Submitted: 24 March, 2024 Accepted: 30 August, 2024 Published: 03 May, 2025 DOI:10.22514/jocpd.2025.067

Journal of Clinical Pediatric Dentistry

CASE REPORT

Spontaneous eruption of an impacted mandibular first molar with root development at Nolla stage 9 after removal of the odontoma: a case report

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Abstract

Background: A mandibular first molar impaction is relatively rare. Several factors contribute to first molar impaction, including inadequate space in the dental arch, mechanical obstructions like supernumerary teeth or odontomas, eruption mechanism disruptions and idiopathic causes. Clinical scenarios offer a range of treatment options, such as observation, surgical exposure, orthodontic traction or extraction. **Case**: In this case, a mandibular first molar was impacted beneath a large odontoma. Located near the lower border of the mandible, this impacted molar exhibits a distally curved and notably shortened root with root development at Nolla stage 9. A surgically removed odontoma resulted in spontaneous eruption of the impacted first molar and normal occlusion without orthodontic traction. Further, the impacted tooth's root length gradually increased until it was comparable to the contralateral molar's. **Conclusions**: In this situation, observation with the intention of waiting for spontaneous eruption after obstructions have been removed is an optional treatment approach if the impacted tooth is enclosed by a dental follicle and is erupting in the correct direction.

Keywords

Impacted mandibular first molar; Nolla stage 9; Odontoma; Spontaneous eruption

1. Introduction

The impaction of permanent tooth is a common occurrence, affecting a prevalence ranging from 5.6% to 18.8% of the population. A majority of impacted teeth occur in the mandibular and maxillary third molars, maxillary canines, central incisors, and mandibular second premolars. Mandibular first molar impaction, however, occurs only 0.01% of the time [1, 2]. First molar eruption failures in permanent dentition can be attributed to various mechanical obstructions, such as supernumerary teeth or odontomas; inadequate dental arch space, and disruptions in the eruption mechanism, or idiopathic causes, such as primary eruption failure and single tooth ankylosis [3, 4]. In most cases, tooth impaction and obstruction are often discovered accidentally during routine dental or radiological examinations. Various pathological conditions may result in neighboring and opposing teeth being affected, including caries, periodontitis, root resorption, opposite occlusal teeth extrusion, ultimately causing malocclusion to develop. Clinically, impacted teeth can be treated with monitoring, orthodontic, surgical traction or extraction [5–7]. The decision will differ depending on the eruption abnormality, the patient's age, and the developmental status of the impacted tooth root. As referenced, each therapeutic choice has distinct indications, contraindications, benefits and drawbacks. When impacted teeth are caused by specific mechanical obstructions, surgical remove obstruction and monitoring are routine therapeutic strategies. It is possible to make the correct diagnosis and decide what treatment options to pursue on a case-by-case basis with the help of a thorough clinical and radiological assessment. This increases the probability of preserving impacted teeth. Dental practitioners are tasked with diagnosing and treating this challenging situation [8, 9].

This case report presents a patient with an impacted mandibular first molar underneath a large odontoma. It is located near the lower border of the mandible with a distally curved and notably shortened root which is at Nolla stage 9. The impacted first molar underwent spontaneous eruption and achieved normal occlusion without orthodontic traction after surgical removal of the odontoma. Further, the root length of the impacted tooth gradually increased to reach a length similar to that of the contralateral molar.

2. Case report

A 10-year-old female patient was referred to the Department of Pediatric Dentistry of Stomatology Hospital of Zhejiang University School of Medicine with a chief complaint of left mandibular first molar impaction with an odontoma detected on routine radiographs. No systemic disorders or family genetic histories were reported.

A straight lateral profile was revealed by the extraoral examination along with a coordinated and symmetrical frontal face (Fig. 1A). There were no signs of pain or clicking associated with the temporomandibular joint examination. During the intraoral examination (Fig. 1B), it was found that the patient was in the mixed dentition stage with caries present on teeth 55 and 65. The left mandibular first molar was not visible and the right first molars exhibited a crossbite. The left mandibular first molar was impacted beneath a large odontoma near the lower border of the mandible, as shown in a panoramic film obtained from a different medical facility. Consequently, cone-beam computed tomography (CBCT) scanning was performed to determine the precise location of the impacted molar and the dimensions of the odontoma. Located at the coronal and distal regions of the impacted molar, the odontoma measures 19.29 × 20.07 × 10.62 mm. Around the odontoma, the buccal and lingual sides of the mandible were very thin (Fig. 2). Nolla stage 9 root development of the bilateral first molars was observed. However, the roots of left impacted molar were curved distally and significantly shortened in length compared to those of the right molar. The left mandibular second molar was also absent (Fig. 2). Lateral cephalograms were shown in Fig. 3 and Cephalometric measurements were presented in Table 1.

