








Orthodontic traction of an impacted incisor during the mixed dentition period: A case report

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Highlights

Early diagnosis and accurate treatment planning are crucial for successful management of impacted maxillary incisors in mixed dentition.

Surgical exposure, bonding, and orthodontic traction with removable appliance showed successful incisor eruption.

The combined orthodontic-surgical approach effectively restored both esthetics and function, emphasizing the importance of individualized treatment.

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Abstract

Dental impaction is a common issue in orthodontics, often arising from the prolonged retention of deciduous teeth, dentoalveolar discrepancies, or supernumerary teeth. Early diagnosis, through clinical and radiographic evaluation, are crucial for successful management of impacted maxillary incisors in mixed dentition. Regarding its position the orthodontic traction can be done by removable appliance. This case report describes the successful management of an impacted maxillary central incisor (#9) in a 7-year-and-9-month-old female patient with historical of trauma at primary anterior teeth follows by a formation of a cyst. She presented an angle Class II, good transverse relationship, positive space discrepancy in both jaws and vertical impaction of tooth 9 (Nolla's stage 9). The treatment involved a permanent incisor surgical exposure, bonding of an orthodontic button to the crown and a ligature wire. The traction was made with a removable appliance due to its vertical bone position, by a continuous force of 50gF during 7 months. The outcome was favorable, with the impacted incisor repositioned, during mixed dentition. The patient was referred for orthodontic treatment to leveling and alignment. This combined surgical-orthodontic approach demonstrated the effectiveness of accurate diagnosis and appropriate biomechanics.

Keywords: Dentition, Mixed; Orthodontics; Orthodontic Appliances, Removable; Tooth Eruption; Tooth, Impacted

INTRODUCTION

The eruption of permanent teeth, particularly the maxillary central and lateral incisors, plays a crucial role in establishing occlusion, facial aesthetics, speech articulation, and efficient mastication. However, these teeth are among the most commonly impacted, with impaction rates that necessitate early clinical and radiographic monitoring to prevent complications.¹⁻⁴

Early diagnosis, guided by a comprehensive clinical history and appropriate imaging techniques, such as conventional radiography and, when necessary, cone-beam computed tomography (CBCT), is essential for effective management.⁵⁻⁸ Clinically, indicators such as prolonged retention of deciduous incisors, delayed eruption of adjacent teeth, or asymmetry in eruption patterns may suggest impaction.^{4,6,9,10}

Teeth are considered impacted when they are unable to erupt due to malposition, insufficient space, or physical barriers, such as supernumerary teeth, odontomas, or ankylosis.^{8,11,12} Common etiological factors contributing to upper incisor impaction include trauma to deciduous teeth, abnormalities in the positioning of the tooth germ, dentoalveolar discrepancies, alveolar clefts, and early or late loss of primary teeth.^{13,14} If neglected, impaction can lead to root resorption, cyst formation, infections, and space loss due to the migration of adjacent teeth.^{13,14}

Effective management of impacted teeth typically requires interdisciplinary cooperation between orthodontists and oral surgeons. Treatment success relies on adherence to fundamental biomechanical principles and accurate three-dimensional localization of the impacted tooth.^{7,15-17}

The aim of this case report is to present the clinical management of a maxillary central incisor impaction, which was successfully repositioned in the arch with surgical exposure and orthodontic intervention using a removable appliance.

CASE REPORT

A 7-year-and-9-month-old Caucasian female patient was brought by her mother to the * The chief complaint was the delayed eruption of the maxillary left central incisor (tooth 9). She presented in early age a trauma at primary anterior teeth follows by a formation of a cyst. The treatment was ulectomy to incisor exposition, but it did not erupt.

Clinical examination revealed a mixed dentition stage, a bilateral Class II molar relationship with an accentuated overjet of 6 mm and a maxillary transverse constriction. Notably, the permanent maxillary left central incisor was clinically absent despite the presence of adequate space in the dental arch. According to the analyses of Moyers¹⁸ a positive space discrepancy of +2.2 mm in the maxillary arch and +2.0 mm in the mandibular arch was recorded (Figure 1).

Facial analysis demonstrated symmetry, an increased lower facial third, and a passive lip seal. The lateral view highlighted a convex facial profile, mandibular retrusion, and an obtuse nasolabial angle (Figure 2).

