Contemporary Pediatric Dentistry

Case Report
Contemp Pediatr Dent 2025:6(1):70-78
DOI: 10.51463/cpd.2025.5

Surgical exposure and orthodontic traction of impacted maxillary central incisor after alteration of eruption sequence: A case report

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Highlights

- Tooth eruption is a multifactorial, individualized, and unpredictable process; comparison with the contralateral tooth is essential due to expected bilateral symmetry.
- Central incisor impaction was successfully managed through early intervention and ongoing adjustments during growth.
- Regular orthodontic monitoring enables early correction of abnormalities, supporting proper growth and successful treatment outcomes.

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Received: 10 Feb 2025
Accepted: 15 Apr 2025
Online First: 28 Apr 2025

Abstract

Delayed diagnosis of tooth eruption disturbances may result in the impaction of permanent teeth. This case report describes the clinical management of an impacted maxillary permanent central incisor in an 8-year-old boy with good general health, skeletal Class I relationship (ANB = 2°), posterior crossbite, and transverse maxillary deficiency. The patient underwent rapid palatal expansion, followed by orthodontic traction of the impacted incisor. Eruption was achieved within six months, and by the end of the mixed dentition stage, the patient exhibited a stable occlusion with successful alignment of the incisor. This case highlights the importance of early orthodontic assessment and continuous follow-up from the primary to permanent dentition. Timely diagnosis and treatment planning during growth can facilitate favorable outcomes and reduce the risk of future occlusal complications.

Keywords: Corrective; Delayed Diagnosis; Impacted; Orthodontics; Tooth Eruption

INTRODUCTION

Tooth eruption is a physiological process involving the axial movement of teeth from within the alveolar bone to their functional position in occlusion. Both primary and permanent dentitions follow a relatively predictable chronological eruption sequence. However, this process can be influenced by various factors, including ethnicity, sex, and local environmental conditions, which contribute to normal variations in eruption timing and may require complementary diagnostic examination.[1,2]

Prolonged retention of primary teeth is a multifactorial condition defined by the persistence of a primary tooth in the oral cavity beyond its expected exfoliation time. This condition is often associated with local, systemic, or genetic factors that contribute to the delayed eruption of the corresponding permanent successor.[1]

Tooth eruption typically begins once a developing tooth surpasses Nolla's stage 6 (approximately one-third root formation) and is expected to complete when root development is finalized. A tooth is considered impacted when it fails to erupt due to the cessation of its eruptive potential.[3–5]

The aim of this case report is to present the clinical management of an impacted maxillary permanent central incisor, which was successfully repositioned in the dental arch through surgical exposure and orthodontic traction.

CASE REPORT

Diagnostic and case description

An 8-year-old male patient presented with the chief complaint, "my teeth are not erupting." Clinical examination revealed delayed eruption of the permanent maxillary central incisor (Figure 1A–C). The patient was in good general health, reported no familial history of similar conditions, and had no history of dental trauma in the primary dentition. He maintained regular oral hygiene and exhibited an oral habit of onychophagia. Informed consent was obtained from the legal guardian.

Intraoral examination revealed a mixed dentition stage with Angle Class II molar relationship, Class I canine relationship, posterior crossbite, and transverse maxillary deficiency. The primary maxillary left central incisor had recently exfoliated. The upper dental arch was triangular in shape, while the lower arch was parabolic (Figure 1D–H). Panoramic radiography confirmed the presence of all permanent teeth, except the third molars. The permanent maxillary right and left central incisors were located at different vertical positions within the bone. Notably, the right central and lateral incisors were positioned on the same vertical plane, which was likely the main etiological factor behind the prolonged retention of the primary right central incisor (Figure 2A).

Lateral cephalometric analysis revealed a skeletal Class I anteroposterior relationship (ANB = 2°), with a balanced growth pattern (SN.GoGn = 35°, NSGn = 68°), mesofacial pattern (BaNa.PtGn = 87°), straight bone profile (NA.Pog = 6°), and a convex soft tissue profile (Ls–S = +1 mm; Li–S = 0) (Figures 2B and 2C).