After a comprehensive assessment of the patient's clinical history, extraoral and intraoral examinations, radiological examinations, and histological analysis of a surgical specimen, odontoma, first molar impaction, caries, malocclusion, and congenital hypodontia were determined to be the diagnosis. The odontoma was then surgically removed. To assess spontaneous eruption potential, a traction button was attached to the impacted molar but orthodontic traction would be considered if necessary. Histopathological examination of the specimen confirmed the diagnosis of odontoma. A dysplastic enamel, dentin, and pulp were found partially arranged in a normal-tooth manner, and partially haphazardly, with reduced enamel epithelium (Fig. 4). After surgical removal of the odontoma, inter-arch elastic traction was applied to correct crossbite of the right molars, and a Trans-Palatal Arch (TPA) was subsequently utilized to preserve maxillary arch width and prevent the left maxillary first molar extrusion. Fig. 5 demonstrated the impacted mandibular first molar eruption process. Root length at post-surgery (Fig. 5B) increased compared to that at the pretreatment (Fig. 5A). After a 15-month follow-up period after surgery, the impacted first molar was observed to be emerging dramatically through the gingiva (Fig. 5C). Intraoral photos at a 17-month follow-up (Fig. 6) showed correct occlusion of right molars, a TPA on the maxillary dentition, and the almost fully erupted left mandibular first molar. Following another 2 months, the first molar achieved normal occlusion (Fig. 5D). As the root length of the impacted tooth gradually increased, it eventually reached a length comparable to that of the contralateral molar. Image J (Version 1.8.0, National Institutes of Health, USA) was used to measure the root length of mandibular first molars using panoramic radiograph with scale. The average root length ratio of 36/46 reached approximately 0.91 (Fig. 5F). An interesting observation was noted that as the curved root of the left mandibular first molar disengaged from the lower border of the mandible, the newly formed portions became straight. 22-month follow-up records comprising facial and intraoral photographs revealed satisfactory frontal and lateral profiles with occlusions that were normal (Fig. 7). No recurrence of odontoma was noted in panoramic radiograph. Additionally, cephalometric tracing pre- and post-treatment along with superimpositions were shown in Fig. 8. A proactive approach to preserving vertical height should also be taken after the left maxillary second molar eruption, as permanent implant restoration of the congenitally missing left mandibular second molar was generally suggested to defer until jawbone development is completed.

3. Discussion

Over 80% of impacted teeth are maxillary and mandibular third molars. In contrast, first permanent molar eruption failure is rare, with a documented rate of 0.01% [1]. Supernumerary teeth, odontogenic tumors or cysts in the eruption path are usually the cause of teeth failing to emerge or becoming impacted, and can be identified clinically or radiographically. Among these obstacles, odontoma is the most common odontogenic tumor, ranging in prevalence from 0.65%–1.87% [10]. Surgical removal is the predominant therapeutic approach for pediatric patients to prevent potential complications such as permanent tooth impaction, and the prognosis is favorable with rare reoccurrences [11]. Moreover, impaction may also result from aberrant positioning of tooth germs. Idiopathic factors can also cause impaction [12, 13]. In this case, impaction of the first molar was attributed to the presence of an odontoma, which exerted pressure leading to downward displacement of the tooth germ towards the lower mandibular cortical border, resulting in curved roots.

The process of tooth eruption involves tooth germ migration from its initial developmental site within the alveolar process to its functional position in the oral cavity [14]. Pre-eruptive, eruptive, and post-eruptive characterize this movement. Various theories have been proposed to explain the mechanism underlying tooth eruption. A key factor in driving this process may be the contraction of collagen within the periodontal ligament. However, it has not been definitively established that eruption rate and collagen turnover are directly correlated [15, 16]. An alternative hypothesis proposes that vascular pressure contributes to eruption force [17]. There was a significant decrease in eruption rate with a reduction in this pressure, suggesting that interstitial fluid pressure played an important role in eruption. The role of tissue and vascular pressures in eruptive phenomenon has yet to be confirmed in high-quality studies. Periodontal ligaments are thought to affect tooth eruption. Nevertheless, literature indicates that the absence of roots or periodontal ligaments does not necessarily impede the process [18]. In this case, the impacted tooth's roots were curved distally due to the mandible's cortical plate constriction at its lower border. This perspective is further supported by the fact that the tooth had reached Nolla stage 9, nearing maturity. According to another theory, tooth eruption is primarily determined by the dental organs, particularly the crown. In the 1980s, a series of experiments were conducted to explore the contributions of the dental crown and follicle to the eruption process [19–21]. Researchers found that the