Panoramic radiography confirmed the vertical impaction of tooth 9, with no evidence of supernumerary teeth, odontomas, or pathological lesions. The impacted incisor was classified as Nolla's stage 9, indicating complete root formation (Figure 3). Lateral cephalometric analysis revealed a skeletal Class II relationship ($ANB = 5^\circ$), with a well-positioned maxilla ($SNA = 82^\circ$) and a mandibular retrusion ($SNB = 77^\circ$). The patient exhibited a dolichofacial growth pattern ($SN.GoGn = 44^\circ$, $SN.Gn = 70^\circ$, Facial Axis = 88°), with vestibularized and protruded upper and lower incisors ($1.NA = 24^\circ$, $1.NA = 5$ mm; $1.NB = 28^\circ$, $1.NB = 5$ mm) (Figure 4).

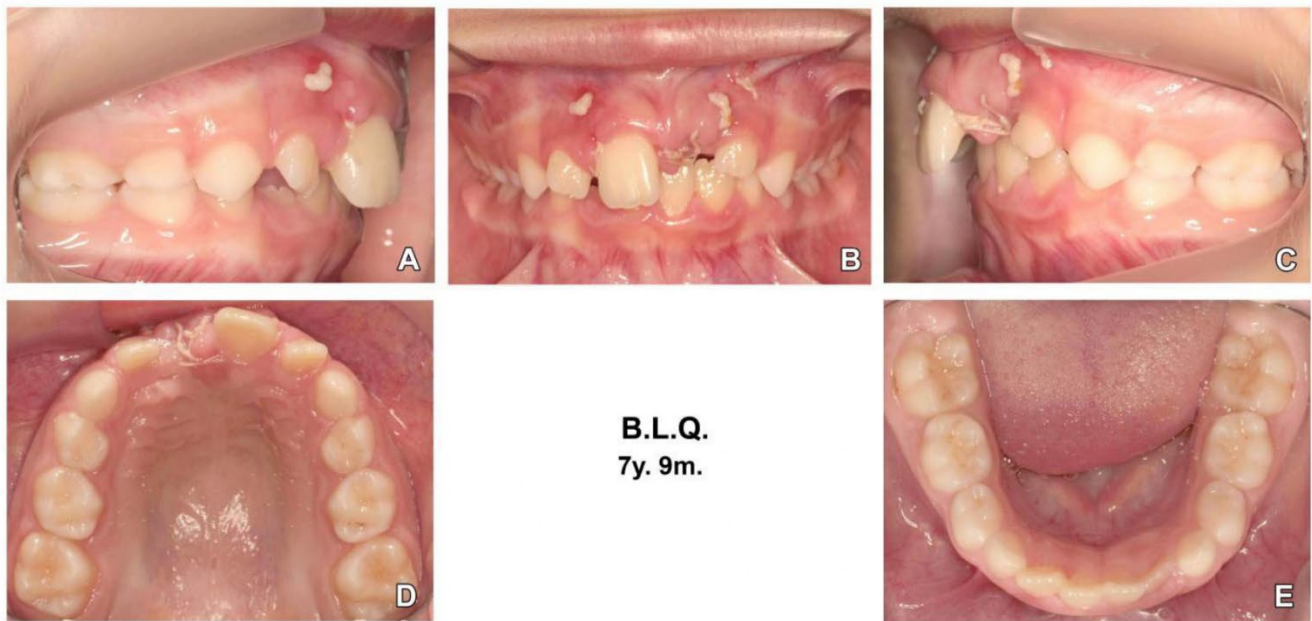


Figure 1. Initial intraoral photographs showing mixed dentition, absence of the maxillary left central incisor, increased overjet, and adequate space in the maxillary arch



Figure 2. Initial extraoral photographs: (A) right profile view; (B) frontal view at rest; and (C) frontal smiling view, demonstrating facial symmetry, convex profile, and passive lip seal



Figure 3. Initial panoramic radiograph revealing vertical impaction of the maxillary left central incisor with no evidence of supernumerary teeth, odontoma, or associated pathology



