Intentional replantation: A viable treatment option for specific endodontic conditions

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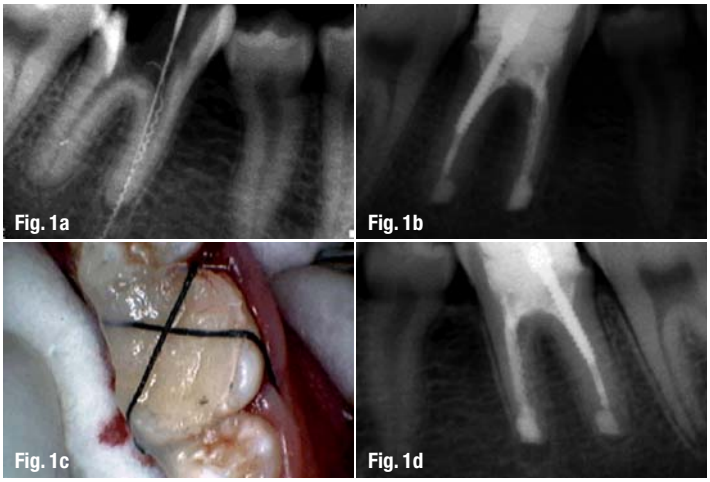

Fig. 1a_Tooth #46 with a fractured Lentulo spiral pushed past the apical foramen in the mesiolingual canal.
Fig. 1b_Tooth replanted after removal of the fractured instrument (apicoectomy and retrograde MTA obturation).
Fig. 1c_Clinical photograph showing stabilisation of the replanted tooth with sling sutures.
Fig. 1d_Six-month follow-up.

_*Intentional replantation* is defined as the purposeful extraction of a tooth in order to repair a defect or cause of treatment failure and thereafter the return of the tooth to its original socket.[1] Any tooth that can be atraumatically removed in one piece is a potential candidate for intentional replantation. However, specific indications include:[1–3]

_all other endodontic non-surgical and surgical treatments have failed or are deemed impossible to perform;
_limited mouth opening that prevents the performance of non-surgical or peri-radicular surgical endodontic procedures;
_root-canal obstructions; and
_restorative or perforation root defects that exist in areas that are not accessible via the usual surgical approach without excessive loss of root length or alveolar bone.

Contraindications may include:[1–2]

_long, curved roots;
_advanced periodontal diseases that have resulted in poor periodontal support and tooth mobility;
_multi-rooted teeth with diverging roots that make extraction and reimplantation impossible; and
_teeth with non-restorable caries.

In order to provide the best long-term prognosis for a tooth that is to be replanted intentionally, the tooth must be kept out of the socket for the shortest period possible, and the extraction of the tooth should be atraumatic to minimise damage to the cementum and the periodontal ligament. The periodontal ligament attached to the root surface should be kept moist in saline, Hank's Buffered Salt Solution (HBSS), Viaspan or Doxycycline solution for the entire time the tooth is outside the socket.

We have documented three clinical cases to exemplify the potential of intentional replantation as a viable treatment option in select endodontic cases.

_Case I

A 14-year-old male patient presented with a separated Lentulo spiral extending 4 to 5 mm beyond the apex of the mesiolingual root canal of tooth #46 (Figs. 1a–d). The tooth was badly broken and the instrument tightly screwed into the root canal. All efforts to remove the spiral were futile, and we were concerned that it would fracture at the apex.

Apical surgery was ruled out because accessibility to the mesiolingual root would have been limited. We decided to replant the tooth intentionally and discussed this treatment option with the patient, who agreed to our proposal. Since the tooth was badly broken, we planned to reinforce its core with a post in the distal canal prior to extraction.

Once we had obtained adequate anaesthesia, the tooth was extracted atraumatically with an extraction forceps. We did not use surgical elevators and

took care that the beaks did not go beyond the cemento-enamel junction (CEJ), as this may have damaged the cementum and the periodontal ligament.

