Autotransplantation of an Unerupted Wisdom Tooth Germ without Its Follicle Immediately After Removal of an Impacted Mandibular Second Molar: A Case Report

***Fou Shaou Lai,** DDS*

Contact Author

Dr. Lai
Email: *shaoulai@shaw.ca*

ABSTRACT

An impacted left mandibular second molar (tooth 37) was extracted, but most of its dental follicle remained in the socket. The crown and dental papilla of an unerupted, left mandibular third molar (tooth 38) were then placed into the socket of tooth 37. Successful interaction between the dental follicle of tooth 37 and the crown and dental papilla of tooth 38 led to the formation of a new tooth 37 at the recipient site. This suggests that the dental follicle may function non-specifically with the crown and dental papilla of other tooth germs.

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Autotransplantation of the mandibular wisdom tooth has long been a treatment option for impaction of the mandibular second molar.[1,2] Although transplantation of a partly formed tooth with greater root development will yield a better result,[3,4] a tooth germ with early Hertwig's epithelial root sheath (HERS) formation can be successfully transplanted if it is well placed in the bony socket and wrapped with soft tissue.[5] At the end of the "bell" stage, the enamel organ will have morphodifferentiated into a crown, allowing the tooth germ to be handled more easily during the surgical procedure. Because the cells of the enamel organ, dental papilla and dental follicle "interact through a system of effectors, modulators and receptors" (cell signaling),[6] it is optimal for tooth development that the tooth germ be transplanted integrally and atraumatically.

The operation requires delicacy, particularly in removing the fragile dental follicle of the donor tooth germ from the bony crypt and the mucoperiosteal tissue covering it. In the case described below, I used the retained dental follicle of the recipient socket rather than that of the donor tooth as a less difficult, surgical alternative.

Case Report

A 14-year-old boy with excellent general and oral health visited my office for a second opinion about the extraction of his impacted left mandibular second molar (tooth 37) and developing wisdom tooth (tooth 38).

Figure 1: Radiograph showing the impacted left mandibular second molar (tooth 37) and the unerupted third molar (tooth 38). Note the early Hertwig's epithelial root sheath of tooth 38 beginning to form a furcation.

Figure 2: Extracted tooth 37 with residual torn dental follicle attached.

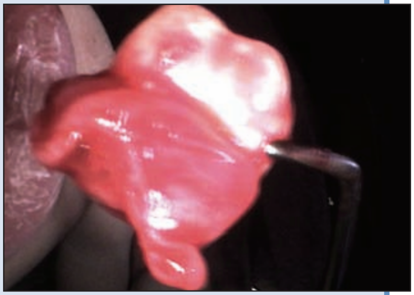

Figure 3: Extracted tooth 38 germ with dental follicle absent.

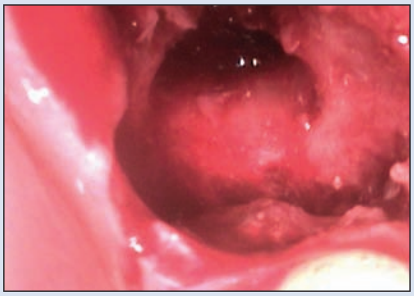

Figure 4: Tooth 37 socket with most of the dental follicle remaining.

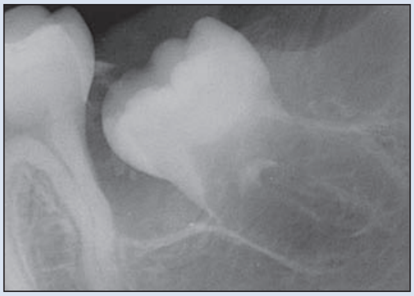

Figure 5: Radiograph taken immediately after placement of tooth 38 into the tooth 37 socket.

Figure 6: Photograph showing tooth eruption with healthy gingival tissue 3 months after transplantation.

