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Fate of developing tooth buds located in relation to mandibular fractures in three infancy cases

CASE REPORT

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Abstract – The fate of developing tooth buds located in relation to mandibular fractures was investigated in three infancy cases. Three infants, 2 girls and a boy, aged from 1 year and 5-months old to 2 years and 6-months old, were treated for dislocated mandibular fracture in the symphyseal region by manual reduction and fixation with a thermoforming splint and circumferential wiring under general anesthesia. Fracture healing was uneventful in all cases. A few years later, no obvious deformity of the jaw or malocclusion was observed; however, malformation of the crown was found in one of the permanent teeth on the fracture line in the first case. In the second case, no abnormality was observed in one of the permanent teeth on the fracture line, but the effect on the other tooth could not be evaluated due to abnormality of the tooth probably not related to the injury. In the third case, root formation was arrested in one of the permanent teeth on the fracture line and the tooth was lost early after eruption. The development of tooth buds on the fracture line is not predictable and therefore, should be monitored by regular follow up.

Fractures of the maxillofacial skeleton are infrequent in infancy; however, the clinical features and consequences of the fracture are different from those of adults. Therefore, modification is required for treatment and management of the patient depending on the stage of development (1–4). We experienced three cases of severely dislocated mandibular symphyseal fracture and successfully treated them by manual reduction and fixation with a thermoforming splint and circumferential wiring under general anesthesia (5). So far, several reports have been reported as to the treatment of mandibular fracture in children (1–5); however, there have been only a few reports in which the fate of permanent tooth buds on the fracture line was investigated (6–10).

In this report, we investigated the fate of unerupted permanent tooth buds on the fracture line in three cases of mandibular fracture in infancy and discussed the factors determining the fate of the affected tooth buds.

Case reports

Case 1

The patient was a female of 1 year and 5 months old who had been injured by falling from the infant carriage of a bicycle. She was taken to a nearby clinic and referred to our department. On examination, disruption of the mandibular arch was observed between the left deciduous lateral and central incisors. Luxation or tooth fracture was not observed. X-ray examination revealed a dislocated mandibular fracture in the symphyseal region (Fig. 1a). With a diagnosis of mandibular fracture, she was admitted to hospital and treated under general anesthesia on the same day. The fracture was reduced manually, an impression was taken for the plaster model, and a thermoforming splint was fabricated while the patient was under general anesthesia. The splint was placed on the reduced alveolar arch and fixed with circumferential wiring. The postoperative course was uneventful and the circumferential wiring was removed after 17 days. At the age of 3 years and 5 months, deciduous dentition was completed. The left central incisor was erupted at 6 years and 1-month old. Malformation of the crown has been observed in the left central incisor (Fig. 1b), but the root formed normally at the age of 11 years and 5 months (Fig. 1c). No abnormality was found in the left lateral incisor.

Case 2

The patient was a female of 1 year and 6 months old who had been injured by falling from the infant carriage of a bicycle. Mandibular fracture was noted at a nearby hospital and she was referred to our department. On examination, disruption of the mandibular arch was observed between right deciduous lateral and central

Fig. 1. Case 1. (a) X-ray finding at the first visit (1 year and 5-months old). A dislocated fracture was observed in the symphyseal region of the mandible. (b) Intraoral finding (11 years and 5-months old). Malformation of the crown was observed in the left central incisor. (c) X-ray finding (11 years and 5-months old). Abnormal calcification of the crown of the left central incisor was observed, but the root had formed normally.