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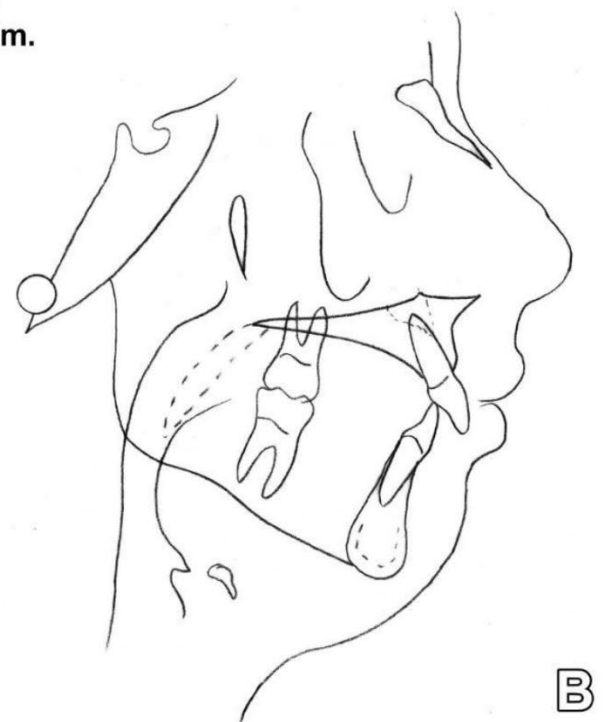


Figure 4. Cephalometric evaluation: (A) initial lateral cephalometric radiograph; and (B) corresponding cephalometric tracing, indicating a skeletal Class II pattern with a dolichofacial growth tendency

At cone-beam computed tomography (CBCT) analysis tooth 9 was vertical and well position, favorable to orthodontic traction. As an additional finding, the tooth 11 was in Nolla stage 7 and it was

diagnosed in ectopic position as it is intraosseous and in mesial position of the root of tooth 10 (Figure 5).

