensure minimal trauma to the bone and soft tissues and to avoid any possible damage to the root of the left lateral incisor, and a gold chain was bonded on the labial surface of the crown of LMCI (Figure 4). The patient was followed up for 6 months to allow for spontaneous eruption of the impacted LMCI. There was no clinical sign of spontaneous eruption of LMCI after 6 months, as indicated from the unchanged number of links in the orthodontic chain emerging from the gum immediately post-surgery and at the review appointment. At this visit, the decision was made to actively erupt the LMCI.

FIG (1) A pre-treatment intraoral view showing the space of the unerupted LMCI.

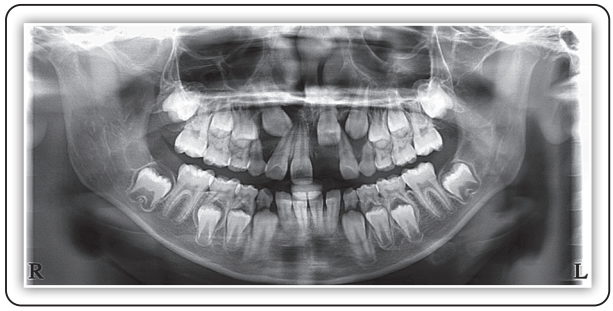

FIG (2) Pre-treatment OPG. The LMCI crown at the level of the middle third of the root of the RMCI, with a favorable angulation in relation to midline.

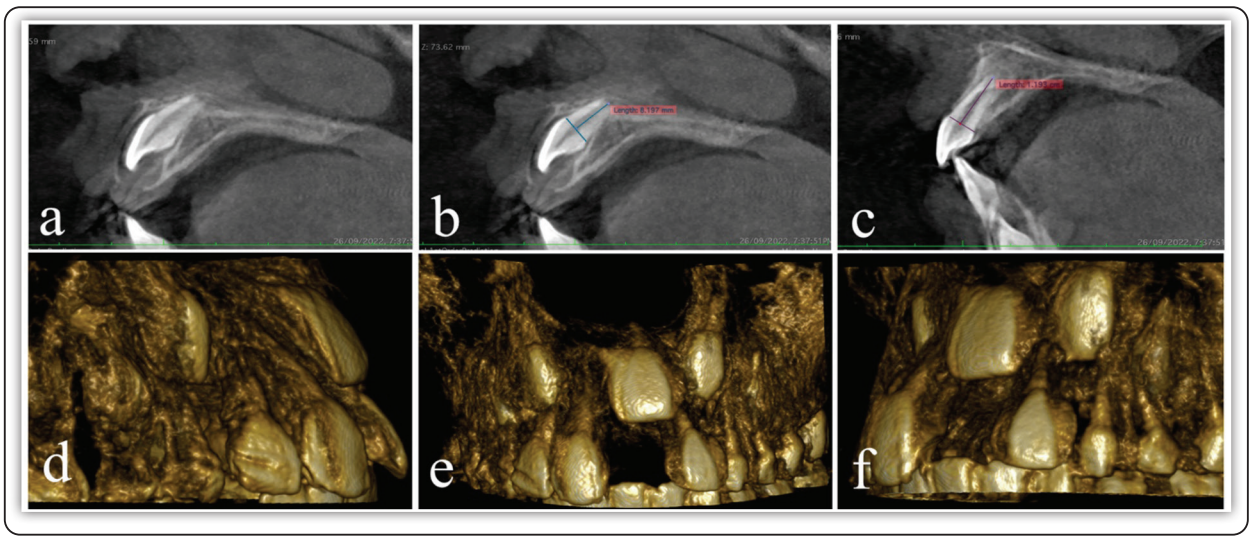

FIG (3) Different CBCT views of the unerupted LMCI. (a) sagittal view shows the LMCI with an open apex and the impaction in the labial side. (b) shows the length of the LMCI root to be about 8.2 mm, shorter by about 4 mm when compared to the root of the RMCI (c). (d, e, and f) are different three- dimensional views showing the positional relationship of the LMCI to the neighboring teeth.