Following extraction, we kept the tooth moist by immersing it in Viaspan. With the beaks of the forceps, we held the tooth by its crown and cut the overextended Lentulo spiral. Thereafter, we performed a 3 mm Class I root-end preparation with an ultrasonic tip, at the apical end of all three canals. A retrograde filling was done with mineral trioxide aggregate (MTA). The extraction socket was then irrigated with normal saline and gently suctioned to remove blood clots. The socket was filled with tricalcium phosphate in order for the tooth to be 2 to 3 mm higher than before. This helped in planning a good post-endodontic restoration.

The tooth was carefully reinserted into its socket and brought into occlusion with digital manipulation and patient bite force. The tooth was stabilised it its socket with a sling suture. The patient was re-evaluated after seven days, and the sutures were removed.

_Case II

A 22-year-old male patient presented with a history of trauma to his maxillary anterior region. Clinical examination revealed an Ellis Class III fracture of tooth #12, with the fracture line extending to the root palatally. Once the mobile fragment had been extracted, we realised that the fracture line extended 2 to 3 mm sub-crestally. In order to bring the apical end of the fracture line to a supra-crestal position, we considered two options: orthodontic extrusion and intentional replantation. The patient did not accept orthodontics as an option owing to the extended treatment time required.

Once the tooth had been atraumatically extracted, it was kept moist in Viaspan. We inserted tricalcium phosphate in the apical 3 to 4 mm of the socket and reinserted the tooth with a 180° rotation to bring the deep fracture line into a more accessible labial side. The tooth was then splinted with fibre-reinforced composite for a period of three weeks. The root-canal treatment was completed at a later date, and the facial surface was built up with composite. We decided not to proceed with the crown immediately after stabilisation to prevent loading of the tooth. The patient was recalled periodically for follow-up.

_Case III

A 23-year-old female patient presented with pain in her upper right anterior tooth. There was no history of trauma, and clinical examination revealed a deep palato-gingival groove (PGG) with respect to tooth #12 (Figs. 2a–e). The intra-oral peri-apical radiograph revealed a peri-apical radiolucency. We decided to extract the tooth, seal the groove and then replant the tooth. After adequate anaesthesia had been obtained, the tooth was extracted with all the necessary precautions and immersed in Viaspan. With help of the forceps, it was then held by its crown. The PGG was debrided with the tip of the ultrasonic scaler and sealed with glass-ionomer cement (GIC). The socket was then gently curetted and the tooth reinserted. Sutures were placed in the inter-dental area and endodontic treatment was completed one week later. The apical 4 to 5 mm of the root were sealed with MTA, and the rest of the root canal was back-filled with thermo-plasticised gutta-percha. The patient was re-evaluated after seven days.

_Discussion

Intentional replantation in dentistry has been performed for more than ten centuries and was used extensively to manage odontalgia.[4] In 1561, Pare recommended its use when a healthy instead of a diseased tooth was mistakenly extracted![5] In 1712, Pierre Fauchard[6] replanted a tooth and reported it to be stable on follow-up. Several steps in the replantation were debated, for instance the need for amputation of root apices, immediate or delayed replantation, root-canal obturation before or after replantation, removal or preservation of periodontal ligament cells and the goal of ultimate healing—bony ankylosis or ligament repair.

It was in 1881 that Thompson[7] presented the treatise on the replantation of teeth and emphasised the importance of peri-cemental tissues for treatment success. Later, Fredel[8] in 1887 and Scheff[9] in 1890 addressed the role of periodontal ligament cells with regard to external root resorption after replantation. As the replantation technique became increasingly refined, it was used as an easy alternative for failing root-canal treatment and hence evoked sharp criticism for the technique of replantation *per se*.