Initial treatment plan

The primary objectives of the initial treatment were to correct the posterior crossbite and transverse maxillary deficiency, and to facilitate the eruption of the permanent maxillary right and left central incisors. Rapid palatal expansion (RPE) was performed using a modified Haas appliance, accompanied by the extraction of the primary maxillary right central incisor (Figure 3A). Given the difference in vertical positioning between the permanent maxillary right central and lateral incisors, extraction of the retained primary incisor was deemed necessary to reestablish the correct eruption sequence.

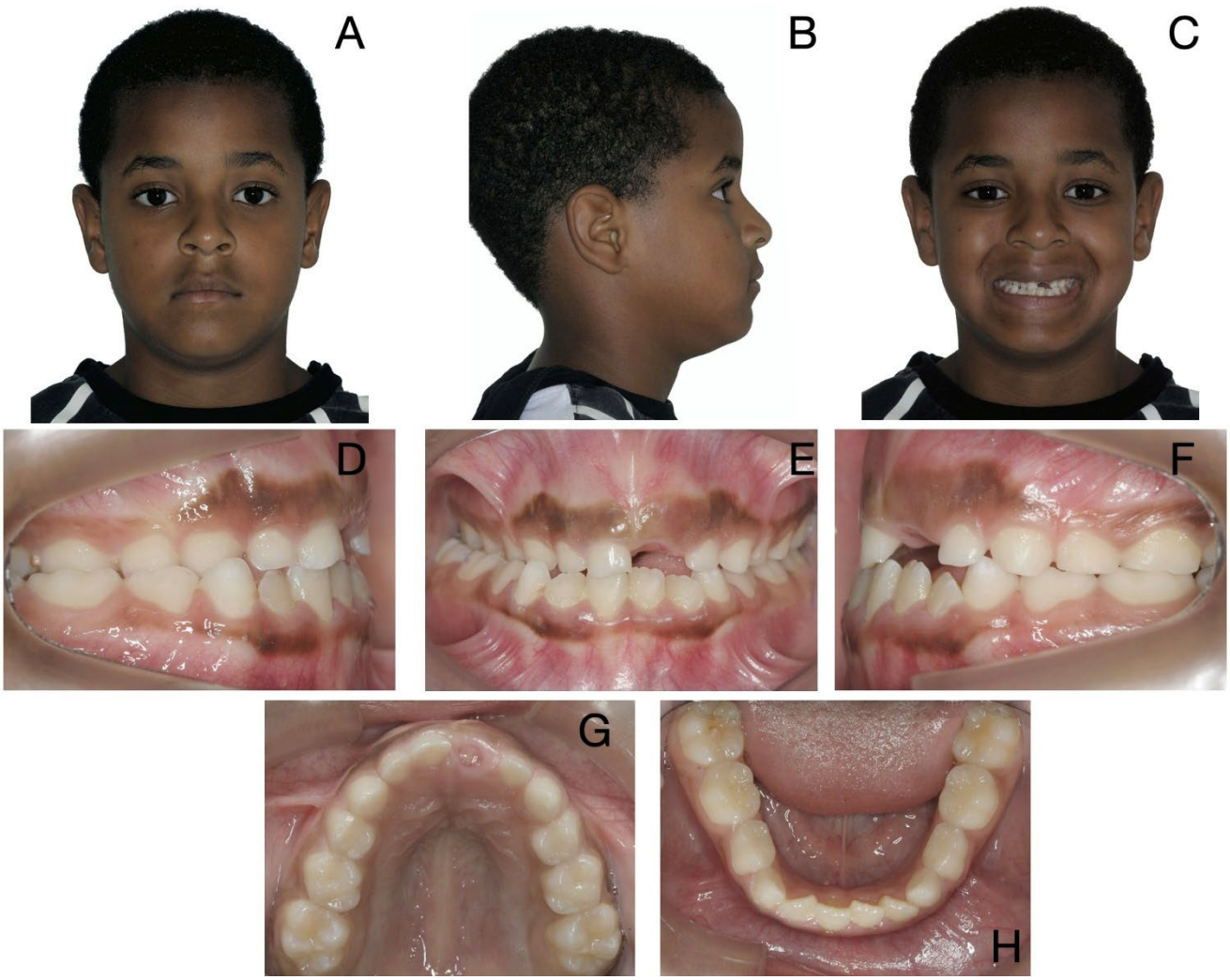

Figure 1. Pretreatment extraoral and intraoral photographs. A: Frontal facial view at rest; B: Right profile view; C: Frontal smiling view; D: Right intraoral view; E: Frontal intraoral view; F: Left intraoral view; G: Maxillary occlusal view; H: Mandibular occlusal view

