

## Management of Delayed Eruption of Maxillary Incisors: Three Case Reports

Supachai Lertnimulchai<sup>1</sup>, Keith Godfrey<sup>2</sup> and Sukonrat Boonchai<sup>3</sup>

<sup>1</sup>Private Orthodontist, Amphoe Mueang, Nongkhai, Thailand

<sup>2</sup>Department of Orthodontics, Faculty of Dentistry, Khon Kaen University, Khon Kaen, Thailand

<sup>3</sup>Oral surgeon, Dental department, Loei hospital, Loei, Thailand

### Correspondence to:

Supachai Lertnimulchai, Private Orthodontist, 1074 Janejobtid Road, Amphoe Mueang, Nong Khai, 43000 Thailand Tel: 042-420951

E-mail: k.supachai.l@gmail.com

### Abstract

Management of delayed eruption of maxillary incisors is one of the most challenging orthodontic situations due to dealing with facial esthetics. Careful management by a combination of orthodontics and surgery produces a satisfactory result. This article presents three patients with various dentition stages and individual treatment protocols, but based on general orthodontic diagnostic and treatment principles.

**Key words:** Delayed eruption, Impacted tooth, Maxillary incisors

Received Date: Jan 14, 2015, Accepted Date: Jun 26, 2015

doi: 10.14456/jdat.2015.22

## Introduction

Delayed eruption of maxillary incisors is a commonly encountered deviation from normal eruption patterns.<sup>1</sup> It may be identified by comparing with a contralateral tooth that has already erupted significantly earlier and at a normally expected age. Delayed eruption of a maxillary incisor is a major concern of parents with regards to the facial esthetics of their children. It is likely to have adverse psycho-social effects on both parent and child.<sup>2</sup>

The process of normal eruption and the source of eruptive force are still controversial issues. The mechanisms that lead to delayed eruption are local and systemic conditions.<sup>1</sup> Physical obstructions are a common local cause of delayed eruption. The obstructions include supernumerary teeth, mucosal barrier, scar tissue, odontoma, tumor, injuries to deciduous teeth, premature loss of primary teeth with dental arch space loss, impacted and ankylosed teeth, tooth size to arch-length discrepancy, radiation damage, and oral cleft.

Suri *et al.* found from a literature survey that there were a large number of what they called systemic conditions including malnutrition, endocrine disorders, genetic disorders (such as Apert syndrome, Cleidocranial dysplasia, Down syndrome, Gardner syndrome, Rutherford syndrome) and idiopathy.<sup>1</sup> Delayed eruption caused by systemic condition may relate to “primary failure of tooth eruption” (PFE). PFE or idiopathic failure of tooth eruption is a situation of non-ankylosed failure to erupt partially or fully because of malfunction of the eruption mechanisms, molars were most commonly affected; incisors, canines, and premolars were also involved, but with a reduced individual frequency.<sup>3</sup>

The alternative treatments for delayed eruption of maxillary incisor with systemic condition include

1. no treatment or observation,
2. induced eruption of unerupted maxillary incisor, and
3. surgical removal of unerupted maxillary incisor.

Orthodontically assisted tooth eruption should be the first alternative treatment because of the evidence of both its benefits and it being the least invasive.<sup>4-6</sup> The treatment protocol consists of removal of any obstruction, a plan to gain space and induction of tooth eruption.<sup>7</sup>

The characteristics of delayed eruption of maxillary incisor depend on the cause. Although there are general principles for orthodontic retrieval of unerupted teeth, these principles must be adapted to the needs and clinical characteristics of each individual patient. Three case reports associated with delayed eruption of maxillary incisor with individual orthodontic treatment plans are presented.

### Three case reports

#### Case 1

The mother of a Thai girl, aged 8 years 2 months complained about incomplete eruption of her maxillary left central incisor. She had no history of trauma in the maxillary anterior region but, she had early loss of her primary maxillary left central incisor. The panoramic radiograph showed a horizontally positioned maxillary left central incisor (Fig. 1). Clinical examination found only the incisal tip exposed high in the labial sulcus. There is also the likelihood of impaction of the maxillary premolars but that will be a separate and later concern.

The girl was in early mixed dentition. The clinical examination showed an Angle Class I anterior openbite malocclusion, a straight profile, slightly increased anterior facial height, normal nasolabial angle, and incomplete eruption of her maxillary left central incisor with incisal tip exposure and in the middle of the alveolus. The maxillary right central incisor was deviated to the left by 1 mm. The space was not enough for eruption of this maxillary left central incisor. There was also a slight labial frenum prominence (Fig. 2).