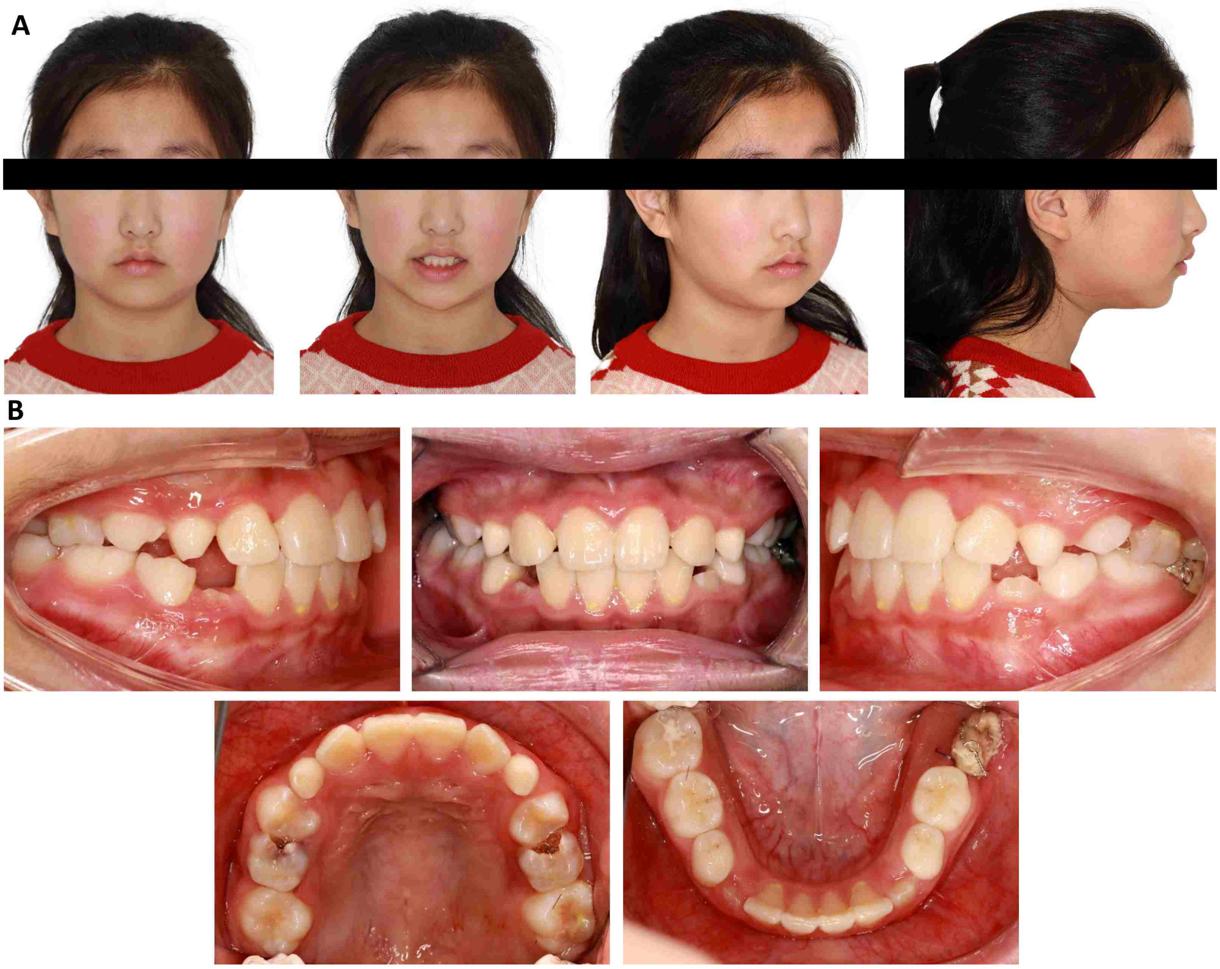

FIGURE 1. Extraoral and intraoral examinations post-surgery. (A) Extraoral photographs. (B) Intraoral photographs.