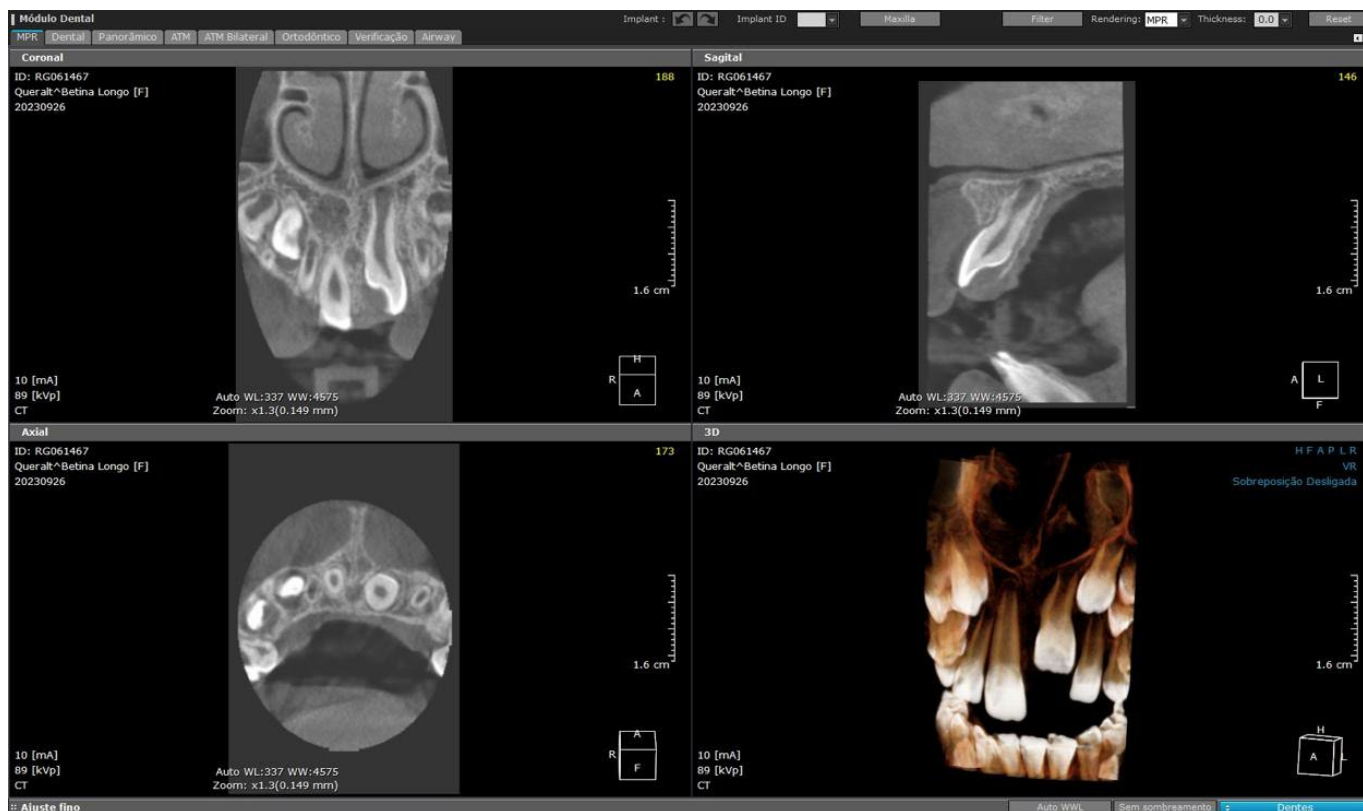


Figure 5. Cone-beam computed tomography (CBCT) images showing the three-dimensional position of the impacted maxillary left central incisor, confirming a favorable vertical orientation for orthodontic traction

Initial Treatment Plan

A comprehensive treatment plan was formulated with the initial objective of guiding the eruption of the impacted upper left central incisor, through orthodontic traction, aiming to establish both functional and esthetic occlusion.

Treatment Progress

Surgical exposure of the tooth 9 was performed under local anesthesia (Alphacaine 100 – DFL, Rio de Janeiro, Brazil) following antisepsis. A button was bonded to the crown using a light-cured resin system (Filtek One Bulk Fill – 3M, Campinas, Brazil) under moisture control (Figure 6). A ligature wire was connected on the button to a helioid loop on the adjacent lateral incisor, providing initial anchorage. The surgical site was sutured, and postoperative hygiene instructions were given, including the use of 0.12%

chlorhexidine (PerioGard – Colgate, New York, United States).

Orthodontic traction was initiated 15 days post-surgery using a removable appliance with a modified buccal arch and vertical elastics (Figure 7). A continuous force of approximately 50gF was applied over a seven-month period. The patient demonstrated excellent compliance with elastic wear, which contributed significantly to the eruption of tooth 9 without periodontal complications (Figures 8 and 9).

After seven months of treatment, the impacted maxillary incisor successfully erupted into the dental arch, with no clinical or radiographic signs of root resorption or periapical pathology (Figure 8). The gingival margin remained well preserved, highlighting the effectiveness of the light and continuous force protocol.



Figure 6. Intraoperative photograph demonstrating surgical exposure of the impacted maxillary left central incisor and bonding of an orthodontic button to the crown