A 2 by 4 partial fixed orthodontic appliance (0.022 x 0.028-inch slot size, MBT prescription) was used for the traction of the LMCI. A trans-palatal arch (TPA) was fabricated and inserted at the beginning of the orthodontic treatment phase to control vertical anchorage. However, the patient could not tolerate the appliance due to severe discomfort and chewing difficulty for the following few days and it was removed upon the patient's demand. Although quite rare, such problems with TPA have been reported in a previous study[6]. Given the patient was in the early mixed dentition stage, only the erupted three permanent incisors and the first permanent molars were available for vertical anchorage during traction. The risk of only a few teeth available for vertical anchorage during the impacted incisor traction was explained to the parent. Also, the orthodontist ensured that only light forces not exceeding 50 grams were applied during the activation of the appliance.

Orthodontic brackets were placed passively and a 0.02-inch round stainless steel (SS) archwire was used as a base wire to prevent torquing the roots of the incisors in any direction. A step-down bend was placed in the base archwire between the brackets of the RMCI and the left lateral incisor to prevent the slippage of the wire mesiodistally and to prevent the drift of the neighboring incisors in the LMCI space during traction. The orthodontic chain bonded to the LMCI was actively engaged with a series of nickel-titanium (NiTi) overlay wires (piggyback mechanics) until the emergence of the tooth into the oral cavity (Figure 5). The patient was given a recall visit every four weeks to assess the treatment progress and reactivate the appliance. The chain was replaced with an orthodontic bracket and the alignment of the tooth was continued when sufficient labial surface of the LMCI was exposed.

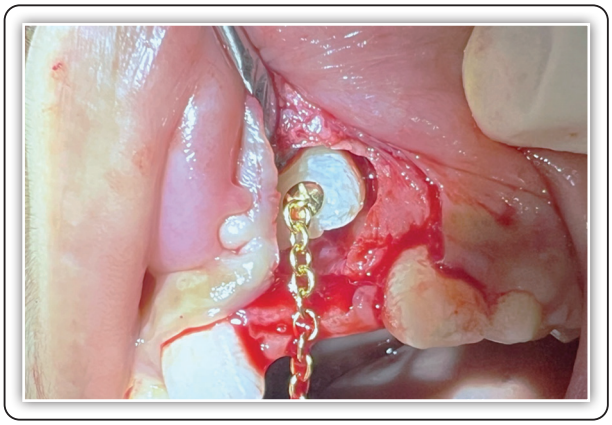

FIG (4) A full-thickness flap is raised and the orthodontic chain is bonded on the labial surface of the LMCI.

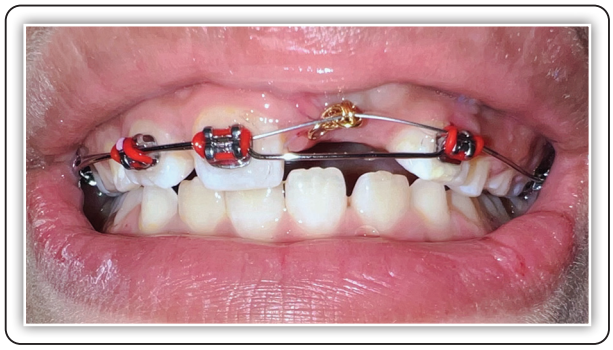

FIG (5) Frontal intra-oral view showing the mechanics used for traction of the LMCI. A 2 by 4 partial fixed appliance with a piggyback NiTi wire engaging the orthodontic chain to apply light vertical traction force.

Treatment results

The overall duration of the orthodontic stage of treatment was seven months. Clinically, the LMCI was adequately aligned with the rest of the incisors, a normal pocket depth when measured from six points around the clinical crown, and a 4mm wide attached gingiva. The treatment did not adversely affect the position of the other maxillary incisors, especially in the vertical direction (Figure 6). Radiographically, post-treatment OPG revealed good root alignment of the LMCI and normal bone level mesially and distally (Figures 7 and 8).