Fig. 2. Case 2. (a) X-ray finding at the first visit (1 year and 6-months old). A dislocated fracture was observed in the symphyseal region of the mandible. (b) Intraoral finding (6 years and 9-months old). The crown of the right central incisor had formed normally. The right deciduous lateral incisor and canine were congenitally fused. (c) X-ray finding (6 years and 9-months old). The root of the right central incisor was developing normally. The right lateral incisor was still unerupted and fused with the permanent canine similar to deciduous lateral incisor and canine.

incisors. Luxation or tooth fracture was not observed. On X-ray examination, dislocated mandibular fracture of the right symphyseal region was observed (Fig. 2a). She was admitted to hospital and treated the next day. Under general anesthesia, the fracture was manually reduced and fixed using a thermoforming splint that was made during the operation with circumferential wiring. The postoperative course was uneventful and the circumferential wiring was removed after 7 days. Three months after surgery, deciduous tooth alignment was good. At the age of 6 years and 9 months, both central incisors erupted and no abnormality was found in the right central incisor (Fig. 2b,c). The effect on the right lateral incisor was difficult to evaluate as it was still unerupted and fused with the permanent canine similar to a deciduous lateral incisor and canine.

Case 3

The patient was a male of 2 years and 6 months old who had been injured in a traffic accident while travelling in the back seat of a car. He was transferred to a nearby hospital where a mandibular fracture was noted and he was referred to our department. On examination, the mandibular arch was disrupted between right deciduous lateral and central incisors. On X-ray examination, a dislocated mandibular fracture was observed in the symphyseal region (Fig. 3a). He was admitted to hospital and treated the same day. Under general anesthesia, the fracture was manually reduced and fixed with a thermoforming splint and circumferential wiring. The postoperative course was uneventful and the circumferential wiring was removed after 9 days. At the age of 3 years and 3 months, the right deciduous central incisor was extracted due to remarkable mobility. X-ray examination also showed abnormal development of the unerupted right central incisor (Fig. 3b). At the age of 4 years and 3 months, eruption of the right central incisor was observed, but it was lost at the age of 5 years and 5 months. At the age of 7 years and 6 months, no abnormality was found in the left central incisor except for a small white patch on the crown (Fig. 3c). On X-ray examination, the root of left central incisor was forming normally (Fig. 3d).

Discussion

The fate of developing tooth buds located in relation to mandibular fractures was investigated in three infancy cases. These three cases had similar features as follows: (i) infant of 1 or 2 years, (ii) mandibular fracture in the

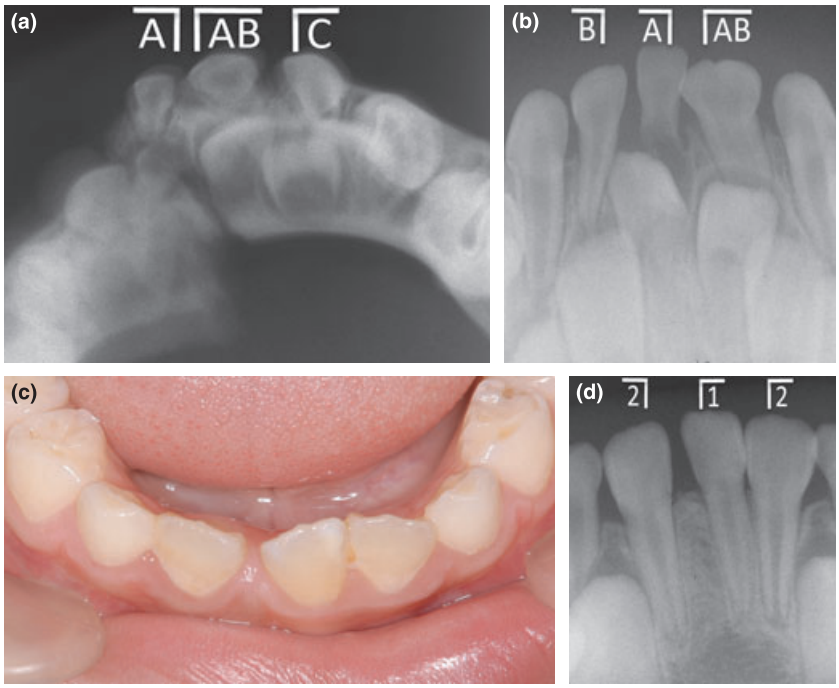

Fig. 3. Case 3. (a) X-ray finding at the first visit (2 years and 6-months old). A dislocated fracture was observed in the symphyseal region of the mandible. (b) X-ray finding (3 years and 3-months old). The root of the right deciduous central incisor was remarkably absorbed. The unerupted right central incisor showed abnormal formation of the crown and root. (c) Intraoral finding (7 years and 6-months old). The right central incisor was lost. The crown of the left central incisor had formed almost normally. (d) X-ray finding (7 years and 6-months old). The root of the left central incisor was developing normally.