Treatment progress

Posterior crossbite correction was achieved through overcorrection within three weeks. The expansion protocol involved activating the screw by one-quarter turn in the morning and one-quarter turn at night.[6,7] Once stopped the activation, the screw was immobilized with self-polymerizing acrylic resin. The appliance was kept over 6 months as retention period and once completed a removable appliance was used for one year [8]. Once the desired expansion was reached, screw activation was discontinued and the appliance was stabilized using self-polymerizing acrylic resin.

The modified Haas appliance remained in place for six months to serve as a retention device. Following this period, a removable appliance was used for an additional year.[8] During treatment, the permanent maxillary right lateral incisor erupted spontaneously, while the permanent maxillary right central incisor remained unerupted and at the intraosseous level (Figure 3B).

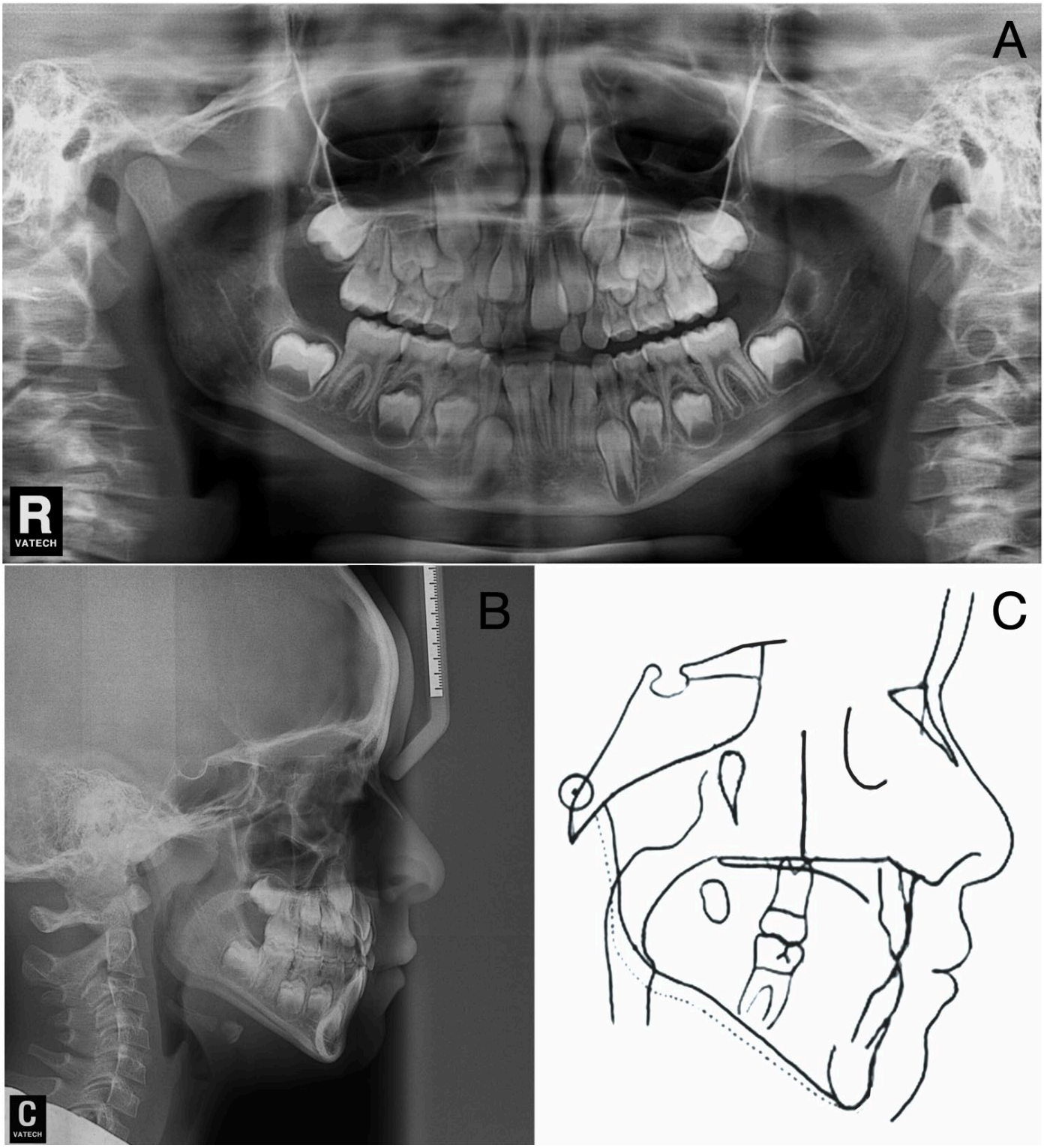

Figure 2. Pretreatment radiographic and cephalometric records. A: Panoramic radiograph showing developing dentition and impaction of the maxillary right central incisor; B: Lateral cephalogram; C: Cephalometric tracing illustrating skeletal and dental relationships

