

Medicolegal Aspects of Replanting Permanent Teeth

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A b s t r a c t

Replantation of a permanent tooth is an intervention that carries the same responsibilities in terms of informed consent as a surgical procedure. Unlike many procedures that can be planned in advance, an avulsion requires decision-making shortly after the injury, often by a distraught patient or parent. Under these circumstances, patients or parents prefer, or may even pressure, clinicians to make the replantation decision for them. Later, the parents may seek advice of other professionals or be confronted by lay opinions or Internet information that may lead them to doubt the decision or even feel betrayed by the dentist who provided the acute care. This article uses an actual parent complaint to illustrate the medicolegal aspects of the replantation decision and describe measures to be taken by the clinician faced with this situation.

MeSH Key Words: dentist-patient relations; informed consent; risk management; tooth replantation

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Replantation of an avulsed tooth is an invasive procedure that requires informed consent of the patient or parent and the cooperation of the patient. Informed consent requires the dentist to know and explain the range of outcomes that include survival prospects, possible effects of replantation on future interventions and costs associated with the decision to replant a tooth. Because replantation is such a rare occurrence, dentists often consult published guidelines or information posted on dental association Web sites. Unfortunately, even recent guidelines do not address the question of whether it is in the patient's best interests to replant a tooth.¹ Other guidelines do not include information from recent basic science, clinical and socioeconomic investigations or they include untested "treatments."¹⁻³ As a consequence, dentists make recommendations and provide treatment for this rare injury based on information that is neither current nor comprehensive. Injuries such as avulsions often lead to insurance and legal claims and dentists who treat such injuries are routinely required to submit their clinical records. Lawyers and regulatory bodies regularly recruit dental specialists to submit letters of expertise about injury cases based on the dentists' treatment records and consultants' subsequent clinical examinations.

Outcomes of Replantation

The injured, upset patients who present to dentists'

offices expect them to replant teeth successfully because other dentists and magazine articles have implied that replantation is the treatment of choice. Dentists have been successful in informing the public that, if an avulsed tooth is placed in milk and it and the child are brought to a dentist quickly, then positive outcomes can be expected. However, evidence shows that the most important determinant of survival is immediate replantation at the accident site.⁴⁻⁶ Delayed replantation (longer than 5 minutes) will invariably lead to root resorption and eventual loss of the tooth regardless of the storage medium.⁴ Likewise, if the pulp is not removed and endodontic treatment completed, survival will be compromised by the likelihood of inflammatory resorption with rapid tooth loss.^{7,8} Because immature incisors have less root mass, root resorption is more significant and immature apices complicate conventional root canal treatment.⁹ Finally, if replantation is undertaken in a pre-adolescent or youth who has not completed growth, replacement resorption and ankylosis will lead to apparent submergence and distortion of the gingival architecture during vertical jaw growth.^{10,11} The outcome is frequently determined even before the patient presents to a dentist. The evidence is clear that delayed replantation of teeth with incomplete root development in growing jaws produces predictably poor outcomes.^{9,12} Young adults whose skeletal growth is complete have longer

post-replantation survival rates, but the long-term outcome is the same: eventual tooth loss as a direct result of the avulsion.^{4,7,9}

Clinician-based Factors in Decision-making

Despite evidence that delayed replantation leads to tooth loss and sequelae that may compromise future restorative care, dentists are still likely to replant avulsed incisors. Factors that promote this practice include delays in translation of research information into clinical practice and the immediate appreciation that the patient or parent offers the dentist. This is one of the few heroic moments in dental practice and once clinicians experience this appreciation, subsequent clinical choices are apt to be influenced by favourable memories.

Additional factors may play a role in a dentist's decision to recommend delayed replantation of an avulsed incisor. The clinician who replants the tooth is often not the person who has to deal with late-presenting complications, such as surgical extraction of the ankylosed incisor, bone grafting before prosthetic restoration and implant failure. Many dentists continue to practise the techniques they learned as undergraduates despite changes in the evidence base. The time lag between publication of new evidence and acceptance of that evidence into clinical practice coupled with the human tendency to resist change mean that dentists will likely continue to recommend delayed replantation for some time, even for pre-adolescents. Finally, clinicians and patients or parents are often willing to take a chance.