There are many reasons for an adverse outcome of a replantation: the tooth can fracture during extraction and may be completely lost; peri-cemental tissues can be damaged, reducing the likelihood of reattachment; infection; external root resorption; and ankylosis. Therefore, it is extremely important to understand that intentional replantation should be the last choice, selected only when all the other options of treatment—non-surgical and surgical—have been exhausted. Replantation can be a treatment of choice in cases in which a surgical approach

Fig. 2a_Clinical photograph of tooth #12 showing the PGG.
Fig. 2b_Intra-oral peri-apical radiograph showing the peri-apical lesion.
Fig. 2c_Tooth extracted, PGG prepared with ultrasonics.
Fig. 2d_PGG sealed with GIC.
Fig. 2e_Intra-oral X-ray showing obturated canal. The sealed PGG is superimposed on the root-canal obturation.

can be difficult, for example on the lingual root of a mandibular molar, or in cases in which a surgical approach would be very invasive, such as the removal of thick bone from the buccal aspect of a second mandibular molar.

Intentional replantation has a better prognosis when the extra-oral time is kept as short as possible and trauma to the periodontal ligament and cementum is minimised.[1] It is advisable to perform routine endodontic treatment intra-orally before the tooth is extracted to minimise the extra-oral time. It is also suggested that a team of two dentists work in tandem to prevent prolonged treatment time, thus improving the chances of success. The use of elevators should be avoided, and the beaks of the extraction forceps should not go beyond the CEJ. The cortical bone integrity should be maintained, and the tooth should be extracted as atraumatically as possible.

The medium in which the tooth is kept moist plays an important role. Saline, HBSS, milk, Viaspan, to name a few, are widely used. Viaspan is used for organ transplantation and preservation. Owing to its antioxidant activity, the solution keeps the periodontal ligament moist and reduces the likelihood of surface resorption.[2]

We generally use ultrasonic tips to prepare the root-end and the debridement of the PGG. It conserves the tooth structure and produces significantly less smear layer compared with burs.[3] Commonly used root-end filling materials are amalgam, Intermediate Restorative Material (IRM), Super EBA, GIC, Diaket, composite and MTA. The sealing ability and marginal adaptation of MTA have been proven to be superior and not adversely affected by blood contamination. In addition, MTA promotes deposition of new cementum and stimulates osteoblastic adherence to the retro-filled surface.

In two of our cases, tricalcium phosphate was placed in the apical few millimetres of the socket. This was done in order to bring the defect supragingivally so that the integrity, aesthetics and prognosis of the case were improved. Tricalcium phosphate is an osteo-conductive material that acts as scaffold for bone growth and is gradually degraded and replaced by bone.[10]

A palato-gingival groove is a developmental anomaly that represents an infolding of enamel and Hertwig's epithelial root sheath.[11] PGG can vary in depth, length and complexity, causing varying degrees of periodontal defects. Mild grooves terminate at the CEJ, whereas moderate grooves continue apically along the root surface. A treatment option for a PGG terminating close to CEJ is to expose the groove surgically and to seal it thereafter. As presented, the groove extended beyond the apex in Case III. Here, the defect was sealed extra-orally and the tooth replanted. GIC was used to seal the PGG, as it chemically adheres to the tooth structure and has a good sealing ability and antibacterial effect.[12]

After replantation, the tooth was splinted for ten days. The splint enabled physiological movement of the tooth to prevent ankylosis. Endodontic treatment was completed one week after replantation in order to prevent inflammatory resorption and ankylosis and to allow splicing of periodontal fibres, which limits the seepage of potentially harmful root-filling materials into the traumatised periodontal ligament.[13] Final restoration of the tooth was delayed to avoid loading and to ensure that proper healing of periodontal ligament took place.

In recent years, several bio-modulators, such as enamel matrix protein[14], hydroxyapatite and platelet-rich plasma,[15] have been used in intentional replantation cases to improve the success rates. Guided tissue-regeneration techniques can also be employed along with these supplements to further improve the likelihood of success.

We conclude that intentional replantation is a viable treatment option in carefully selected cases in which all other treatment options have been exhausted.

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Editorial note: A complete list of references is available from the publisher.

_contact roots

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