However, the patient failed to maintain good oral hygiene towards the end of orthodontic treatment and there was extensive gingival inflammation present around the bonded teeth.

FIG (6) Post-treatment intra-oral frontal view showing the recovered LMCI.

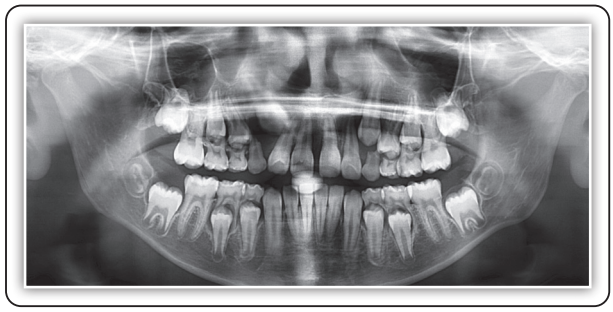

FIG (7) Post-treatment OPG showing good alignment of the recovered LMCI.

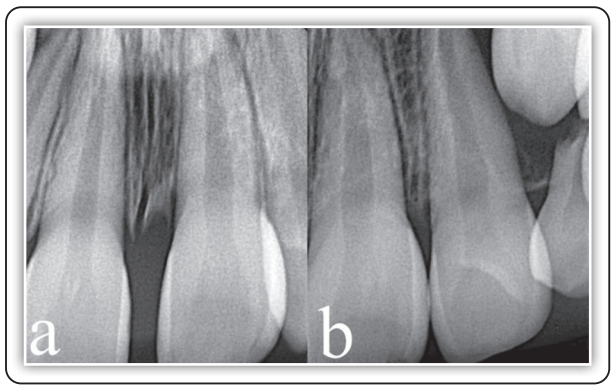

FIG (8) Periapical radiographs showing normal interproximal bone level around the recovered LMCI from (a) mesial and (b) distal aspects.

DISCUSSION

At the age of this patient, the delayed eruption of a permanent central incisor is usually noticeable by children and parents[7]. Next to intrusion injuries, avulsion of the primary incisor has the highest prevalence of damage to the underlying permanent incisor[8,9].

OPG allows viewing of the entire area of the developing dentition in the mixed dentition phase at a relatively reduced radiation dose and cost[10,11]. However, CBCT is indicated in assessing impacted teeth for relative position to surrounding structures, any resorption affecting the neighboring teeth, and accurate surgical and orthodontic treatment planning[12]. CBCT assessment confirmed that the LMCI had no root dilaceration, which is less likely to occur in the case of an avulsion injury to its predecessor[13]. CBCT also revealed that the

LMCI root had an open apex and was 4 mm shorter compared to the normally erupted RMCI. A recent systematic review reported that impacted incisors have shorter roots compared to normally erupted incisors, even after successful traction[14].

Closed surgical exposure is reported to be the technique of choice to achieve the best outcomes in terms of gingival health and esthetics[15–17]. The 2 by 4 partial fixed orthodontic appliance is a versatile appliance that allows precise control over teeth positions, does not rely on patient compliance, and is indicated for recovery of impacted upper incisors in the early mixed dentition[18].

The decision to allow time for spontaneous eruption of the tooth after the surgical exposure and bonding of the orthodontic chain was based predominantly on the age of the patient at the time of intervention, the favorable tooth position, and the incomplete root formation[19]. However, there was no sign of spontaneous eruption of the tooth after 6 months. At this stage, We decided to proceed with active traction of LMCI as there was evidence suggesting that it was unlikely for impacted incisors to spontaneously erupt with further wait [20].