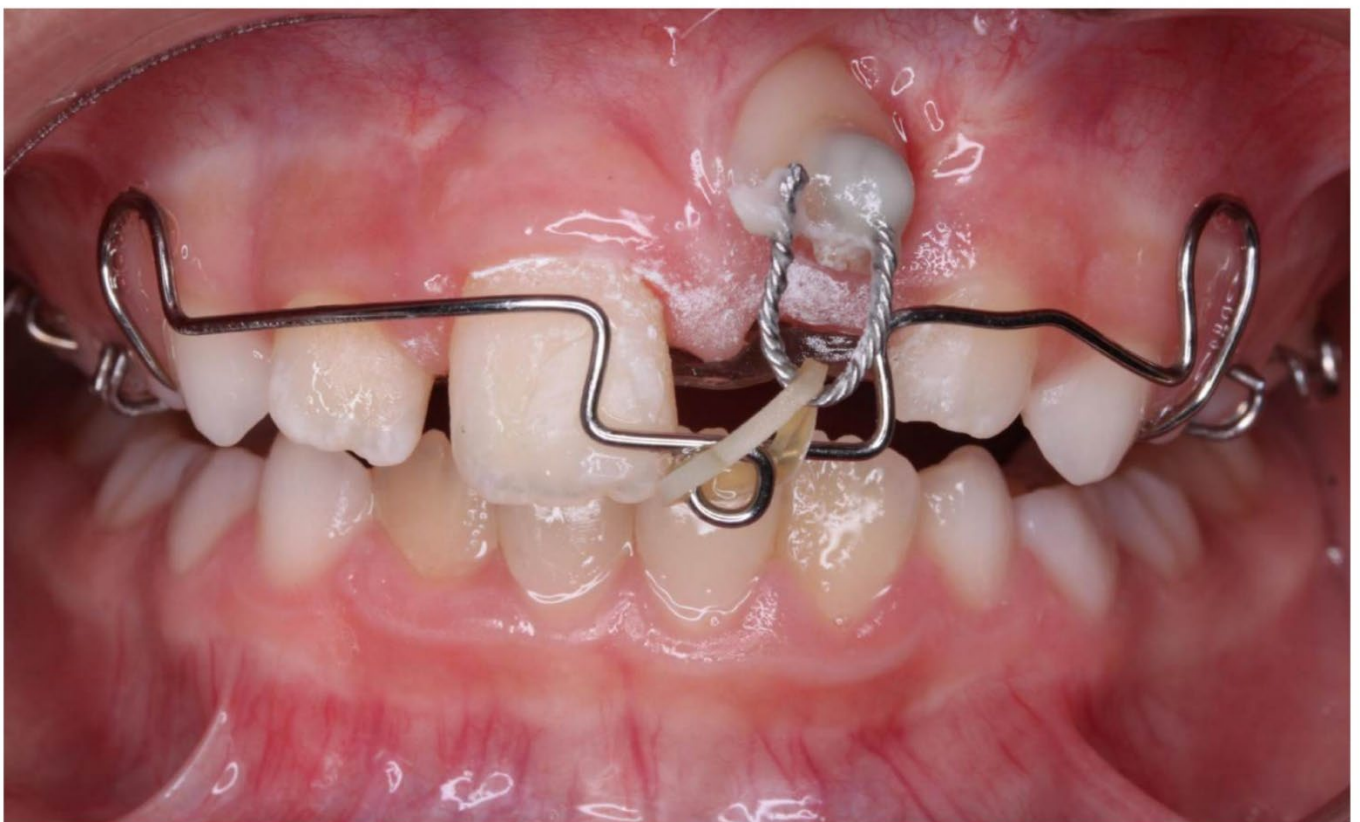


Figure 7. Removable orthodontic appliance used for traction of the impacted incisor, incorporating a modified labial bow and elastic traction system