Based on the orthodontic records, the interceptive orthodontic objectives were to

1. create space for the incisor to erupt, and
2. induce the unerupted tooth to its appropriate position.

A “2 x 3” fixed appliance (2 molar bands and 3 bonded incisors) was used initially to create space which facilitated eruption of the left incisor. Surgical exposure was not required. An orthodontic bracket was bonded to the impacted tooth which was then aligned in the “2 x 4” appliance combination initially using an 0.014-in copper nickel-titanium wire as an overlay (piggy-back)

on an 0.018-in Australian stainless steel main arch wire. In 12 months, the maxillary left central incisor was induced to the normal position. The finishing archwire was 0.019 x 0.025-in stainless steel. The total active treatment was 15 months (Fig. 3 - 4). A fixed retainer of four maxillary incisors was made for 2 years.



Figure 1 Pre-treatment panoramic radiograph



Figure 2 Pre-treatment facial and intra-oral photographs



Figure 3 Post-treatment facial and intra-oral photographs



Figure 4 Post-treatment panoramic radiograph

## Case 2

This case was a Thai boy, aged 14 years 8 months, whose mother was concerned about the failure of eruption of his maxillary right central incisor. He had no history of trauma in the maxillary anterior region. The panoramic radiograph showed that two supernumerary teeth were related to delayed eruption of the maxillary right central incisor with dilacerations at the apical root (Fig. 5). One supernumerary obstructed the maxillary

right central incisor. The other supernumerary was presented at the apical region of the root of the maxillary left central incisor. There was insufficient space for eruption of the maxillary right central incisor. Clinical examination showed an Angle Class I malocclusion, a straight profile, normal vertical facial proportions, normal nasolabial angle, and absence of the maxillary right central incisor. The maxillary left central incisor was deviated to the right by 2 mm (Fig. 6).

Based on the orthodontic records, the treatment objectives were to

1. remove all supernumerary teeth,
2. create space for the incisor to erupt, and
3. guide the unerupted tooth to its appropriate position.

The two supernumerary teeth were both removed by an oral surgeon before orthodontic treatment. 0.014-in copper nickel-titanium wires were used as initially. After complete orthodontic aligning, an open coil spring was used to make space for the maxillary right central incisor. After space opening for 7 months,

the maxillary right incisor did not move. At the end of 12 months, surgical exposure was then done by the surgeon and lingual button with ligature wires (4 ligature wires twisted) bonded to the incisor by the author (orthodontist) with following mucosal flap closure was performed (Fig. 7). The right maxillary incisor was moved into the normal position in another 13 months.

All spaces were closed in 30 months. At the finishing stage, 0.019 × 0.025-in stainless steel archwires were used. The total active treatment was 36 months (Fig. 8 - 9). Invisible retainers were made and used full-time for one year and then nights only.



