Impacted Maxillary Central Incisor: Surgical Exposure and Orthodontic Management: A Case Report

Saranya Suksuphew* Apa Juntavee**

Abstract
An impacted maxillary permanent incisor can pose a problem for children at an early age. This impacted incisor is usually diagnosed accurately when there is delayed eruption. In this article, the impacted permanent incisor was placed into the proper position by means of surgical exposure and orthodontic traction. The treatment resulted in a clinically ideal appearance.

Keywords: Impacted maxillary permanent incisor/Orthodontic traction

Introduction
The impact of maxillary permanent incisor development may possess important problems in terms of esthetics and occlusion in the early mixed dentition\(^1\). Children with a marked delayed eruption of permanent incisors are usually at the age of 8–10 years old\(^2\). The maxillary incisor can be considered impacted if the following conditions exist: 1.) No historical record of previous extraction, 2.) Eruption of contra-lateral incisor which occur 6 months earlier, 3.) Both incisors are un-erupted and the lower incisors have erupted one year previously or deviate from the normal sequence of eruption e.g., lateral incisors erupt before the central incisor, 4.) Maxillary incisors have delayed eruption 6 months after the normal eruption date\(^3\). The prevalence of an impacted maxillary central incisor among the 5–12 year-age-group has been reported as 0.13%. In reference to the Malaysian population of regional hospitals, the prevalence has been estimated at 2.6%\(^3\).

What follows are reasons for failure of maxillary incisor eruption:\(^2\)–\(^4\)

1. Supernumeraries: A supernumerary tooth is a common cause of failure in upper central incisor eruption. If found in the anterior maxilla adjacent to the midline, a supernumerary is thus known as a mesiodens.

2. Retained deciduous incisor: A deciduous incisor which becomes non-vital as a result of trauma or caries or ankylosed may not be resorbed. This tooth may then deflect or even prevent the eruption of the permanent successor.

3. Dilaceration: Following trauma, usually to the deciduous predecessor, the crown of the developing permanent tooth may be displaced. As a result, the crown and root may develop at an angle to each other. This is known as dilaceration.

4. Ankylosis: Ankylosis occurs when the root of a tooth becomes fused to the alveolar bone which prevents the eruption of an incisor. There is often a history of trauma.
5. Dense mucoperiosteum: The mucoperiosteum may become dense during development or due to formation of scar tissue following surgery.

6. Ectopic development: Severe malposition and/or impaction against another tooth may inhibit the permanent incisor from erupting.

7. Other pathology: Some pathology such as cysts or odontomes may also prevent the eruption of a permanent incisor.

Dental and medical history, including clinical and radiographic evaluation used to diagnose an impacted maxillary central incisor is as follows:

1. Dental and medical history: A detailed dental and medical history should be obtained to determine possible aetiology which may cause delayed eruption. Early clinical examination with radiographic investigation at 6–8 years can detect the presence of un-erupted maxillary incisors.

2. Examination

2.1 Clinical examination: An intraoral examination should be conducted at the time of the retained deciduous teeth and buccal or palatal swelling. The examination also includes the assessment of availability of space for the central incisor.

2.2 Radiographic investigations: If an obvious cause cannot be clinically identified, the following radiographs need to be taken: an anterior occlusal radiograph for general assessment purposes or two periapical radiographs should be taken using the parallax technique for detailed assessment of the position, root and crown morphology. If radiography is available, the vertical tube shift technique can be applied for detailed assessment of the position, root and crown morphology of the tooth in combination with an upper anterior occlusal radiograph.

Management

The management of the un-erupted incisor depends on whether the tooth is viable, or whether it can be brought into an acceptable position within the arch. Suggested options for management are the following:

1. Observation only

If the permanent incisor cannot be brought into an acceptable position and if there is no associated pathology or resorption of adjacent teeth, it may simply be kept under observation. The advantage of this approach is that it preserves alveolar bone, thus retaining the option for orthodontic space closure when the patient is older. Occasionally, the position of teeth initially thought to be hopeless can spontaneously be improved to enable them to be brought into the arch. One obvious disadvantage of this approach is that the patient must be regularly reviewed to ensure the possible detection of pathology and/or resorption of other teeth.