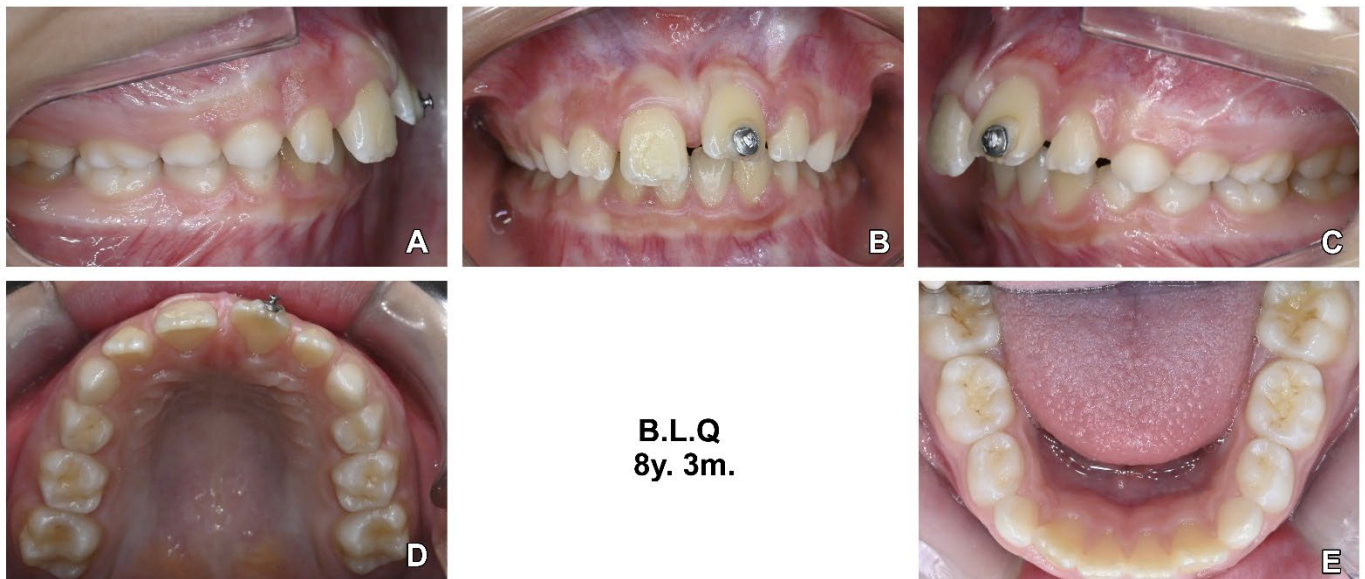


Figure 8. Clinical intraoral photographs after orthodontic traction, showing successful eruption and alignment of the maxillary left central incisor with satisfactory gingival contour



Figure 9. Follow-up panoramic radiograph demonstrating successful eruption of the maxillary left central incisor, with no signs of root resorption or periapical pathology

The patient continues to attend follow-up appointments at the *. The most recent panoramic radiograph revealed no signs of periapical pathology or root resorption (Figure 9).

DISCUSSION

This case report described the successful management of an impacted maxillary left central incisor in a 7-year-and-9-month-old female patient during the mixed dentition phase.

The diagnosis was supported by clinical and radiographic evidence, including the absence of supernumerary teeth or other eruptive obstructions and confirmation of complete root formation, classified as Nolla's stage 9.¹⁹ The tooth presented in a favorable vertical position and with adequate space in the dental arch.

The chosen therapeutic approach—surgical exposure followed by orthodontic traction using a removable appliance—was based on the favorable position of the impacted tooth and the presence of adequate space in the dental arch.^{7,15,20} This technique, involving the bonding of an orthodontic attachment and the placement of a traction wire emerging through the surgical incision, is well-documented in the literature for its predictability and clinical efficacy.^{7,21}

In the present case, a button was bonded to the impacted incisor, and traction was applied using a removable appliance. This choice was supported by both the favorable three-dimensional orientation of the tooth and the available space in the arch. Removable appliances offer advantages in such contexts due to their ease of fabrication, reduced cost, and ability to deliver lighter, more physiologically compatible forces.^{20,22}

Although this modality is widely accepted, it is not devoid of risks. Potential complications include ankylosis, root resorption, pulp necrosis, and periodontal damage, all of which must be clearly communicated to the patient and their guardians prior to initiating treatment.^{7,15} Ankylosis remains a significant concern, having been initially described by Johnston (1969) and subsequently confirmed in contemporary studies.^{23,24}

There is ongoing debate in the literature regarding the optimal surgical technique for exposure. Some authors favor simple crown exposure²⁵, while others advocate for the use of a repositioned flap, which may offer superior periodontal outcomes.²⁶ The open eruption technique is generally reserved for younger

patients, where spontaneous eruption remains a possibility.²¹

Anchorage method selection is another critical consideration. While fixed appliances are often preferred for their superior control of tooth movement^{21,26}, removable appliances are considered advantageous in cases where gentler forces are desirable and when minimizing periodontal trauma is a priority²². Even though, studies highlight the importance of individualizing appliance selection based on clinical context, eruption path, and biomechanical demands.^{5,27}

Despite concerns about adverse effects on the periodontium during traction of impacted teeth²⁸, evidence suggests that with careful management of force magnitude and duration, it is possible to preserve both periodontal health and pulpal vitality.^{15,29} This supports the notion that orthodontic-surgical management, when executed with precision and biological awareness, remains a safe and effective strategy for treating impacted maxillary incisors.

CONCLUSIONS

The primary objective of the treatment, achieving eruption of the impacted maxillary left central incisor, was successfully accomplished through surgical exposure followed by orthodontic traction using a removable appliance. This approach proved to be effective and minimally invasive, preserving periodontal health and avoiding unnecessary complications. Treatment success was supported by early diagnosis, appropriate biomechanics using light and continuous forces, and excellent patient compliance. This case also underscores the importance of timely surgical exposure and orthodontic traction, particularly after the eruption of adjacent lateral incisors, to prevent space loss. Moreover, it emphasizes the need for careful monitoring of canine position and eruption during this developmental stage to ensure favorable outcomes.

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