Changing the Angulation of the Tooth Germ in the Bony Crypt: A Case Report

Jin-Myoung Jang*/ Je Seon Song**/ Jae-Ho Lee***/ Hyung-Jun Choi****/ Seong-Oh Kim*****

An ankylosed primary molar may cause rotation or ectopic impaction of succedaneous premolar. When conventional treatment modalities such as observation, surgical exposure with or without orthodontic traction, and autotransplantation are not possible, the simple surgical relocation method could be an alternative treatment option for a lingually rotated premolar during the tooth germ stage before opting to extraction. In the case reported herein, the lingually rotated permanent mandibular second premolar tooth germ was surgically relocated within its bony crypt. Continued root development and spontaneous eruption were observed without complications during the 3.5-year follow-up period.

Key words*: tooth germ, surgical relocation, ankylosis*

INTRODUCTION

Ankylosis is common in primary dentition, with a reported prevalence of 7-14%.[1,2] The primary mandibular first molars are the most frequently affected teeth, followed by the primary mandibular and maxillary second molars.[3] The ankylosis of a primary molar may cause significant tipping of the adjacent teeth,[4] deflected eruption paths for adjacent or opposing teeth,[5] and rotation or impaction of succedaneous premolars.[5,6]

If severe rotation or ectopic impaction of premolar occurs in association with the ankylosed primary molar, appropriate treatment should be performed to establish normal occlusion. The treatment options for a rotated or impacted premolar include extraction of the ankylosed primary molar and periodic observation of the premolar for spontaneous correction of the eruption path, surgical exposure with or without orthodontic intervention, autotransplantation and extraction of the premolar.[7,8]

In cases where the prognosis of treatment is uncertain or extraction of the premolar is required, surgical relocation could be considered as an alternative treatment option during the tooth germ stage with immature root development.

*Jin-Myoung Jang, DDS, Graduate School Student.
**Je Seon Song, DDS, PhD, Associate Professor.
***Jae-Ho Lee, DDS, PhD, Professor.
****Hyung-Jun Choi, DDS, PhD, Chief Professor.
*****Seong-Oh Kim,DDS, PhD , Professor.

Send all correspondence to:
Seong-Oh Kim
Department of Pediatric Dentistry, Yonsei University College of Dentistry
250 Seongsanno, Seodaemun-gu, Seoul 120-752, Korea
Phone: (82-2)2228-3171
E-mail: ksodds@yuhs.ac

This report presents a case of simple surgical relocation method which successfully changed the angulation of the permanent mandibular second premolar at the tooth germ stage, which exhibited continued root development and spontaneous eruption during the 3.5-year follow-up period.

Case Report

A girl aged 5 years and 10 months was referred from a local dental clinic for the evaluation and treatment of an unerupted primary mandibular right second molar. She had been told that the successor tooth could not erupt because of the ankylosed primary tooth. She had no contributory medical history. A clinical examination revealed that the primary mandibular right second molar had not erupted into the oral cavity, and a radiographic examination demonstrated that the primary mandibular right second molar was infraoccluded (Fig 1A). Furthermore, the dental follicle of the succedaneous tooth was lingually angulated within its bony crypt. Computed tomography (CT) imaging revealed that, the permanent mandibular right second premolar was lingually rotated more than 45˚(Fig 1B). It seemed unlikely that the long axis of the premolar would be improved after extraction of the primary mandibular right second molar.

The treatment plan was to extract the primary mandibular right second molar and permanent mandibular right second premolar under general anesthesia due to the poor prognosis with unfavorable lingual angulation of the tooth germ.

Further investigation revealed a ball-shaped bony crypt and a small gap between the tooth germ and the surrounding bone, and so the possibility of rotating the tooth germ was carefully evaluated.

On the day of the surgery, the impacted primary mandibular second molar was surgically extracted, and the angulated crown of the second premolar, which was covered by the dental follicle, was

observed through the extraction socket. The second premolar was carefully rotated in its bony crypt by pressing down on the marginal ridge in the buccal direction using a dental explorer, so that the long axis was ultimately positioned favorably for the future (Fig 2). Since the second premolar was in the initial root-forming stage, the surgical procedure of changing the angulation of the second premolar tooth germ was easy to perform without any resistance. Bone preparation was not needed as the tooth germ was rotated within its bony crypt. To minimize the damage to the developing tooth germ, neither bone preparation around the extraction socket nor repeated surgical attempts to change the angulation of the tooth germ were conducted.