Figure 5 Pre-treatment panoramic radiograph



Figure 6 Pre-treatment facial and intra-oral photographs



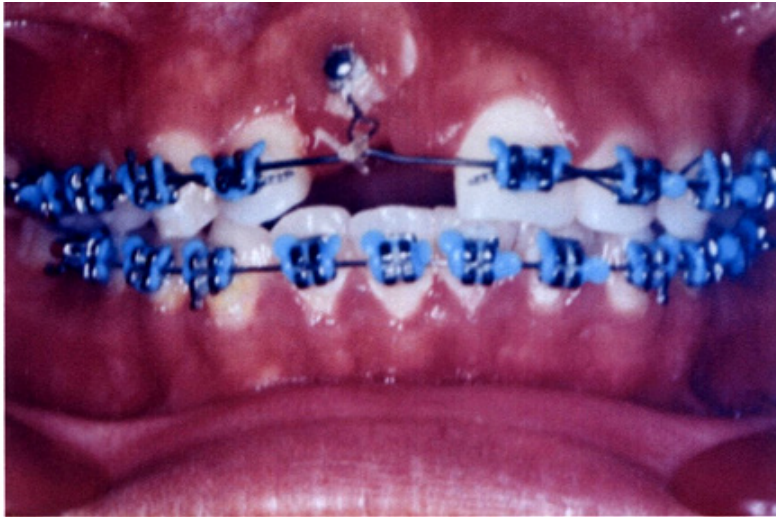


Figure 7 Closed surgical exposure was done on maxillary right central incisors



Figure 8 Post-treatment panoramic radiograph



Figure 9 Post-treatment facial and intra-oral photographs

### Case 3

A Lao male, aged 27 years 6 months was dissatisfied with non-eruption of his maxillary right lateral incisor and canine. He had wanted to have orthodontic treatment for many years. He had no history of trauma in the maxillary anterior region. The panoramic radiograph showed that non-eruption of the maxillary right lateral incisor and canine (Fig. 10). The space was not enough for these two unerupted teeth. The clinical examination found an Angle Class I malocclusion, a straight profile, normal vertical facial proportions, normal nasolabial angle, and absence of maxillary right lateral incisor and partial crown exposure of canine. The maxillary left central incisor was deviated to the right 3 mm (Fig. 11).

Based on the orthodontic records, the treatment objectives were to

1. create space for the incisor to erupt,
2. guide the unerupted canine, make space and retrieve the lateral incisor later.

Before orthodontic treatment, the patient was referred for removal of all of third molars, but he

postponed this. Initial treatment wires were 0.014-in copper nickel-titanium. In 6 months, the maxillary right canine was induced into the normal position. Then an open coil spring was used to make space for his maxillary right lateral incisor. After space opening with fixed appliances for 3 months and no movement of the maxillary right lateral incisor, it was surgically exposed together with bonding of a lingual button tied with ligature wires to the incisor crown by an oral surgeon with closed surgical exposure technique. After orthodontic extrusion in three visits, the crown was exposed in the oral cavity (Fig. 12).

Once the lateral incisor became sufficiently exposed, the button was replaced with a standard bracket. The tooth was then moved into the normal position in 22 months. The finishing archwire was 0.019 × 0.025-in Stainless. The total active treatment was 25 months (Fig. 13 - 14). The patient refused to have the removal of his third molars. Invisible retainers were made and used full- time for one year and then nights only.



Figure 10 Pre-treatment panoramic radiograph



Figure 11 Pre-treatment facial and intra-oral photographs



Figure 12 Crown of maxillary right lateral incisor exposed in oral cavity after 3 visits of orthodontic traction

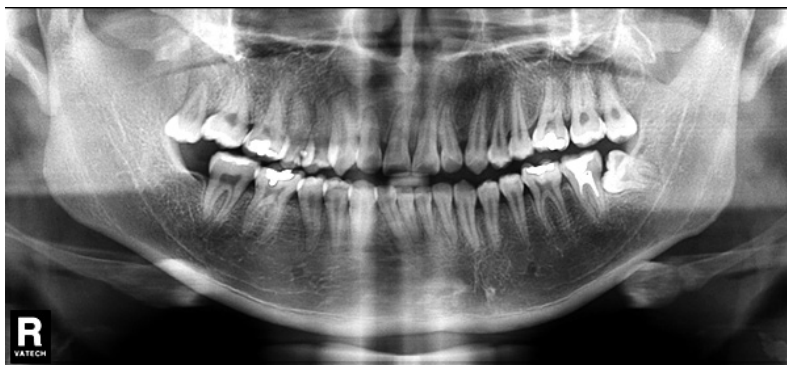


Figure 13 Post-treatment panoramic radiograph





Figure 14 Post-treatment facial and intra-oral photographs

## Discussion

Delayed eruption of the maxillary incisor can be a challenging problem, and treatment often requires orthodontics as well as surgical exposure. These three case reports demonstrate examples of successful retrieval of unerupted teeth. An important benefit of the treatment protocol was avoidance of artificial tooth replacement. Moreover, the patients and parents were pleased with the treatment results.

The best time for the treatment is in the early stage,<sup>7-10</sup> and the global aim of early treatment is to relieve the child's psycho-social problem.<sup>8-9</sup> However, only one of these patients was treated at a young age.

Treatment in the early stage often required the modified appliances with 2 x 4 fixed appliances. It is much efficient in child due to non-compliant appliance. To obtain the sufficient anchorage, bonding to primary canines and permanent molars is recommended. In case 1, only the small tip of the tooth was exposed, and the extrusion force was applied using an elastic chain with a stiff arch wire. The 0.014-in copper nickel-titanium wire overlay (piggy-back) onto a 0.018-in Australian wire was continued to tooth aligning into

normal position. This combination of wires was a simple method to move a delayed erupted tooth.