The goal of intervention at this stage, given the patient was in early mixed dentition, was solely to recover the impacted incisor rather than achieve ideal tooth positioning. It was important to avoid moving the roots of lateral incisors toward the crowns of the developing canines for the risk of root resorption. Therefore, the brackets were placed passively on the incisors and a round 0.02-inch SS base archwire was used to avoid torquing the roots of the incisors, especially the left lateral incisor, which was also close to the crown of the impacted LMCI.

CONCLUSION

Recovery of an impacted maxillary central incisor is crucial, as this tooth has an important role in facial esthetics and speech. The close collaboration of the orthodontist and the oral surgeon during assessment, treatment planning, and commencement of treatment resulted in the successful recovery of the tooth. Cases of impacted maxillary incisors must be assessed individually, and the risks/benefits of treatment must be weighed carefully and explained clearly to parents/legal guardians before treatment.

REFERENCES

1. Seehra J, Yaqoob O, Patel S, O'Neill J, Bryant C, Noar J, et al. National clinical guidelines for the management of unerupted maxillary incisors in children. British Dental Journal 2018 224:10 [Internet]. 2018 May 25 [cited 2024 Oct 30];224(10):779–85. Available from: https://www.nature.com/articles/sj.bdj.2018.361
2. Cruz RM. Orthodontic traction of impacted canines: Concepts and clinical application. Dental Press J Orthod [Internet]. 2019 Jan 1 [cited 2024 Nov 22];24(1):74–87. Available from: https://pubmed.ncbi.nlm.nih.gov/30916252/
3. Al-Zoubi H, Alharbi AA, Ferguson DJ, Zafar MS. Frequency of impacted teeth and categorization of impacted canines: A retrospective radiographic study using orthopantomograms. Eur J Dent [Internet]. 2017 [cited 2024 Nov 22];11(1):117. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC5379823/
4. Lenzi MM, da Silva Fidalgo TK, Luiz RR, Maia LC. Trauma in primary teeth and its effect on the development of permanent successors: a controlled study. Acta Odontol Scand [Internet]. 2019 Jan 2 [cited 2024 Oct 6];77(1):76–81. Available from: https://pubmed.ncbi.nlm.nih.gov/30345854/
5. Tanki JZ, Talib Amin Naqash, Atul Gupta, Randhir Singh, Ankush Jamwal. Impacted maxillary incisors: Causes, Diagnosis and Management. IOSR Journal of Dental and Medical Sciences. 2013;5(2):41–5.
6. Mousa MM, Al-Sibaie S, Hajeer MY. Pain, Discomfort, and Functional Impairments When Retracting Upper Anterior Teeth Using Two-Step Retraction With Transpalatal Arches Versus En-Masse Retraction With Mini-implants: A Randomized Controlled Trial. Cureus [Internet]. 2023 Jan 9 [cited 2024 Dec 20];15(1). Available from: https://pubmed.ncbi.nlm.nih.gov/36636520/
7. Jeong Y, Shin J, Park S, Jeong T, Lee E. Morphometric Comparison and Prognostic Analysis of Permanent Maxillary Central Incisors with Eruption Disturbances-A Cross-Sectional Study. Children (Basel) [Internet]. 2024 Mar 1 [cited 2024 Nov 2];11(3). Available from: https://pubmed.ncbi.nlm.nih.gov/38539342/