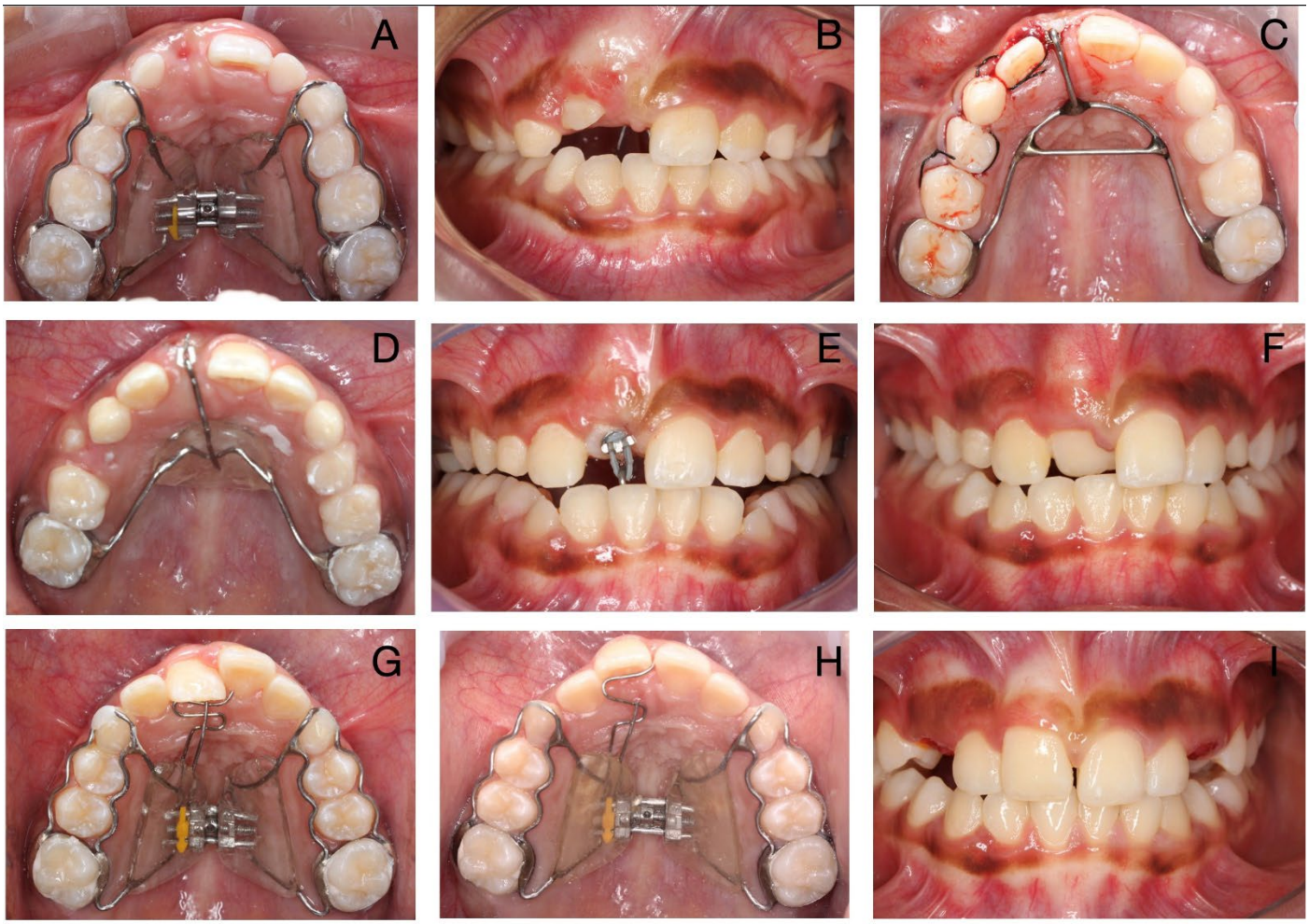

Figure 3. Intraoral photographs during orthodontic treatment. A: Rapid palatal expansion with Haas appliance; B: Frontal view showing altered eruption sequence and retained primary incisor; C: Nance appliance with hook for elastic traction; D: Occlusal view of Nance appliance; E: Frontal view showing orthodontic button and traction mechanics; F: Erupted but rotated maxillary right central incisor in crossbite; G: Second rapid palatal expansion with "S" spring for labial movement; H: Activation of "S" spring; I: Progressed alignment of the maxillary right central incisor

New orthodontic records revealed that the permanent maxillary right central incisor remained impacted and intraosseous, corresponding to stage 9 of Nolla's developmental stages. Given the absence of spontaneous eruption, a surgical approach was undertaken to expose the impacted tooth.

An orthodontic button was bonded to the labial surface of the exposed tooth, and a ligature wire was attached to facilitate traction. A palatal arch with a horizontal bar and hook was cemented to serve as anchorage for the elastic traction system (Figure 3C). Orthodontic traction was applied using an elastic chain extending from the appliance hook to the ligature wire on the impacted tooth. The elastic was replaced every fifteen days, with a consistent force of 60 grams-force (gF) applied to guide the eruption of the incisor.[9,10]

Two months after initiating traction, the palatal arch fractured and was subsequently replaced with a Nance palatal appliance, which included a hook embedded in the acrylic for continued elastic traction (Figures 3D and 3E). After six months of traction, the permanent maxillary right central

incisor successfully erupted. However, it presented with a notable palatal rotation, resulting in an anterior crossbite and insufficient space in the arch for proper alignment (Figure 3F).

To address the transverse deficiency and facilitate tooth alignment, a second phase of rapid palatal expansion (RPE) was performed using a new Haas expander. The same activation protocol—one-quarter turn in the morning and one-quarter turn at night—was followed for one week. An "S" spring was incorporated into the expander to apply labial force on the erupted incisor and guide it into proper alignment (Figure 3G).

Following cessation of screw activation, the "S" spring was activated by 1 mm every 30 days until optimal positioning of the incisor was achieved (Figures 3H and 3I).

The total treatment time was approximately four months. Satisfactory transverse maxillary width was achieved, along with successful positioning of the permanent maxillary right central incisor. The patient was monitored through the transition to permanent dentition and exhibited favorable facial aesthetics, Class I molar and canine relationships, coincident dental midlines, and well-aligned parabolic upper and lower arches. Mild crowding was observed in the lower arch, with normalized overjet and overbite. The patient was subsequently referred for comprehensive orthodontic treatment to finalize occlusal alignment and address residual details (Figures 4A–H).

DISCUSSION

This case report initiated with the diagnosis of a posterior crossbite associated with transverse maxillary deficiency, which was successfully corrected using a tooth-borne expander appliance during the patient's growth phase. Additionally, prolonged retention of the primary maxillary right central incisor led to impaction of its permanent successor. The favorable outcome was attributed to early intervention, timely diagnosis, and continuous re-evaluation and adjustment of the treatment plan throughout the patient's occlusal development.