Risks Associated with the Decision Not to Replant

Although outcomes are predictably poor in cases of delayed replantation, dentists may be at greater risk of complaint or legal challenge for *not* replanting a tooth, regardless of a dismal extra-alveolar history. That is because failure of a replanted incisor may not occur for a number of months or years after replantation, but conflicting opinions can come rapidly. In fact, replanted teeth may last many years in patients who have mature roots and have achieved their full jaw growth.¹³ This is the area where anecdotal information, probability and clinical experience lead to conflicting advice to parents resulting in loss of confidence in a clinician who recommends *against* replantation. Another dentist may correctly tell the patient or parent that he or she replanted a tooth that lasted many years concluding that, if the patient had come to him or her, the tooth could have been "saved."^{7,13} Parents who search the Internet for information find avulsion guidelines that explain *how* to replant a tooth, but lack information about *whether* to replant. Obviously, this can lead to loss of confidence in the decision not to replant, even feelings of betrayal by a dentist who did not replant a tooth, and this may, in turn, generate a complaint. The quotation below is from a parental

complaint for which one of the authors was asked to provide an expert opinion almost 10 years ago. It illustrates a number of points that affect every clinician.

In order to assist the Complaints Committee with its deliberations, we would appreciate your providing us with a letter of expertise concerning the subject of the avulsion of a maxillary permanent central incisor in a seven year old.

If a seven year old child presents at the dental office with an avulsed (but whole) permanent central incisor which has been wrapped in a cloth soaked with milk and which was avulsed approximately one and one half hours previously, what acute care treatment would be recommended under the circumstances.

In this situation, the supporting alveolar bone (tooth socket) is more or less intact, although there may be some soft tissue lacerations present. As the tooth was retrieved from the school playing field, there may be a small amount of dirt adhering to it.

In this case, the treating dentist recommended against replantation. The parents concurred, then were disturbed to hear contrary advice from others they consulted in the weeks following the avulsion and ultimately lost confidence in the process that led them to choose not to have the tooth replanted.

Specific risk factors for this 7-year-old child included:

- The extra-alveolar duration was longer than 5 minutes (delayed replantation); therefore, periodontal ligament regeneration could not occur and eventual tooth loss would be inevitable.⁴⁻⁹
- The central incisor root apex was immature, so pulpectomy and apexification with calcium hydroxide would be required.² Recently, mineral trioxide aggregate (MTA) has been used to seal the immature apex.¹⁴ Root immaturity (short thin roots, wide apices) poses a greater risk for survival than the inability to complete root canal treatment.^{7,9}
- If root canal obturation was not possible, incisor survival would be further compromised.⁹
- The small amount of dirt is not a known risk and could have been removed before replantation.
- This pre-adolescent would have an ankylosed incisor that would appear to submerge as his maxilla grows downward and forward. This would not be apparent until his adolescent growth spurt 5 or more years following his injury and replantation.^{10,11}
- Replantation would involve multiple appointments, multiple radiographs, endodontic treatment and restoration of the access cavity. Estimated first-year chair time would be over 7 hours including the emergency replantation and splinting appointment.¹⁵

- The effects of delayed replantation on subsequent single-tooth implant sites are still not fully understood, but sites for implant placement are likely compromised after replantation due to ankylosis and replacement resorption of the replanted tooth.¹⁶

The outcomes in this case were based solely on time out of the mouth, i.e., pulp necrosis, periodontal ligament necrosis, root resorption with ankylosis and eventual loss of the tooth. The storage medium is irrelevant in this case. If the necrotic pulp were managed by pulpectomy, then completion of obturation and incomplete root formation would be further complicating factors due to the child's age. Replantation would require root canal treatment, splinting, follow-up and associated radiographs, reassessment and endodontic visits. First-year costs would approximate \$1,500.¹⁵ The incisor could be submerged up to 3–5 mm if it survived until adolescent growth was completed.^{9,10}

Parental or Patient Desires and Informed Consent

If parents understand the consequences and elect for replantation and the child allows the procedure, the tooth can be replanted. The following technique predictably produces ankylosis, but reduces the probability of inflammatory root resorption that leads to loss of the tooth in the short term.¹⁷ The necrotic periodontal ligament is removed by prophylaxis with flour of pumice and water, the root canal treatment is completed with gutta-percha and sealer, the immature apex is sealed with a retrograde apical filling of intermediate restorative material (IRM) before replantation and the replanted tooth is splinted for 2 months to facilitate ankylosis.