symphyseal region, (iii) dislocation of bone fragment, (iv) deciduous teeth were preserved, (v) treated by manual reduction and fixation with a thermoforming splint and circumferential wiring under general anesthesia, (vi) antibiotics was prescribed and postoperative infection was not observed, (vii) good fracture healing was obtained. However, the fate of the permanent tooth buds was different in each patient. In case 1, malformation of the crown was observed in one of the permanent teeth on the fracture line, but the root was normally formed. This is probably due to the fracture occurred during formation of the crown of the central incisor but the damage was relatively mild, allowing tooth development after injury. In case 2, the central incisor erupted normally without any abnormality. The effect on the lateral incisor could not be evaluated due to abnormality probably not related to the injury, since the lateral incisor is considered to have been already fused with the canine at the time of the injury. In case 3, the crown of the affected tooth was mostly completed at the time of the injury, but damage to the tooth bud was serious and root formation was arrested, resulting in loss of the tooth.

Several reports have analyzed the effect of a fracture on the unerupted permanent tooth buds (6–10). In general, the effect of a fracture on the unerupted permanent tooth buds on the fracture line was dependent on the age of the patient, the stage of tooth development, the condition of deciduous teeth, site of fracture and degree of dislocation, relationship between the fracture line and tooth buds, treatment method, duration until treatment and complications such as infection; however, the effect of these factors on permanent tooth buds has not been sufficiently analyzed.

The stage of tooth development is a crucial factor in the fate of tooth buds. Ranta & Ylipaavalniemi (7) reported that teeth whose root formation was in progress at the time of injury seemed to erupt normally but teeth whose crown was in the process of calcification were likely to show malformation of the crown and root. On the contrary, Suei et al. (10) described that a tooth bud continued to develop irrespective of the stage of tooth development; however, the stage of tooth development cannot be a marker of whether the tooth bud will develop normally, but is only a possible marker of what part of the affected tooth was damaged.

The relationship between the fracture line and tooth buds is generally examined on X-ray film. Although X-ray examination in infants is sometimes difficult, it is reasonable to consider that the fracture line passes through the tooth bud, as a tooth bud is less resistant to traumatic force than the surrounding bone tissue. In the present three cases, the relationship between the fracture line and tooth buds was difficult to examine on X-ray film due to one bone fragment above the other because of severely dislocated fracture. However, the fracture line was considered to pass dominantly through either of the tooth buds on the fracture line, as an abnormality of the permanent tooth was observed in one of the teeth on the fracture line.

The fate of the tooth buds on the fracture line is dependent on the severity of their injury. Koenig et al. (9) described that damage to the tooth buds was relatively mild compared with that of bone tissue because of its elasticity. Suei et al. (10) described that the degree of fracture dislocation was not related to a later abnormality of teeth close to the fracture. Ranta & Ylipaavalniemi (7) speculated that abnormal development of the affected tooth was related to disruption of the blood supply to the tooth bud at the time of injury; however, damage by the fracture occurred at the histological level and was difficult to evaluate clinically.

Abnormality observed in the affected tooth is mostly discoloration of the crown, malformation of the crown or root, arrest of development, or disturbance of eruption. As a relatively rare abnormality, the formation of a tooth-like structure or cyst-like lesion was reported (11, 12). Hitchin (11) speculated that the remnant of Hertwig survived and proliferated to form such a structure.