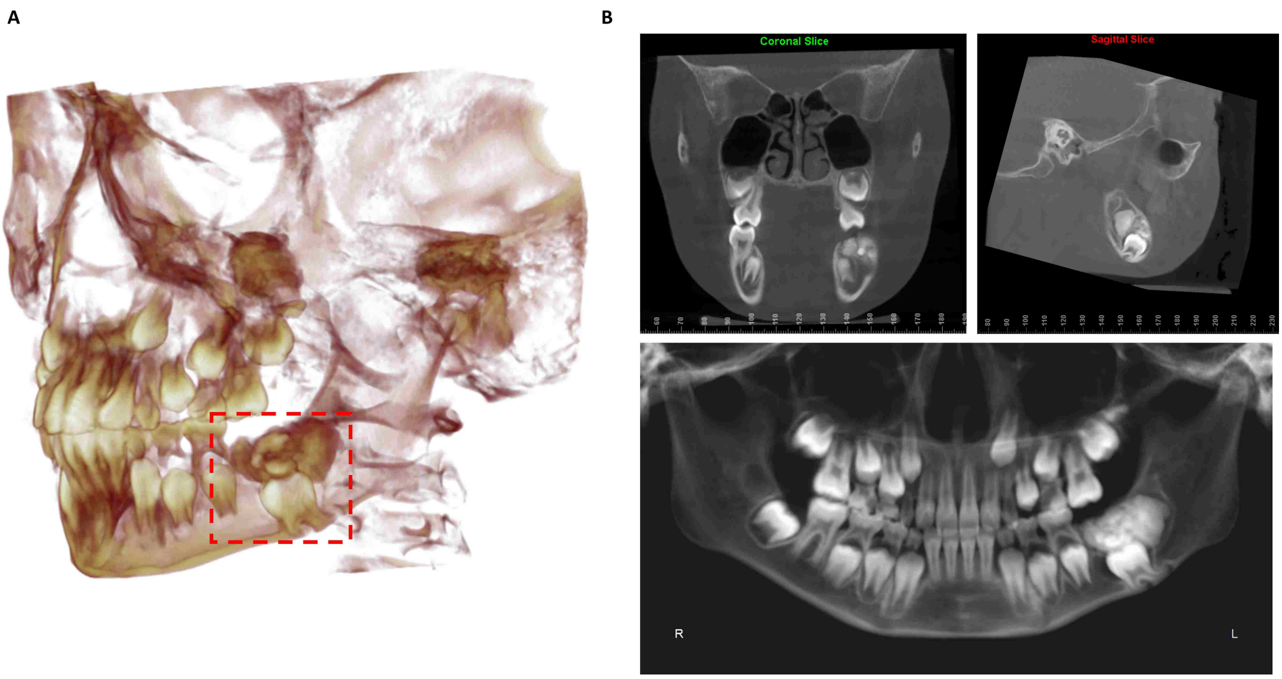

FIGURE 2. Pretreatment CBCT scanning reconstructed image and slices showing impacted molar and odontoma. (A) CBCT scanning reconstructed image showing impacted molar and odontoma in red dashed box. (B) Coronal, sagittal and panoramic slices.

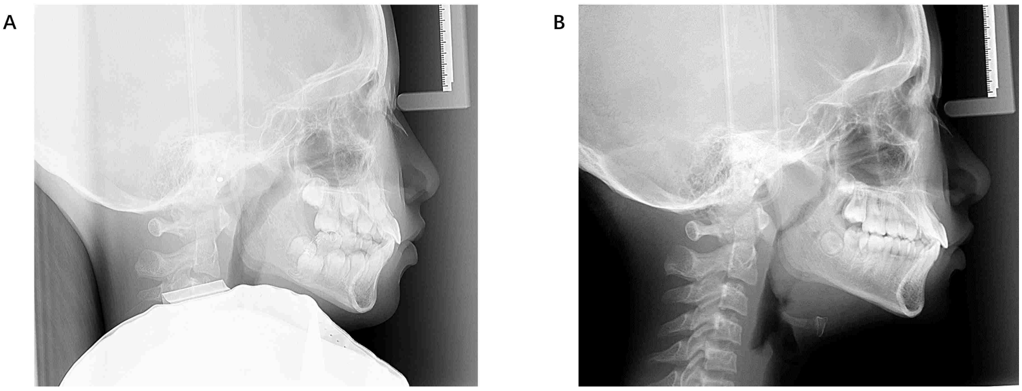

FIGURE 3. Lateral cephalograms post-surgery and 22-month follow-up observation after surgery. (A) Lateral cephalogram after odontoma removal surgery while before orthodontic treatment. (B) Lateral cephalogram at 22-month follow-up observation after surgery.

TABLE 1. Cephalometric values of pre- and post-treatment.

Measurement	Pre-treatment	Post-treatment	Norm	Std Dev
Skeletal				
SNA (°)	80.1	79.1	82	4
SNB (°)	75.9	75.2	78	4
ANB (°)	4.2	3.9	3	2
PP-FH (°)	7.6	8.6	4	3
PP-GoGn (°)	22.9	18.8	23	4
OP-SN (°)	21.9	24.2	24	4
MP-SN (°)	36.7	35.4	35	4
FMA (°)	31.1	27.3	30	4
Y-axis Angle (°)	66.4	64.4	65	3
S-Go/N-Me (%)	61.6	63.1	64	4
ANS-Me/N-Me (%)	52.4	52.0	53	2
Dental				
U1-L1 (°)	124.0	121.3	122	8
U1-SN (°)	100.0	102.7	105	5
U1-NA (mm)	3.3	4.7	4	2
U1-NA (°)	19.9	23.5	24	5
L1-NB (mm)	5.9	6.6	6	2
L1-NB (°)	31.9	31.3	30	6
FMIA (°)	49.5	52.0	53	6
Soft tissue				
UL-EP (mm)	1.2	−0.3	3	2
LL-EP (mm)	1.0	0.1	4	2
Z-Angle (°)	57.7	63.4	67	5

SNA: Sella Nasion A point angle; SNB: Sella Nasion B point angle; ANB: ANB angle; PP-FH: Palatal lane to Frankfort horizontal plane angle; PP-GoGn: Palatal plane to Mandibular plane angle; OP-SN: Occlusal plane to SN plane angle; MP-SN: Mandibular plane to SN plane angle; FMA: Frankfort horizontal plane to Mandibular plane angle; S-Go/N-Me: Posterior/Anterior facial height ratio; ANS-Me/N-Me: Lower anterior/Anterior facial height ratio; U1-L1: Interincisal (Upper incisor to Lower incisor) angle; U1-SN: Upper incisor to SN angle; U1-NA: Upper incisor to NA distance; L1-NB: Lower incisor to NB distance; FMIA: Frankfort horizontal plane to Mandibular incisor angle; UL-EP: Upper Lip to E-Plane distance; LL-EP: Lower Lip to E-Plane distance.