If the parent and patient are content, they will not complain regardless of the pathological outcome. The dentist should explain outcomes and costs based on the extraoral history and risk factors (**Box 1**). The parent must then make the decision without coercion from the dentist. Parents of children with cancer or epilepsy make life-changing decisions for their children when the consequences are more serious than those of replantation. Dentists should provide the prognosis and have the parent or patient choose treatment based on the evidence described. Dentists must guard against their inherent optimism about treatment outcomes, coercion by parents to make the decision for them and the influence of initial praise received for replanting a tooth. The parent or patient will decide based on their risk comfort level, and the dentist's records will describe the informed consent process to protect against future changes of mind, failure to comply with follow-up instructions or early negative outcomes. If the informed parent opts for replantation, then the dentist should apply his or her best technical expertise according to the best available evidence.

Box 1 To replant or not: extraoral history and risk factors

- If the tooth was out of the mouth less than 5 minutes, replant and follow guidelines for management.
- If the tooth was out of the mouth and into cold milk or other physiological medium within 5 minutes and available for replantation within 30 minutes, replant and follow guidelines for management.
- If the tooth was out of the mouth more than 5 minutes and not stored in physiological media, there is only one outcome: root resorption and eventual tooth loss.
- If the patient has completed adolescent growth, the tooth may last longer than if he or she were pre-adolescent as root resorption slows with age.
- If the patient is a pre-adolescent, the tooth will become infraoccluded as he or she grows and the amount of infraocclusion will increase with adolescent growth.
- If the root of the avulsed tooth is not completely formed, the prognosis for survival following replantation is hopeless.
- If the root of the avulsed tooth is completely formed, pulp necrosis is the expected outcome.
- If the root is incompletely formed and replantation is rapid, vitality may be maintained but is not predictable.
- Approximately half of the incisors replanted in pre-adolescents are lost within 4–5 years.
- There is insufficient evidence to understand the late effects of replantation and root resorption on single-tooth osseointegrated implants that replace replanted teeth.
- First-year costs involve approximately 5–7 hours treatment time, \$1,500, 4–6 visits and 7 radiographs.

Parents and children faced with the situation of delayed replantation must be given accurate and up-to-date information on the likely outcomes of injury management. Then, without coercion or clinician bias, they must be left to make a decision based on the evidence and their child's specific risk factors. This means that dentists must remain critical and active consumers of the dental literature, and patients or parents may elect more often to have avulsed teeth left out of the mouth when faced with the costs and prognosis of replantation now that the reliability of single-tooth implants has been demonstrated. ♦



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The Knocked-out Permanent Tooth: Information for Patients, Parents and Caregivers

Before the accident, the tooth was held in place by fibres and cells called the periodontal ligament. The fibres were torn apart and many of the cells were damaged, either by the accident or because of the length of time out of the mouth. *If the tooth has been out of the mouth more than 5 minutes, it will never be the same again.* That means that if it is put back in, it will have to be extracted sooner or later.

Things that can cause a tooth to fail

- Infection can lead to the root rapidly dissolving (months to a year).
- The tooth can become part of the bone and simply dissolve over time (year(s)).
- The child can grow while the tooth remains in its same position. The tooth will appear “short” and will have to be removed (year(s)).
- The tooth can dissolve just below the crown and snap off; the root must be extracted (years).

What do we know?

- After 5 minutes, the periodontal ligament (the tissue that normally attaches the tooth to the bone) will not heal by its normal mechanism.
- Teeth that are so young that the root has not fully formed have very poor survival prospects (months to a year).
- Dentists can prevent infection by completing root canal treatment before putting the tooth back.
- Replanted teeth in youth over 16 have better prospects for longer (years) survival than those in pre-adolescents.

Responsibilities of the patient, parent or caregiver

- Allow radiographs for diagnosis of damage.
- **Decide whether the tooth should be replanted or left out of the mouth.**
- Cooperate in the replantation, splinting and root canal treatment.
- Comply with instructions if antibiotic coverage is required.
- Return for post-operative splint removal and radiographs at the appropriate times as described by the dentist before replantation (usually splint removal before 2 weeks and radiographs at that time, at 6 weeks, 6 months, 12 months, then yearly).

Responsibilities of the dentist

- Determine extra-alveolar duration and storage conditions.
- Inform the patient or parent of the prospects and outcomes of replacing the tooth.
- Attempt to replant the tooth if the patient, parent or caregiver wishes.
- Prevent or control infection.
- Splint the tooth and remove the splint at the appropriate time.
- Begin or complete root canal treatment.

Time out of the mouth is the most important factor determining eventual failure. Immature roots and adolescent growth (that produces submerging teeth) can also reduce the chances for long-term survival of replanted teeth.

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