The treatment method may affect the fate of the permanent tooth bud. There have been a few reports that tooth eruption was disrupted due to penetration of the tooth bud by the plate or wire used for fixation (10, 13, 14). This finding suggested that tooth buds could be injured during the surgical procedure in addition to traumatic force; however, Suei et al. (10) stated that the affected tooth erupted normally after extensive surgery based on appropriate radiological examination in most cases. In the present three cases, the fractures were reduced manually and fixed with a thermoforming splint and circumferential wiring; therefore, damage to the tooth buds was considered to have been minimized.

Development of the affected tooth buds is influenced by infection as well as mechanical stress. Suei et al. (10) reported that the development of tooth buds was impaired in three out of four cases of infection at the site of the fracture and two remained embedded. Lenstrup (6) also reported that an infected permanent tooth bud resulted in malformation of the crown or root and remained unerupted. Therefore, it is important to treat the fracture immediately to avoid infection, although there is no evidence that the time between the injury and treatment is related to the degree of permanent tooth damage. It is also important to maintain space for the permanent tooth when the deciduous tooth is lost (6).

In summary, we successfully treated three cases of dislocated mandibular fractures in infancy by manual reduction and fixation with a thermoforming splint and circumferential wiring under general anesthesia; however, malformation of the crown and the arrest of root formation were observed in two of three cases. The development of tooth buds on the fracture line is not predictable and therefore, should be monitored by regular follow up.

References

1. Haug RH, Foss J. Maxillofacial injuries in the pediatric patient. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2000;90:126–34.
2. Iida S, Matsuya T. Paediatric maxillofacial fracture: their aetiological characters and fracture pattern. J Craniomaxillofac Surg 2002;30:237–41.
3. Ferreira PC, Amarante JM, Silva PN, Rodrigues JM, Choupina MP, Silva AC et al. Retrospective study of 1251 maxillofacial fractures in children and adolescents. Plast Reconstr Surg 2005;115:1500–8.
4. Sano T, Komine Y, Takaku S, Yoshida M, Imai K, Tomori K et al. Clinical observation of jaw fractures in young children. Jpn J Oral Diag/Oral Med 1999;12:606–12.
5. Yamamoto K, Ohgi K, Fujimoto M, Murakami K, Sugiura T, Inoue M et al. Treatment of mandibular fractures in infants. Asian J Oral Maxillofac Surg 2005;17:40–4.
6. Lenstrup K. On injury by fractures of the jaws to teeth in course of formation. Acta Odont Scand 1955;13:181–202.
7. Ranta R, Ylipaavalniemi P. The effect of jaw fractures in children on the development of permanent teeth and the occlusion. Proc Finn Dent Soc 1973;69:99–104.
8. Larsen OD, Nielsen A. Mandibular fractures. II. A follow-up study of 229 patients. Scand J Plastic Surg 1976;10:219–26.
9. Koenig WR, Olsson AB, Pensler JM. The fate of developing teeth in facial trauma: Tooth buds in the line of mandibular fractures in children. Ann Plast Surg 1994;32:503–5.
10. Suei Y, Mallick PC, Nagasaki T, Taguchi A, Fujita M, Tanimoto K. Radiographic evaluation of the fate of developing tooth buds on the fracture line of mandibular fractures. J Oral Maxillofac Surg 2006;64:94–9.
11. Hitchin AD. Traumatic odontome. Br Dent J 1969;126:260–5.
12. Higuchi Y, Inui M, Matsumura Y, Sanada K, Tagawa T. Cyst-like lesion of a developing tooth induced by a mandibular fracture. Endod Dent Traumatol 1997;13:297–9.
13. Nixon F, Lowey MN. Failed eruption of the permanent canine following open reduction of a mandibular fracture in a child. Br Dent J 1990;168:204–5.
14. Calderon S, Kaplan I, Gal G. Development arrest of tooth after correction of mandibular fracture. Endod Dent Traumatol 1995;11:105–7.