Tooth eruption is closely synchronized with craniofacial growth and development. Understanding the average age of eruption is essential for effective orthodontic diagnosis and treatment planning. However, eruption timing is influenced by various factors, including ethnicity, genetics, sex, nutrition, and overall growth, making it a highly individualized and sometimes unpredictable process.[11] In the present case, comparison with the contralateral tooth played a pivotal role in the decision to extract the primary maxillary right central incisor, as the left central incisor had already exfoliated. This clinical observation aligns with studies indicating a high degree of bilateral symmetry in the eruption patterns of teeth within the same group.[12]

Clinical and radiographic evaluations are essential for diagnosing cases of delayed eruption, particularly through assessment of the exfoliation timing of primary teeth. The timely exfoliation of primary teeth is a key factor influencing the eruption of their permanent successors. Additionally, somatic development—specifically the individual's weight and height—should be considered, as these parameters have been shown to positively correlate with the timing of dental eruption.[11–13] Early removal of etiological factors contributing to delayed eruption—such as supernumerary teeth, odontomas, or prolonged retention of primary teeth—is essential to prevent complications.[14–16] In the present case, although delayed eruption of the permanent maxillary right central incisor was diagnosed early and the primary tooth was extracted, this intervention was insufficient to prevent inversion in the eruption sequence between the maxillary right central and lateral incisors.