The clinical benefits of treatment in the early stage are that it favors continuous root formation, and gives good periodontal results.<sup>4</sup> The possible explanation is that the root continuously forms as dental age increases.<sup>11</sup> For example, inducing a horizontally unerupted maxillary incisor into a normal position, root will be moved away from the palatal cortical bone, and will provide space for further root development.<sup>11</sup>

In cases of a delayed erupted tooth, the patient and the parents were informed of the possibility of alternative treatments, including removal of the unerupted tooth in case there is failure of assisted eruption, necessitating artificial tooth replacement.

A conservative method is the preferred initial step for the management of delayed erupted tooth such as removal of supernumerary tooth or odontoma.<sup>12</sup> There are no reports indicating the optimal age for removal of supernumerary tooth in the premaxillary area, unless it may be interfering with eruption of a normal tooth. If the obstruction is removed in the early mixed dentition, especially before normal eruption of maxillary incisors, spontaneous eruption may occur

and the surgical exposure will not be required. In Case 1, although the central incisor was in a horizontal position, surgical exposure was avoided because the tip of the incisor was exposed in the labial sulcus. The tooth spontaneously improved position, enabling bracket bonding without the need for surgical exposure.

Surgical exposure is required in cases of non-spontaneous eruption of an unerupted tooth. The window exposure is used for the impacted tooth near the top of the alveolus with wide attached gingiva, where an apically positioned flap is a choice for a narrow attached gingiva.<sup>13-14</sup> The closed surgical exposure technique is the first treatment of choice for the tooth that is unerupted in the middle of the alveolus or higher, close to the nasal spine.<sup>8-13</sup> It is also claimed that the closed surgical technique is the best technique for retrieving a labially delayed unerupted tooth, especially the unerupted tooth that is impacted high above the mucogingival junction of the adjacent teeth, where an apically positioned flap may be difficult to use effectively.<sup>4,14,15</sup>

The closed surgical technique also provides natural tooth eruption and produces the best esthetic and periodontal results.<sup>13</sup> In Case 2, after removal of both supernumerary teeth, the incisor did not spontaneously erupt within 7 months. The closed surgical exposure technique was performed. For Case 3, although the obstructing canine was aligned in its appropriate position, the lateral incisor did not erupt spontaneously within 3 months. The closed surgical exposure technique was used. During surgical procedure by the oral surgeon, minimum bone loss was important to enable preservation of normal gingival attachment as the tooth erupted. Any extreme bone destruction would be damaging to the periodontal tissue.

In orthodontic guiding of eruption using the closed surgical technique, a flap was raised and a button bracket with an attached steel ligature<sup>16</sup> was bonded to the unerupted incisor followed by flap replacement. In both cases, brackets were placed labially and near the incisor tip to reduce the risk of mucosal

fenestration.<sup>17</sup> Orthodontic traction commenced two weeks after surgery.<sup>15</sup> The extrusion force should be kept light using elastic thread or elastic chain.<sup>9,10</sup> The light force was provided until the tooth was in the normal position. Control of orthodontic anchorage and provision of appropriate bracket torque maximize the quality of the treatment outcome.<sup>18</sup> The periodontal results of the three patients were favorable with esthetic gingival margin and normal gingival contour.

Dilaceration of the root can occur in both primary and permanent dentitions with and without failure to erupt. The prognosis of treatment depends on the position of tooth, degree and position of root dilacerations, and the development of the tooth.<sup>4</sup> In Case 2, there was a small dilaceration at the apical root so the prognosis of guided eruption was good. The right maxillary incisor was aligned into the normal position in 13 months after surgical exposure.

In adolescents and older patients, there is an increasing risk that the unerupted tooth has become ankylosed.<sup>19</sup> In all three cases, ankylosis did not occur during the treatment. Unfavorable results, such as gingival recession, and pulp necrosis were avoided.

Recently, Cone Beam Computed Tomography (CBCT) has become available for high effective localization of unerupted teeth. However, CBCT still has a higher effective radiation dose and cost to the patient than conventional radiography,<sup>20,21</sup> and arguably, is not needed in determining the position and condition of most unerupted teeth.

## Conclusion

A multidiscipline management of delayed eruption of the maxillary incisor of three case reports at various dentition stages, early mixed dentition, early permanent dentition and permanent dentition producing satisfactory results, especially patients and parents avoided to artificial tooth replacement.