8. De Fátima Guedes de Amorim L, Estrela C, Da Costa LRRS. Effects of traumatic dental injuries to primary teeth on permanent teeth--a clinical follow-up study. Dent Traumatol [Internet]. 2011 Apr [cited 2024 Oct 28];27(2):117–21. Available from: https://pubmed.ncbi.nlm.nih.gov/21199335/
9. Sennhenn-Kirchner S, Jacobs HG. Traumatic injuries to the primary dentition and effects on the permanent successors - a clinical follow-up study. Dent Traumatol [Internet]. 2006 Oct [cited 2024 Oct 28];22(5):237–41. Available from: https://pubmed.ncbi.nlm.nih.gov/16942552/
10. Tsiklakis K, Mitsea A, Tsichlaki A, Pandis N. A systematic review of relative indications and contra-indications for prescribing panoramic radiographs in dental paediatric patients. Eur Arch Paediatr Dent [Internet]. 2020 Aug 1 [cited 2024 Nov 1];21(4):387–406. Available from: https://pubmed.ncbi.nlm.nih.gov/31602555/
11. American Academy of Pediatric Dentistry. Prescribing dental radiographs for infants, children, adolescents, and individuals with special health care needs. In: The Reference Manual of Pediatric Dentistry. Chicago: American Academy of Pediatric Dentistry; 2024. p. 313–7.
12. Taju W. Evolution of Assessment of Impacted Maxillary Canines from Plain Radiographs to Cone Beam Computed Tomography. Journal of Umm Al-Qura University for Medical Sciences. 2024 Jun 30;10(1):1–11.
13. Y Zilberman, A Fuks, Y Ben Bassat, I Brin, J Lustmann. Effect of trauma to primary incisors on root development of their permanent successors - PubMed. Pediatr Dent [Internet]. 1986 [cited 2024 Oct 28];8(4):289–93. Available from: https://pubmed.ncbi.nlm.nih.gov/3472176/
14. Žarovienė A, Grinkevičienė D, Trakinienė G, Smailienė D. Post-Treatment Status of Impacted Maxillary Central Incisors following Surgical-Orthodontic Treatment: A Systematic Review. Medicina (Kaunas) [Internet]. 2021 Aug 1 [cited 2024 Nov 23];57(8). Available from: https://pubmed.ncbi.nlm.nih.gov/34440987/
15. Vermette ME, Kokich VG, Kennedy DB. Uncovering labially impacted teeth: apically positioned flap and closed-eruption techniques. Angle Orthod [Internet]. 1995 [cited 2024 Nov 3];65(1):23–32; discussion 33. Available from: https://pubmed.ncbi.nlm.nih.gov/7726459/
16. Becker A, Brin I, Ben-Bassat Y, Zilberman Y, Chaushu S. Closed-eruption surgical technique for impacted maxillary incisors: A postorthodontic periodontal evaluation. American Journal of Orthodontics and Dentofacial Orthopedics [Internet]. 2002 [cited 2024 Nov 3];122(1):9–14. Available from: https://pubmed.ncbi.nlm.nih.gov/12142887/
17. Bollero P, Danesi C, Ricchiuti MR, Milazzo A, Mampieri G, Agrestini C, et al. Long-term periodontal status of palatally and buccally impacted canines after closed surgical-orthodontic approach. Oral Implantol (Rome) [Internet]. 2017 Apr 1 [cited 2024 Nov 29];10(2):162. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC5965064/
18. Garrocho-Rangel A, Hernández-García G, Yáñez-González E, Ruiz-Rodríguez S, Rosales-Berber M, Pozos-Guillén A. 2 × 4 appliance in the mixed dentition stage: a scoping review of the evidence. J Clin Pediatr Dent [Internet]. 2023 Jan 1 [cited 2024 Dec 8];47(1):1–8. Available from: https://pubmed.ncbi.nlm.nih.gov/36627214/
19. Leyland L, Batra P, Wong F, Llewelyn R. A retrospective evaluation of the eruption of impacted permanent incisors after extraction of supernumerary teeth. J Clin Pediatr Dent [Internet]. 2006 [cited 2024 Nov 3];30(3):225–32. Available from: https://pubmed.ncbi.nlm.nih.gov/16683671/
20. Seehra J, Mortaja K, Wazwaz F, Papageorgiou SN, Newton JT, Cobourne MT. Interventions to facilitate the successful eruption of impacted maxillary incisor teeth due to the presence of a supernumerary: A systematic review and meta-analysis. Am J Orthod Dentofacial Orthop [Internet]. 2023 May 1 [cited 2024 Nov 16];163(5):594–608. Available from: https://pubmed.ncbi.nlm.nih.gov/36907703/