2. Create and maintain sufficient space

Adequate space should be maintained or created for the eruption of the permanent incisor by using fixed or removable orthodontic appliances before any surgical intervention.

3. Remove physical obstruction

- Retained deciduous tooth: The retained deciduous tooth should be extracted to allow the permanent incisor to erupt. Approximately 0.2% of retained deciduous roots and 0.3% of retained deciduous teeth have been found to obstruct eruption of permanent incisors.

- Soft tissue: Thickened or enlarged follicles around the unerupted incisor crown and hyperplastic/scar tissue are likely barriers to eruption. In most cases, removal of the fibrous tissue overlying the crown will result in rapid eruption.
Supernumerary/odontome: The presence of a supernumerary tooth or odontome does not necessarily cause delayed eruption of incisors. However, observation with regular radiographic control is advisable to detect any pathological changes. If there is an obstruction, it should be removed. About 50% to 78% of impacted maxillary incisors will erupt spontaneously following the removal of a supernumerary. Full eruption has been found to occur within 1.5–3 years. The earlier the removal of the causative factors, the better the prognosis for alignment of the incisor. Nonetheless, the optimal time for surgical removal of supernumerary teeth is still controversial.

Cyst/pathological lesion: About 5% of cysts were found with the inverted type of supernumerary teeth whereas about 15% of the impacted permanent incisors were caused by other factors rather than by supernumerary or deciduous teeth. Pathological lesions and an associated supernumerary tooth should be removed as they may later become cystic.

Management in case of failure of eruption
After the removal of physical obstructions, the un-erupted incisor should be observed for about 6 months for spontaneous eruption. If the incisor fails to erupt with no obvious obstruction, the following treatment modalities are the possible options: (1, 3-7)

- Exposure with/without Orthodontic traction: It was found that 87% immature roots were present in children less than 10 years old while only 27% in children above 11 years old. About 72% of un-erupted incisors with immature roots erupted spontaneously following extraction of the supernumerary whereas 63% of those with mature roots required further surgical treatment. Surgical exposure should also be done if there is a lack of eruptive movement due to either an enlarged follicle or scar tissue acting as a barrier. The exposure should aim to provide a functional width of attached gingival on the labial surface in order to prevent the muscles of the face from detaching the marginal periodontal tissue from the tooth, thereby causing marginal bone loss and gingival recession.

- Closed eruption technique: The closed eruption technique has been practiced by many clinicians claiming that the esthetic and periodontal outcome is far more superior when compared with the apically positioned flap. With this method, a labial or palatal flap is raised and a bracket or eyelet with a suitable attachment is bonded to the enamel surface of the tooth using acid–etch technique, preferably with a light cure adhesive before the flap is replaced.

Case report
An 8-year-old healthy girl, along with her mother, was presented to the pediatric dental clinic at Khon Kaen University. The parental concern was a retained maxillary left primary central incisor. A history of traumatic falling on the chin when she was 5 years of age was reported by the parent. Prior to this, no dental consultation was sought. The patient recovered uneventfully in a couple of days. Eruption of the maxillary right central incisor and other permanent teeth was found to be normal. No significant family history could be elicited.

The clinical examination revealed firm, retained upper left deciduous central incisor and an un–erupted permanent left central incisor on the same side, while permanent central incisor on right side was erupted in the proper position. All permanent lower incisors were fully erupted (Figure 1 a–e).

Radiographic examinations with panoramic (Figure 2a), occlusal (Figure 2b) and periapical radiographs (Figure 2c) revealed a permanent left central incisor situated above the root of the upper left primary central incisor. The root of the permanent left central incisor was more than 2/3 developed, while the root of primary left central incisor was slightly resorbed.
Figure 1 a–e Pretreatment intraoral photographs

Figure 2 a–c Pretreatment radiographic examination. Panoramic radiograph (a), occlusal radiograph (b), periapical radiograph (c)
The treatment was extraction of retained primary left central incisor to allow the permanent incisor to erupt. The root of extracted primary central incisor was resorbed about 1/5 of normal root length (Figure 3 a-b).