Radiography (**Fig. 1**) revealed that teeth 37 and 38 were obliquely impacted in the alveolar bone; on tooth 38, HERS had begun to form the furcation, and only half of the distal root at the distal aspect of the left mandibular first molar (tooth 36) was covered by alveolar bone. Treatment options discussed with the patient included surgical repositioning with endodontic treatment of tooth 37, upright alignment of tooth 37 surgically with or without orthodontic and endodontic aid, and extraction of tooth 37 to allow tooth 38 to grow and migrate to the site of tooth 37.[1,2] Ultimately, transplantation of tooth 38 to the site of tooth 37 was chosen as treatment.

There are several key points to be noted about the surgical procedure followed in this case:

- When the soft tissue flaps were raised, the dental follicle around the cervical region of the crown of tooth 37 was incised, detached and retracted.
- Interruption of the blood supply to tooth 38 was minimized (< 5 minutes). Impacted tooth 37 was exposed and removed (**Fig. 2**); tooth 38 was then exposed and extracted without its dental follicle (**Fig. 3**); and, finally, tooth 38 was positioned in the tooth 37 socket (**Figs. 4** and **5**).
- The dental follicle of tooth 38 was completely removed from its socket and from the attached covering mucoperiosteal tissue as part of the routine procedure for the extraction of impacted wisdom teeth.
- Although most of the dental follicle of tooth 37 remained in the socket and on the retracted soft tissue flaps, a small amount was detached along with the extracted tooth 37 (**Fig. 2**).
- To avoid additional injury to the retained dental follicle, the recipient socket was not deepened. The dental papilla of tooth 38 was gently seated into the empty tooth 37 socket, allowing the retained dental follicle to fully encapsulate the crown and HERS of tooth 38. As well, tooth 38 was handled cautiously to preserve the reduced enamel epithelium closely attached to the surface of the crown, as this epithelium functions with the dental follicle to create the eruption pathway and also fuses with the oral epithelium to produce the dentogingival junction after tooth eruption.[7,8]

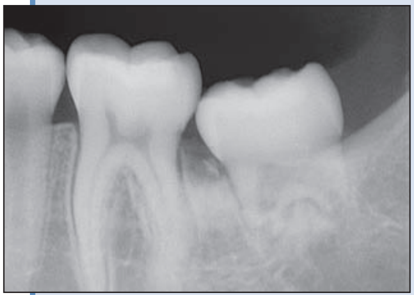

Figure 7: At 7 months after transplantation, developing lamina dura and alveolar bone surround the new tooth 37 and the distal root of tooth 36.

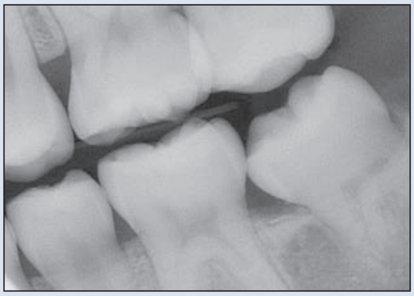

Figure 8: Slightly elongated left upper second molar (tooth 27) preventing upright growth of the new transplant.

Figure 9: After 2.5 years, the mesial marginal ridge of the new tooth 37 was made level with tooth 36 using composite resin.

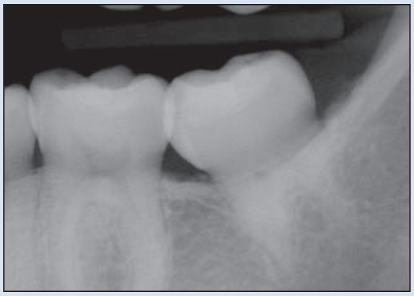

Figure 10: After 3 years follow-up, alveolar bone and lamina dura have developed completely for both the new tooth 37 and the distal aspect of tooth 36.