A panoramic X-ray was obtained immediately after the surgery (Fig 3). The long axis of the permanent mandibular second premolar was improved and favorable for eruption, and the dental follicle appeared to be intact. However, the unerupted permanent mandibular right first molar was inclined mesially due to the submerged primary molar; plan was made to distalize it when it fully erupts into the oral cavity.

After 19 months, the permanent mandibular right first molar had fully erupted into the oral cavity (Fig 4A). The tooth was inclined mesially and space for permanent mandibular right second premolar decreased (Fig 4B). Orthodontic treatment to distalize the first molar and regain space for the second premolar was commenced using a fixed appliance with NiTi and open coil spring (Fig 5A).

The patient was recalled for follow-ups and continued root development was confirmed without dilacerations or root resorption during 3.5-year follow-up period (Fig 5B). The permanent mandibular right second premolar has erupted into the oral cavity (Fig 5A). Continuous periodic observation of the root development of the permanent mandibular right second premolar will be required.

Figure 1. Initial appearance of lingually angulated permanent mandibular right second premolar. A, Panoramic radiograph (White arrow). B, Three-dimensional CT image from the lingual side (Black arrow).

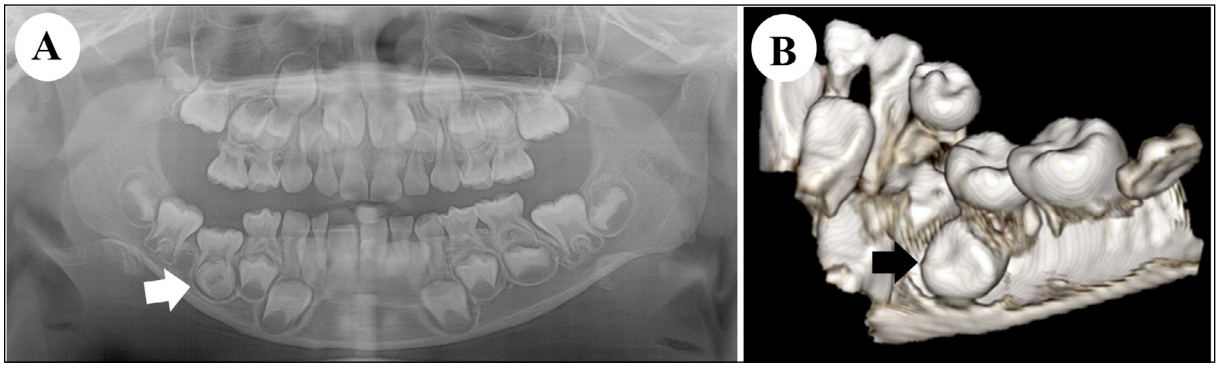


Figure 2. Schematic illustration of surgical procedure. The lingually rotated tooth germ was carefully rotated within its bony crypt.

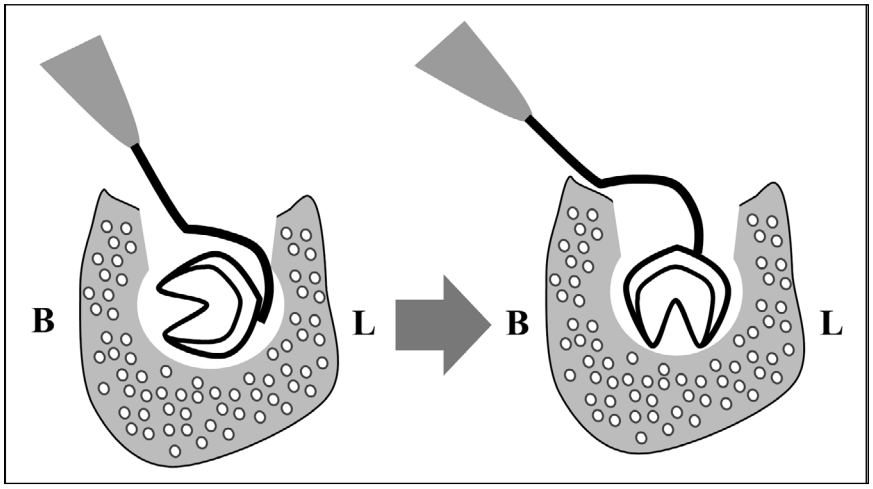


Figure 3. Panoramic radiograph obtained immediately after the surgical relocation. The long axis of the permanent mandibular right second premolar was improved and favorable for eruption (White arrow).