## Acknowledgement

The authors are grateful to Dr. Rewadee Lertnimulchai who corrected all of the patients' records and Mr. Chavit Lertnimulchai who helped to prepare the manuscript.

## References

1. Suri L, Gagari E, Vastardis H. Delayed tooth eruption: pathogenesis, diagnosis, and treatment. A literature review. *Am J Orthod Dentofacial Orthop* 2004;126:432-45.
2. Shaw WC, O'Brien KD, Richmond S, Brook P. Quality control in orthodontics: risk/benefit considerations. *Br Dent J* 1991;170:33-7.
3. Ahmad S, Bister D, Cobourne MT. The clinical features and aetiological basis of primary eruption failure. *Eur J Orthod* 2006;28:535-40.
4. Lin YT. Treatment of an impacted dilacerated maxillary central incisor. *Am J Orthod Dentofacial Orthop* 1999;115:406-9.
5. de Oliveira Ruellas AC, Mattos CT. Multidisciplinary approach to a traumatized unerupted dilacerated maxillary central incisor. *Angle Orthod* 2012;82:739-47.
6. Pinho T, Neves M, Alves C. Impacted maxillary central incisor: surgical exposure and orthodontic treatment. *Am J Orthod Dentofacial Orthop* 2011;140:256-65.
7. Tsai TP. Surgical repositioning of an impacted dilacerated incisor in mixed dentition. *J Am Dent Assoc* 2002;133:61-6.
8. Kolokitha OE, Papadopoulou AK. Impaction and apical root angulation of the maxillary central incisors due to supernumerary teeth: combined surgical and orthodontic treatment. *Am J Orthod Dentofacial Orthop* 2008;134:153-60.
9. Nagaraj K, Upadhyay M, Yadav S. Impacted central incisor, canine, and second molar with 2 supernumerary teeth and an odontoma. *Am J Orthod Dentofacial Orthop* 2009;135:390-9.
10. Pavlidis D, Daratsianos N, Jäger A. Treatment of an impacted dilacerated maxillary central incisor. *Am J Orthod Dentofacial Orthop* 2011;139:378-87.
11. Sun H, Wang Y, Sun C, Ye Q, Dai W, Wang X, et al. Root morphology and development of labial inversely impacted maxillary central incisors in the mixed dentition: a retrospective cone-beam computed tomography study. *Am J Orthod Dentofacial Orthop* 2014;146:709-16.
12. Kajiyama K, Kai H. Esthetic management of an unerupted maxillary central incisor with a closed eruption technique. *Am J Orthod Dentofacial Orthop* 2000;118:224-8.
13. Tanaka E, Watanabe M, Nagaoka K, Yamaguchi K, Tanne K. Orthodontic traction of an impacted maxillary central incisor. *J Clin Orthod* 2001;35:375-8.
14. Vermette ME, Kokich VG, Kennedy DB. Uncovering labially impacted teeth: apically positioned flap and closed-eruption techniques. *Angle Orthod* 1995;65:23-32.
15. Becker A, Brin I, Ben-Bassat Y, Zilberman Y, Chaushu S. Closed-eruption surgical technique for impacted maxillary incisors: a postorthodontic periodontal evaluation. *Am J Orthod Dentofacial Orthop* 2002;122:9-14.
16. Becker A, Shpack N, Shteyer A. Attachment bonding to impacted teeth at the time of surgical exposure. *Eur J Orthod* 1996;18:457-63.
17. Noar JH, Gaukroger MJ. Customized metal coping for elastic traction of an ectopic maxillary central incisor. *J Clin Orthod* 2000;34:585-9.
18. Becker A, Chaushu G, Chaushu S. Analysis of failure in the treatment of impacted maxillary canines. *Am J Orthod Dentofacial Orthop* 2010;137:743-54.
19. Proffit WR, Fields HW. Contemporary orthodontics. 3<sup>rd</sup> ed. St. Louis: Mosby; 2000. p. 233-4.
20. Scholz RP. The radiology decision. *Semin Orthod* 2011;17:15-9.
21. Kang BC, Yoon SJ, Lee JS, Al-Rawi W, Palomo JM. The use of cone beam computed tomography for the evaluation of pathology, developmental anomalies and traumatic injuries relevant to orthodontics. *Semin Orthod* 2011;17:20-33.