Two months after the extraction of primary left central incisor, the permanent central incisor was still un-erupted with a dense mucoperiosteum (Figure 4 a-e). From periapical radiographic evaluation, the permanent left central incisor was at the same level when compared to the previous position. Orthodontic traction using the closed-eruption technique was planned. The parent was informed about the possible risks of the treatment and her consent was obtained before proceeding with the clinical procedure.

For this case, the orthodontic design was an appliance with orthodontic bands on the upper molars with the 0.036 inch stainless steel wire attached to the palatal side and angled to tie with ligature and elastic. The orthodontic bands were first tried for both upper right and left molars followed by taking an impression for an appliance fabrication.

The surgical exposure of the impacted permanent central incisor and bonding a lingual button on the tooth were performed. The orthodontic lingual button was engaged with 0.010-inch ligature wire. The flap was
Soldering orthodontic bands with arch wire was cemented on the first permanent maxillary molars and composite bonding was placed on the permanent maxillary incisors. The ligature wire and palatal stainless steel wire were engaged with intraoral elastic during the surgical procedure (Figure 5 a–e). After the completion of procedure, silk was used to close the flap into normal position. The oral hygiene instruction was then given to the patient, followed by tightening of the dropped ligature wire at the intervals of 1, 3 and 5 weeks. The final adjustment of the ligature wire was done in a 5 weeks after the surgical procedure.

Results space

After 3 weeks of treatment, the movement of the maxillary left permanent incisor was initiated by orthodontic force and generated by ligature wire. The permanent central incisor was erupted into the oral cavity with a slight rotation. The appliance was removed at the 5th week and monitored for self-correction. (Figure 6 a–d)

One year after removing the appliance, the patient was asked to return for a follow-up appointment. The maxillary left central incisor was clinically healthy and erupted into normal position within the arch. Adequate overjet, overbite and intercuspation were achieved. The most significant change was the improvement of patient's smile. The final appearance of the teeth was esthetically pleasing with gingival margins at the same level and similar clinical crown sizes to match the right central incisor. No further mucogingival surgery was recommended (Figure 7 a–e).

Discussion

Even though the maxillary central incisor is a less frequently impacted tooth than an impacted canine, an impacted maxillary incisor poses a problem at an earlier age, which is a disturbing esthetic dilemma. The etiology is not well-understood but the most common cause for late eruption or non-eruption of a maxillary incisor is the presence of an erupted or un-erupted supernumerary tooth7. Injury to the
Figure 6  Intraoral examination after treatment a.) after 1 week of treatment b.) after 3 weeks of treatment c.) after 5 weeks of treatment d.) after appliance removal

Figure 7 a–e  One-year Post treatment. The maxillary permanent left central incisor erupted in normal position
primary tooth may also influence the eruption of the permanent incisor. Trauma may cause deflection or displacement of the permanent tooth bud and alter the eruption pathway, leading to ectopic, premature, delayed eruption or impaction of the permanent tooth. In this case report, a history of a falling accident when 5 years old may affect the eruption of the underlying permanent tooth. In the normal chronology of tooth development, crown completion in the permanent maxillary incisor occurs among children between 4 and 5 years of age. Hence, the magnitude of the trauma probably accounts for the arrest of root development.