Figure 4. Movement of the tooth after 19 months. A, Intraoral appearance. B, Panoramic radiograph.

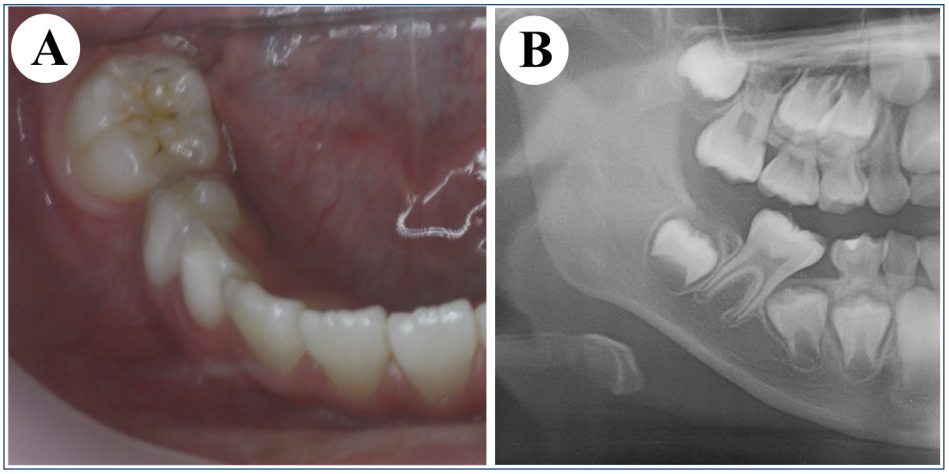
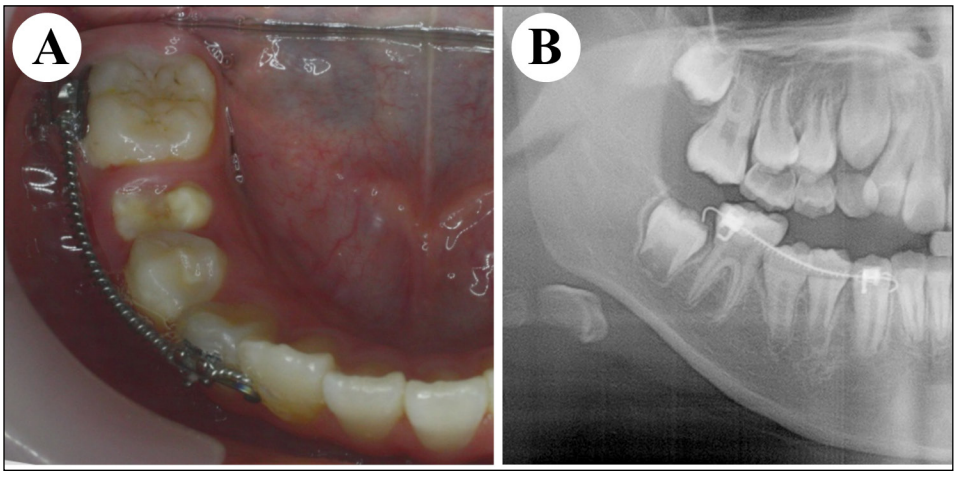


Figure 5. Movement of the tooth after 3.5 years. A, Intraoral appearance. B, Panoramic radiograph.



DISCUSSION

This case report demonstrates continued root development and spontaneous eruption of a severely rotated immature permanent mandibular second premolar tooth germ after a simple surgical relocation procedure.

In this case, the CT image obtained before the surgery revealed that the dental follicle of the succedaneous tooth was lingually angulated within its bony crypt, so it was considered that the premolar would ultimately become ectopically impacted in the lingual direction. The possibility of spontaneous eruption of the second premolar seemed uncertain.