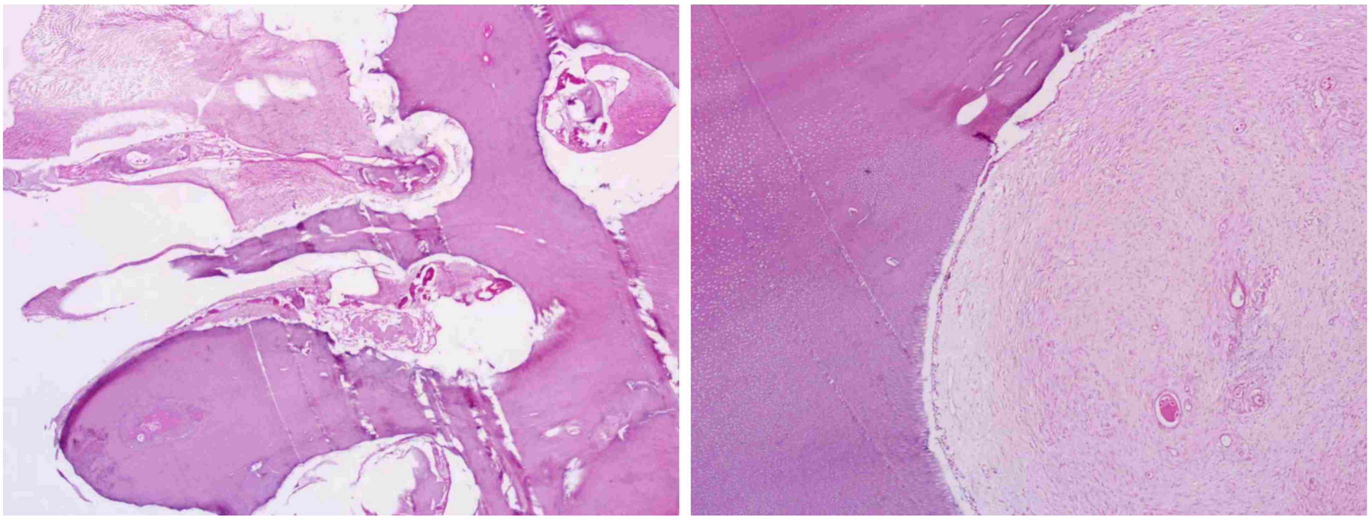

FIGURE 4. Histopathological examination of specimen of the odontoma.