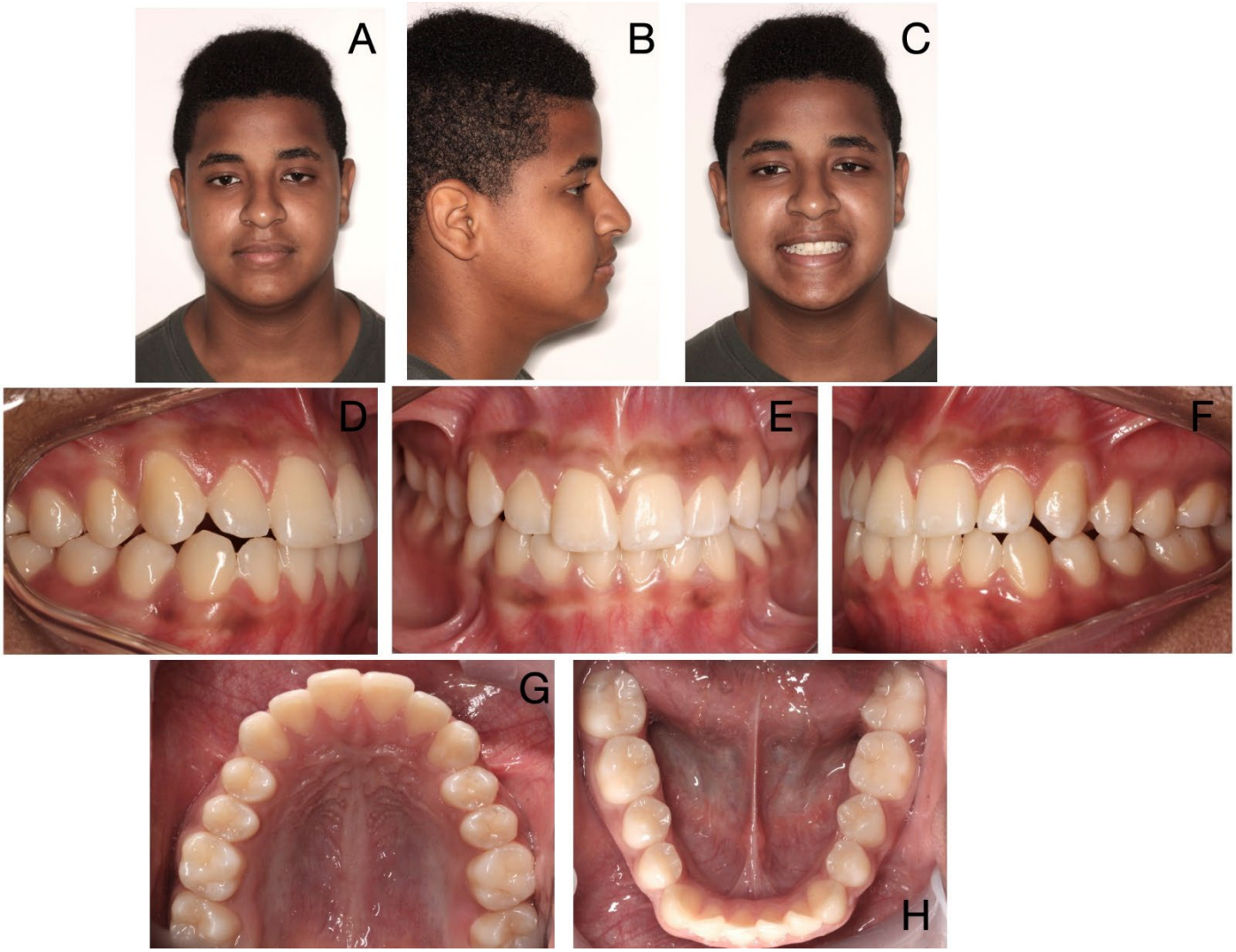

Figure 4. Post-treatment extraoral and intraoral photographs. A: Frontal facial view at rest; B: Right profile view; C: Frontal smiling view; D: Right intraoral view; E: Frontal intraoral view; F: Left intraoral view; G: Maxillary occlusal view; H: Mandibular occlusal view

A tooth typically erupts when approximately one-half to three-quarters of its final root length has developed.[17] A tooth is considered impacted when it fails to erupt within the expected timeframe and shows no clinical or radiographic signs of imminent eruption. For permanent maxillary central incisors, the expected eruption age is between 7 and 8 years.[18,19] Therefore, the diagnosis of impaction should be based on both clinical evaluation and radiographic assessment. Surgical exposure followed by orthodontic traction of an impacted tooth is a conservative approach with a high success rate. However, it carries potential risks, including damage to the periodontium, failure of tooth movement, ankylosis, or even resorption of adjacent teeth. When the impacted tooth is a central incisor, additional aesthetic, phonetic, and functional concerns must also be considered. Evidence indicates that complications such as root dilaceration and developmental anomalies increase with age. Moreover, studies have reported that impacted maxillary central incisors tend to have shorter roots compared to their contralateral counterparts.[20] In the present clinical case, orthodontic traction was successful in facilitating the eruption of the permanent maxillary right central inciso, with no complications observed.

Despite the success of the biomechanics employed, the tooth erupted in a palatal position, resulting in an anterior crossbite and insufficient space for proper alignment. To address this, a second rapid palatal expansion (RPE) procedure was performed to increase arch width. Additionally, a spring was incorporated into the expander to facilitate buccal movement of the permanent maxillary right central incisor. This combined approach effectively created the necessary space and enabled proper alignment of the tooth within the arch, thereby supporting age-appropriate growth and development of the patient.[21,22]