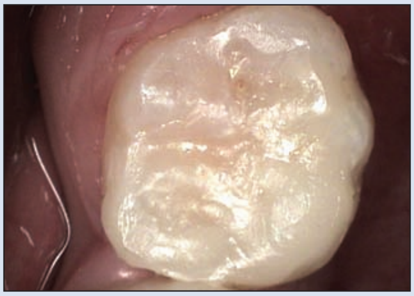

Figure 11: New tooth 37 at 3 years after transplantation.

- Finally, the flap was sutured with tooth germ 38 in place as the new "37" (**Fig. 5**).

Periodic examinations were conducted over the following years. The transplanted tooth erupted at 3 months (**Fig. 6**) and at 7 months postoperation had grown almost to the occlusal level. The well-developing alveolar bone had covered the roots of new tooth 37, as well as the distal root of tooth 36 (**Fig. 7**).

Although the outcome was favourable, the fast growing, buccally aligned upper second molar had prevented the new transplant from achieving an upright position (**Fig. 8**). To make the mesial marginal ridge level with tooth 36, composite resin was placed at the mesial occlusal area 2.5 years after the initial transplantation (**Fig. 9**). The result after 3 years is shown in **Figs. 10** and **11**.

The Role of the Dental Follicle

The dental follicle (or dental sac) is the ectomesenchymal tissue[9] (connective tissue differentiated from neuroectoderm) surrounding the enamel organ and dental papilla. Evidence suggests that, with certain molecular stimulation, dental follicle cells can be the precursors of cementoblasts, osteoblasts and periodontal ligament fibroblasts.[10–12] The dental follicle also recruits osteoclast precursors (mononuclear cells) to form osteoclasts through regulation by chemotactic molecules.[10–14]

The dental follicle seems essential to tooth eruption, although the eruptive mechanism is still unconfirmed. Studies[12,13,15,16] suggest that the coronal half of the dental follicle regulates bone resorption (osteoclastogenesis), while the basal half regulates bone formation (osteogenesis). Both osteoclastogenesis and osteogenesis are necessary for tooth eruption. The presence of the dental follicle allows even an inert replica to erupt, whereas tooth eruption is impossible in its absence.[12,13]

The dental follicle has an extraordinary capacity to repair itself.[17] Vriens and Freihofer[18] noted that despite damage to the follicle of an upper third molar during surgical transplantation, the clinical outcome was good, even at 5 years' follow-up. Although injury to the dental follicle may cause ankylosis or uneruption of the tooth, the threshold of injury necessary to cause these complications remains unknown.[17]

In summary, the current concept of the dental follicle is that it forms the supporting tissues of a tooth — the cementum, periodontal ligament and alveolar bone — and plays an important role in tooth eruption.[7,12–16] However, much remains unknown about gene expression and signaling molecules in the study of cellular interactions among the dental follicle, enamel organ and dental papilla.

Discussion

This case report had 2 significant outcomes. First, the transplanted tooth successfully grew in the recipient socket with minimal damage to the recipient dental follicle. To minimize injury to the recipient dental follicle, the socket was not surgically extended to allow deeper placement of the transplant; therefore, the roots of the transplant were shorter than normal. During root formation, the crown grows away from the bony crypt and the root sheath differentiates toward the crown and not into the jaw.[7] In this case, even with an existing space under the transplanted tooth germ, its roots did not grow downward.

Second, the procedure was framed on the current, general knowledge of the dental follicle. It demonstrated that the function of the dental follicle may not be limited to its own tooth by any determinant molecular regulation. This clinical case report — successful development of the supporting tissue of a transplanted donor tooth and the distal aspect of the adjacent first molar — helps to support this hypothesis.

Conclusion

The results of this case report suggest that the dental follicle can function non-specifically. The retained dental follicle in the recipient socket used as a substitute for the donor follicle may provide a viable option for autotransplantation of an unerupted tooth germ; however, further clinical research is required.

THE AUTHOR

***Dr. Lai** maintains a private practice in Vancouver, British Columbia.*

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***Correspondence to:** Dr. Fou Shaou Lai, 202–6325 Fraser St., Vancouver BC V5W 3A3.*

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