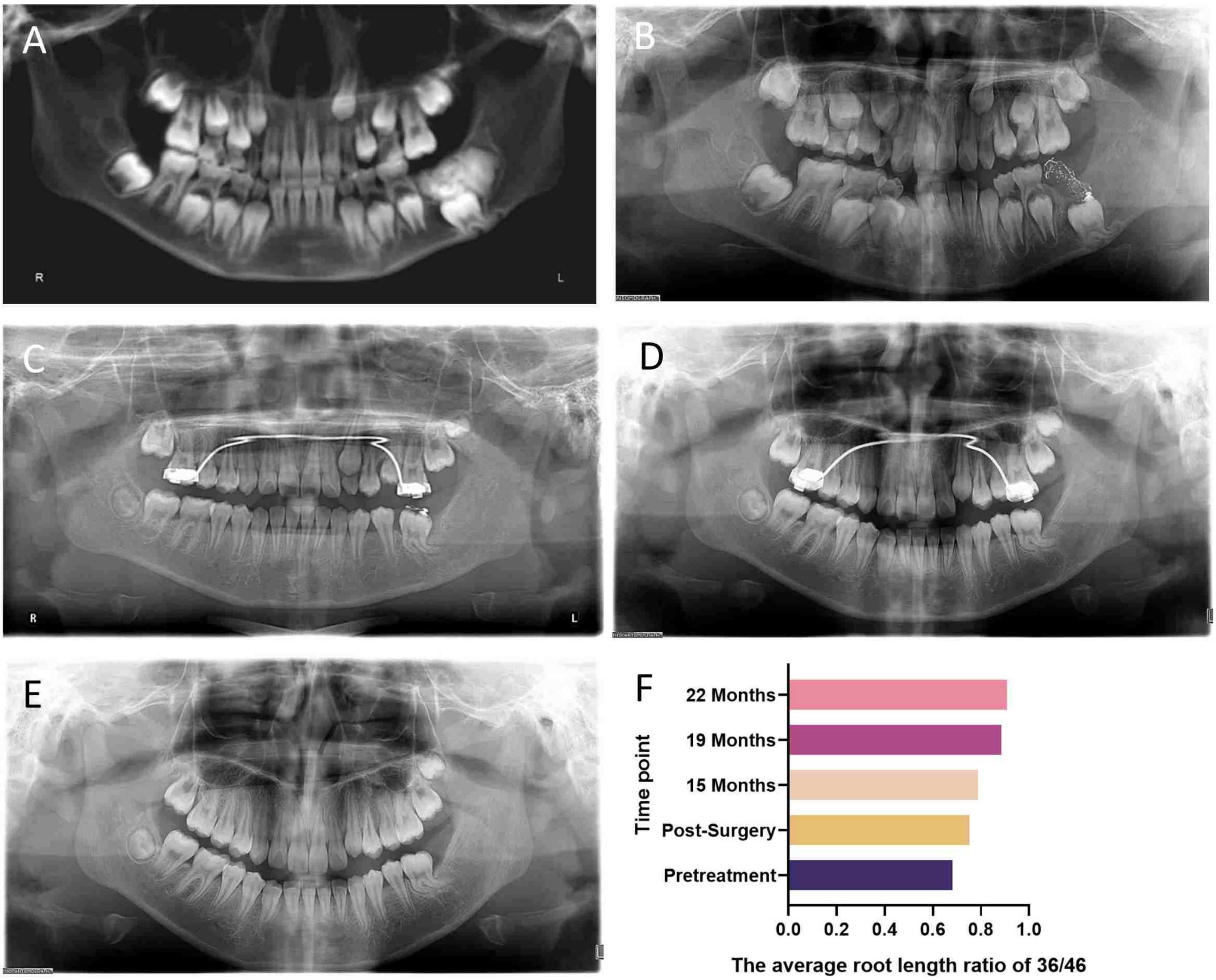

FIGURE 5. Eruption process of the impacted mandibular first molar. (A) Pretreatment. (B) Post-surgery (5 months after pretreatment). (C) 15-month follow-up after surgery. (D) 19-month follow-up after surgery. (E) 22-month follow-up after surgery. (F) The average root length ratio of 36/46.

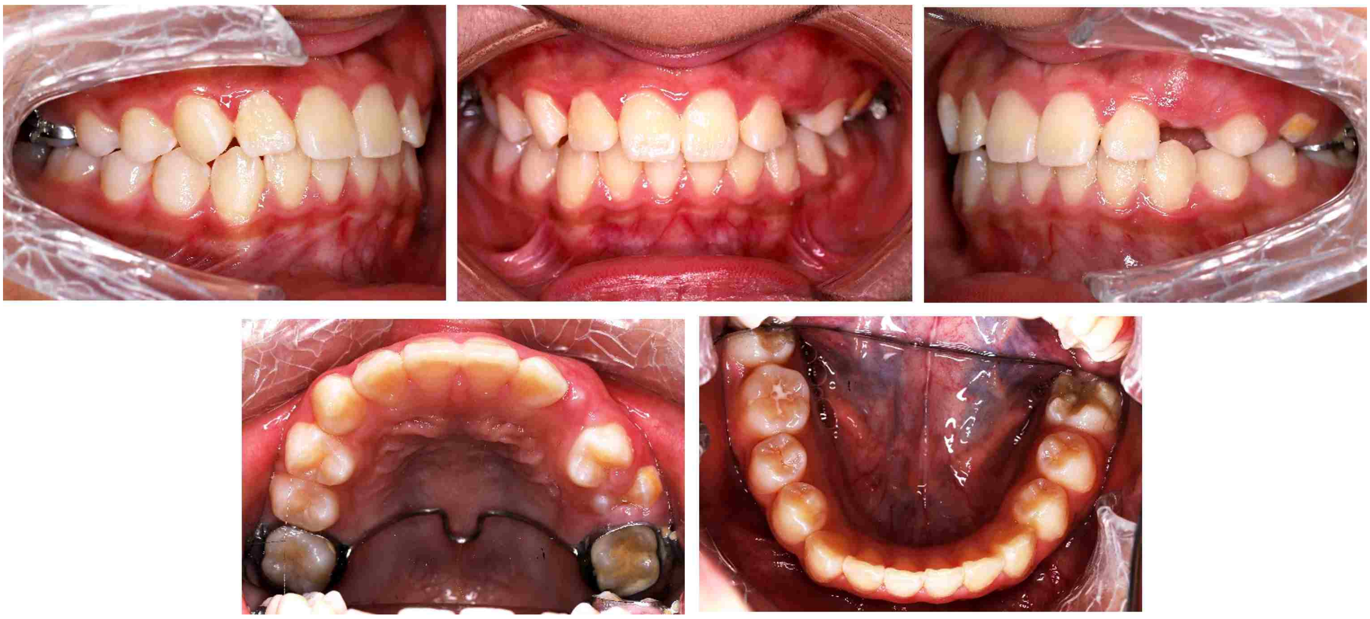

FIGURE 6. Intraoral photographs at 17-month follow-up after surgery showing right molar crossbite corrected and a TPA on bilateral maxillary molars.