CONCLUSIONS

The total treatment time was approximately four months, during which satisfactory transverse maxillary width and proper alignment of the permanent maxillary right central incisor were achieved. Continuous orthodontic follow-up from the primary or mixed dentition through to the permanent dentition is essential for identifying and correcting deviations from normal eruption patterns that may lead to malocclusion. This clinical case highlights the importance of timely orthodontic intervention in achieving favorable treatment outcomes and supporting normal craniofacial growth and development.

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How to cite this article:

Gabriela Leite Pedroso, Gustavo Lopes Puls, Ana Paula Valladares De Almeida, Fabiana Cardoso Pereira Valera, Fábio Lourenço Romano. Surgical exposure and orthodontic traction of impacted maxillary central incisor after alteration of eruption sequence: A case report. Contemp Pediatr Dent 2025:6(1):70-78.

Declarations

Acknowledgements: *Not applicable.*

Conflict of Interest Statement: *Authors disclose no potential conflicts of interest.*

Ethics Statement: *Not applicable.*

Informed Consent: *Informed consent was obtained from the legal guardian.*

Author contributions: *Conception and design: All Authors; Acquisition of data: GLP, GLP, FLR; Interpretation of data: FLR, FCPV; Drafting article: GLP, GLP; Revision artice: GLP, GLP, APVA; Final approval: All Authors.*

Funding: *There is no financial support or sponsorship to declare.*

Data Availability: *The data used to support the findings of this study can be made available upon request to the corresponding author.*

Peer-review: *Externally double-blinded peer-reviewed.*