Intraoral and radiographic examinations are essential for accurate diagnosis and planning for treatment that may be surgically based. The treatment approach of impacted maxillary teeth requires the cooperation of dental specialties such as orthodontists, pediatric dentists, oral surgeons and prosthodontists. Several reports demonstrated successfully treated impacted maxillary incisors by proper crown exposure and orthodontic traction. One treatment modality is to use the surgical crown exposure with the placement of an auxiliary followed by orthodontic positioning of the tooth. Factors to be considered for successful alignment of an impacted tooth are the position and direction of an impacted tooth, the degree of root completion, and the presence of space for the impacted tooth. Based on this case study, the impacted incisor was in normal position. Using Cvek's classification, the maturity of this un-erupted incisor was allocated to Group 3 when teeth had root two-thirds of their final length and adequate space for the impacted incisor. The treatment was removal of the retained deciduous incisor, thereby allowing spontaneous eruption for permanent incisor. After two months, however, the impacted tooth failed to naturally erupt. The surgical exposure and forced eruption was then designed for intervention. Several techniques are commonly used to uncover maxillary labial impaction. The apically positioned flap technique permits ready reattachment of a bracket if unintended debonding occurs, while the closed-eruption technique is believed to provide the best esthetic result. This case study decided that the closed eruption technique was the treatment of choice since it was more reliable as far as esthetic and periodontal health was concerned. Nonetheless, extensive removal of mucoperiosteal soft tissue and underlying bone exacts a price in terms of periodontal prognosis, gingival contour and appearance of the erupted tooth. The approach presented in this article was the semi-fixed appliance. The technique was easier, cheaper and did not require more equipment. Moreover it reduces the overall treatment time required for fully bonded fixed appliance therapy. In the regional hospital providing this appliance to the patient who has this problem was possible. In this case, spontaneous eruption was achieved after force eruption was removed when the permanent tooth reached the oral cavity. This result is in line with that of McDonald and Yap, who in 1986 reported that the spontaneous eruption could be expected only in a case with incompletely root formed.

**Conclusion**

Forced eruption of impacted teeth should be seriously considered in young patients. This special technique, can lead to acceptable results from a periodontal, occlusal and esthetic perspective at an earlier stage. Long-term monitoring of the stability and periodontal health of the impacted incisor, however, should be evaluated following orthodontic traction.

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Reference


Correspondence author

Associate Professor Apa Juntavee
Department of Prosthetic Dentistry,
Khon Kaen University,
Amphur Muang, Khon Kaen, 40002
Tel. +66-4334-8309
Fax. +66-4324-4475
E-mail: apajun@kku.ac.th
พื้นหน้าตัดบนแท่งที่ขึ้นไม่ได้: การจัดการทางศัลยกรรมร่วมกับทันตกรรมจัดฟัน: รายงานคู่ป้าย

บทคัดย่อ
พื้นหน้าตัดบนแท่งที่ขึ้นไม่ได้สามารถส่งผลกระทบกับเด็กได้ดังนั้นในช่วงอายุยังน้อย การให้การวินิจฉฉัยว่าพื้นหน้าตัดบนแท่งที่ขึ้นไม่ได้ก็คือการพบฟันซี่นั้นปรากฏในช่องปากมากกว่าปกติ รายงานผู้ป่วยฉบับนี้เป็นการนำเสนอการจัดการฟันหน้าตัดบนแท่งที่ขึ้นไม่ได้โดยวิธีการทางศัลยกรรมร่วมกับการใช้แรงดึงทางทันตกรรมจัดฟัน ภายหลังการรักษาลักษณะทางคลินิกของฟันหน้าตัดบนซี่นั้นเมื่อการเรียงตัวชัดเจนไม่เอื้อต่อการใช้งาน ฟันหน้าตัดบนแท่งที่ขึ้นไม่ได้อาจใช้แรงดึงทางทันตกรรมจัดฟัน

คำไขรหัส:
ฟันหน้าตัดบนแท่งที่ขึ้นไม่ได้/การใช้แรงดึงทางทันตกรรมจัดฟัน

ผู้รับผิดชอบบทความ
รองศาสตราจารย์ อาภา จันทรเทวี
ภาควิชาทันตกรรมสำหรับเด็ก คณะทันตแพทยศาสตร์ มหาวิทยาลัยขอนแก่น

อาภา จันทรเทวี**
รองศาสตราจารย์ ภาควิชาทันตกรรมสำหรับเด็ก คณะทันตแพทยศาสตร์ มหาวิทยาลัยขอนแก่น

*นักศึกษาหลักสูตรวิทยาศาสตรมหาบัณฑิต ภาควิชาทันตกรรมสำหรับเด็ก คณะทันตแพทยศาสตร์ มหาวิทยาลัยขอนแก่น

**รองศาสตราจารย์ ภาควิชาทันตกรรมสำหรับเด็ก คณะทันตแพทยศาสตร์ มหาวิทยาลัยขอนแก่น