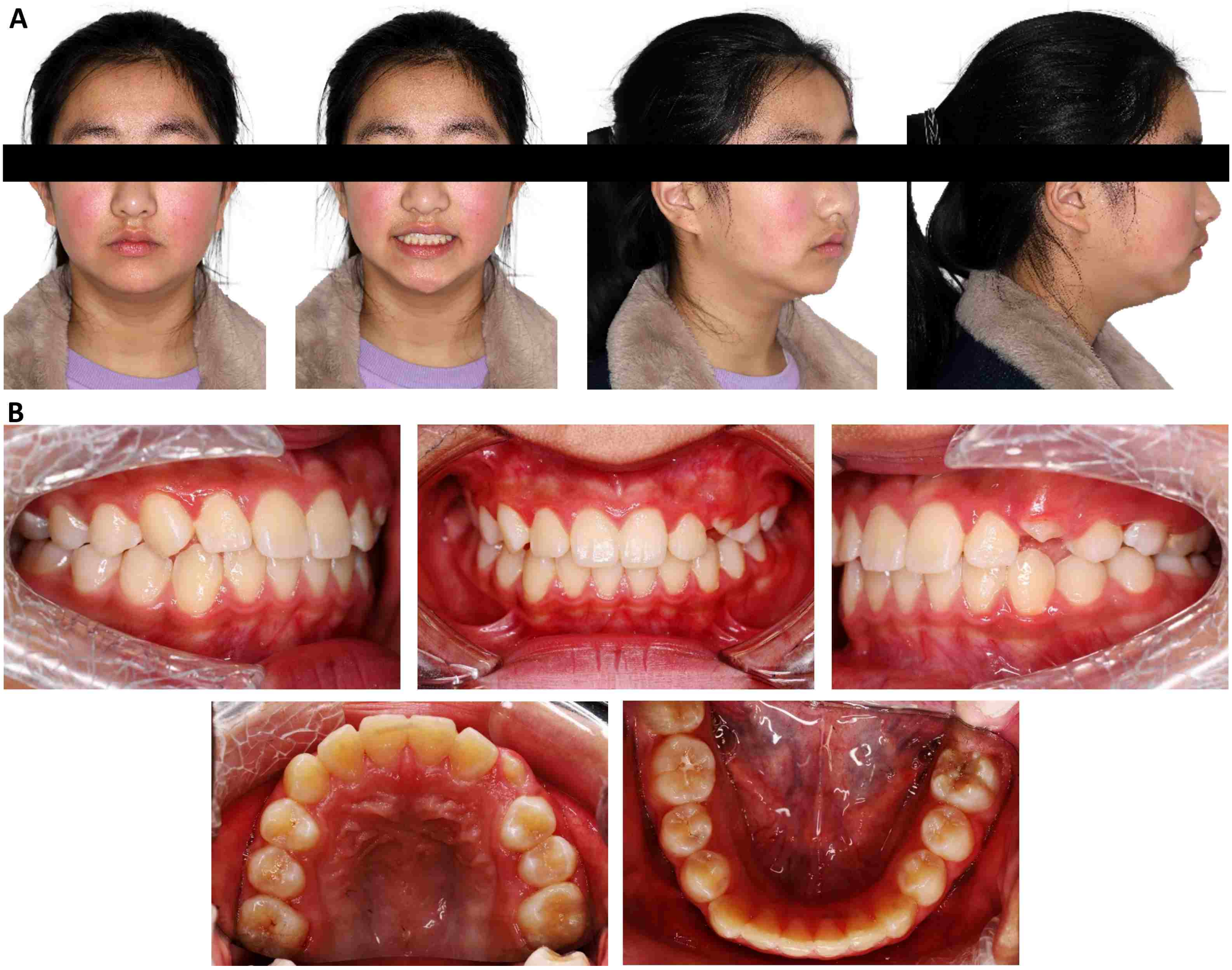

FIGURE 7. Extraoral and intraoral records at 22-month follow-up after surgery. (A) Extraoral photographs. (B) Intraoral photographs.