The treatment options for rotated or impacted teeth include observation, surgical exposure with or without orthodontic intervention, autotransplantation, and extraction. In some cases, there may be interaction between these treatment options.[7,8] The selection of a treatment strategy for rotated or impacted premolars in particular should be made with the direction of impaction in mind. If the crown of an impacted mandibular premolar faces the buccal side and the root faces the lingual side, observation or surgical exposure with or without orthodontic intervention depending upon the degree of rotation or impaction could be considered. However, if the crown of the premolar is positioned lingually, observation without treatment or surgical extraction of the tooth should be planned. Surgical exposure with or without orthodontic intervention should be limited due to the high risk of damage to the lingual nerve and artery. Furthermore, Andreasen[9] suggested that surgical exposure should be confined to cases, both maxillary and mandibular, with no more than 45˚ of tilting and limited deviation from the normal position. In the case reported herein, the premolar had rotated more than 45˚, and so surgical exposure was not suitable. In addition, when surgical extraction of the premolar is needed as the lingual impaction of the premolar is becoming obvious, surgical extraction procedure with lingual approach comes with the inherent risk of damage to the sublingual gland and infection in the sublingual space.[7,10]

The technique used to realign the rotated second molar in the present case is neither a replantation nor an autotransplantation technique; rather, it is a modification of surgical relocation. This surgical technique is very simple and does not require extraction of the tooth or preparation of the alveolar bone. Also, the apex of root is not exposed during the surgical procedure.

The simple surgical relocation method described herein requires only a single surgical procedure and is relatively cost-effective because it obviates the need for complicated orthodontic treatment for the traction of tooth. If used in appropriate circumstances, this technique can bring malposed or nonerupted teeth into arch alignment and, when all other conditions are favorable, a single procedure may be sufficient for bringing such teeth into functional positions at the early tooth germ stage.

There are several requirements for the success of this surgical relocation technique. First, the tooth should be at the initial stage of root development. The surgical relocation procedure is relatively easy at this stage (i.e., Nolla stage 5 or 6, or stage 1 or 2 as defined by Moorrees et al.[11]), since there is very little resistance to the alveolar bone during the surgical procedure. It is very difficult to rotate the tooth germ when its root is already more than one-quarter fully developed within the bony crypt, and this might increase the risk of damage to the developing root. Second, the bony crypt should be sufficiently round to allow the tooth germ to be rotated. Finally, the arc of rotation or alteration of the long axis of the tooth should be within 90˚.[12]

Surgically relocating a tooth from its original position is associated with complications such as inflammatory or replacement root resorption, pulp necrosis, and partial or total arrest of root formation,[13,14] but this procedure could maintain the vitality of the tooth and allow subsequent normal root development.[13,15-17] Roots that are still in a state of development have remnants of the dental papilla at their growing ends, and this follicular root sac moves with the rotated or repositioned tooth, thus maintaining the pulpal vascularity. Although capillaries in the follicular sac are torn during the surgical movement of tooth, the presence of a blood clot, the remarkable ability of the pulpal mesenchyme to reorganize, and the versatility of young connective tissue still allow repair to occur.[15]

In a retrospective study of 100 autotransplanted human premolars, Kristerson[12] found that the degree of pulpal revascularization was greatly dependent upon the stage of root development. Pulp revascularization was observed in 100% of cases in which the tooth was in the initial stage of root development up to a half-developed root, and 0% teeth with fully developed roots. On the other hand, transplantation of tooth germs in dogs at a stage of development where crown formation was complete and early root formation had commenced showed no further root development and later resorption of the teeth.[18] In the present case, although the surgical relocation was performed at an early stage of root development, the simple rotation of the tooth germ within the bony crypt and careful performance of the surgical procedure ensure that the pulpal vascularity and the dental follicle were not impaired, thus assuring pulpal survival after the surgical relocation.

During the surgical procedure it is very important to minimize damage and preserve the periodontal ligament and Hertwig's epithelial root sheath for continuous root development.[19-21] In addition, stem cells from the apical papilla (SCAP) were recently introduced as a source of odontoblasts, which are responsible for the formation of root dentin. Therefore, conservation of SCAP is also of great importance for the continuous formation of the root when treating immature teeth.[22]

CONCLUSION

The age of the patient, severity of angulation, direction of impaction, and degree of root maturity should be considered when selecting case for surgical relocation. The present case illustrates that in cases where surgical exposure of lingually rotated premolar is inadequate and extraction of the premolar is predicted in the future, this simple surgical relocation method could be considered as an alternative treatment modality for changing the angulation of the tooth germ at the initial stage of root development.

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