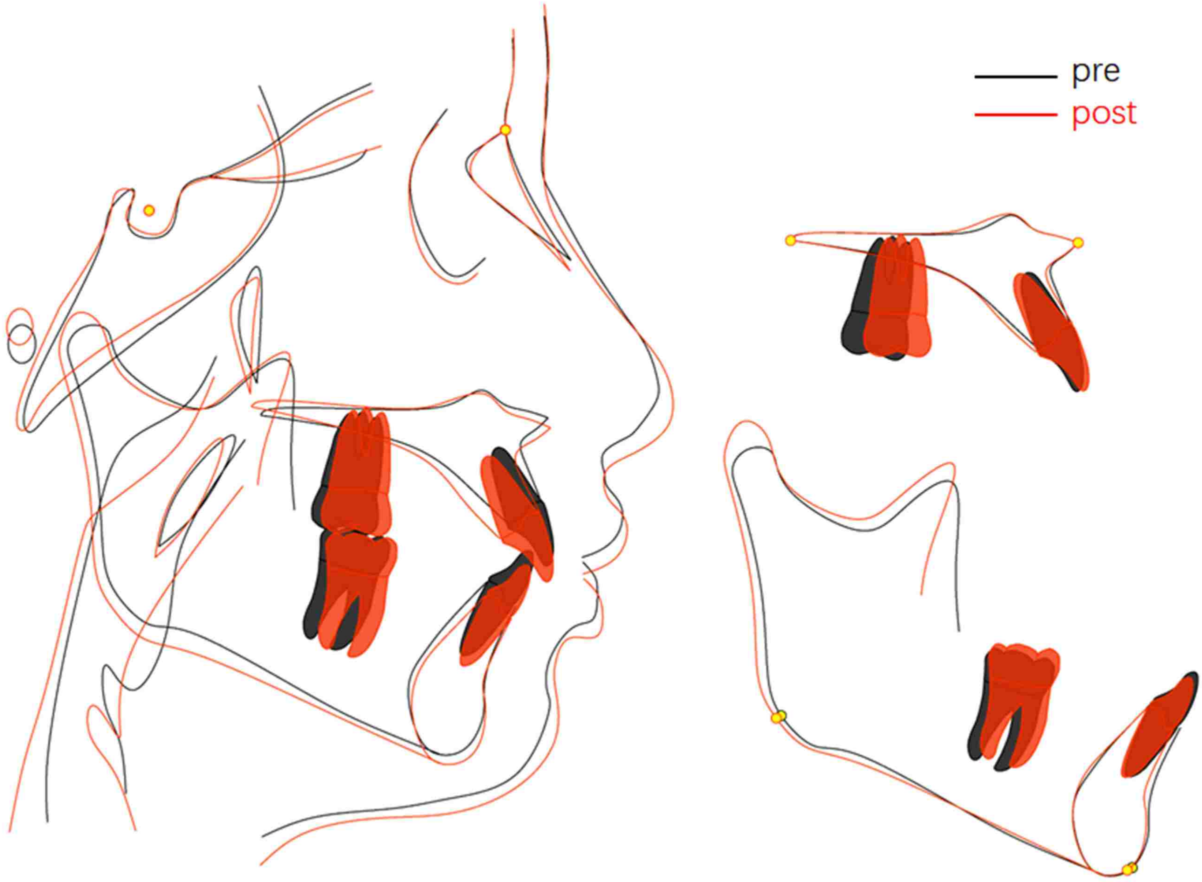

FIGURE 8. Cephalometric tracing pre- and post-treatment along with superimpositions.

dental crown played no significant role in eruption, but the dental follicle, particularly in providing protection, played a significant role. In the current case, the panoramic radiograph revealed a dental follicle surrounding the impacted molar's crown. Thus, this structure may be responsible for the force that eventually triggered spontaneous eruption of the tooth. Moreover, the newly formed straight portion of root may aid in the tooth's eruption to its final occlusal position.

Treatment plans and outcomes for impacted permanent molars are heavily influenced by factors such as tooth inclination, impaction severity, and root development stage. In the case of the mandibular second molar impaction, the importance of vigilant monitoring was emphasized and active intervention should be delayed for at least 12 months to prevent the possibility of spontaneous correction [22]. Clinical observation in the current case aligns with their recommendation. In cases involving impacted teeth with dental follicle tissues, it is recommended to address obstructions and comply with a non-invasive, periodic examination schedule to potentially reduce the complexity and discomfort of initial treatment for patients. Dental professionals should discuss alternative therapeutic strategies for managing the impacted molar with patients and their legal guardians if spontaneous eruption is deemed unlikely. These strategies include orthodontic traction, surgical repositioning, or extraction of the impacted first molar [23–25]. The risks and benefits of these potential interventions must be meticulously balanced with the patient's individualized needs and preferences.

This case implies that a strategy of observation may be used to treat impacted teeth that are enclosed by dental follicles and are erupting in the correct direction after removal of any obstructions in order to wait for spontaneous eruption. However, considering it is just one case report which may limit the generalizability of the results. How can impacted teeth of this nature be expedited by which intervention? Surgical exposure for orthodontic traction or simply eliminating the impediment while preserving the integrity of the dental follicle? To clarify this matter, more cases and further research will be necessary.

4. Conclusions

Surgically removing the odontoma facilitates the creation of an eruption pathway that induces bone resorption and proliferation occur under the influence of the dental follicle. Regardless of how first molar impaction is addressed, prompt identification and intervention are essential.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the first author or corresponding author.

AUTHOR CONTRIBUTIONS

XTL—contributed to conception, case treatment and draft manuscript. TQ—contributed to figure preparation and interpretation. JW and DDZ—contributed to literature searching and interpretation. ZFW and YFZ—critically revised manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The protocol for this study was approved by the institutional ethics review board of the Affiliated Stomatology Hospital, Zhejiang University School of Medicine (No. 2024-062). Informed consent was obtained from legal guardians of the patient.

ACKNOWLEDGMENT

Not applicable.

FUNDING

This research was supported by China Oral Health Foundation (No. C2024-002).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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How to cite this article: Xiangtao Liu, Tao Qiu, Jian Wang, Dandan Zhang, Zhifang Wu, Yafen Zhu. Spontaneous eruption of an impacted mandibular first molar with root development at Nolla stage 9 after removal of the odontoma: a case report. Journal of Clinical Pediatric Dentistry. 2025; 49(3): 200-207. doi: 10.22514/jocpd.2025.067.