THE USE OF INTENTIONAL REPLANTATION TO REPAIR AN EXTERNAL CERVICAL RESORPTIVE LESION NOT AMENABLE TO CONVENTIONAL SURGICAL REPAIR

KREENA PATEL, FEDERICO FOSCHI, IOANA POP, SHANON PATEL, FRANCESCO MANNOCCI

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ABSTRACT

Intentional replantation consists of purposefully extracting a tooth, correcting the defect and replanting it into its original socket. This case report describes how this technique was used to successfully restore an external cervical resorptive (ECR) lesion. A 22-year-old man was diagnosed with ECR of the mandibular right canine following clinical and radiographic examination. CBCT showed the lesion had been initiated distally and extended circumferentially around the root canal. The nature of the resorptive lesion meant that it was inaccessible to repair conventionally in a predictable manner. This report describes how intentional replantation was used to access and restore the lesion with minimal patient cooperation and postoperative discomfort. At an 18-month recall the tooth was clinically sound with no radiographic evidence of inflammatory or replacement root resorption. Intentional replantation should be considered a viable treatment option when ECR is inaccessible and cannot be restored using conventional techniques.

KEY WORDS
Intentional Replantation, External Cervical Resorption, Invasive Cervical Resorption, CBCT

AUTHORS

Kreena Patel BDS (Hons), MJDF RCS
Postgraduate Endodontic Student, Department of Endodontology, Kings College Dental Institute at Guy's King's and St Thomas' Hospital, London

Federico Foschi BDS, MSc, PhD, FHEA, FDS RCS
Consultant in Restorative Dentistry, Department of Endodontology, Kings College Dental Institute at Guy's King's and St Thomas' Hospital, London

Ioana Pop BDS, MFDS RCS, DipSed (KCL), MSurgDent, MClinDent, MEndo
Specialist in Endodontics, Department of Endodontology, Kings College Dental Institute at Guy's King's and St Thomas' Hospital, London

Shanon Patel BDS, MSc, MClinDent, MRD, FDS RCS, PhD
Consultant in Endodontics, Department of Endodontology, Kings College Dental Institute at Guy's King's and St Thomas' Hospital, London

Francesco Mannocci MD, DDS, PhD, FHEA
Professor in Endodontology, Department of Endodontology, Kings College Dental Institute at Guy's King's and St Thomas' Hospital, London

Root resorption describes the loss of dentine and cementum as a result of odontoclastic cell action. It can be classified according to the location on the tooth; external resorption affects the outer surface and internal resorption affects the pulp chamber and root canal wall. External resorption can be sub-classified into transient apical breakdown, external surface resorption, external inflammatory resorption, external replacement resorption and external cervical resorption. External cervical resorption (ECR) is an aggressive, insiduous type of dental resorption initiated in the cervical region.[1] Although the aetiology remains unclear, it is understood to result from a deficiency or damage to the protective cementum immediately below the periodontal attachment.[2,3] Light and scanning electron microscope (SEM) microscope analysis of this area revealed multiple gaps in the radicular cementum which could make the underlying dentine vulnerable to resorption.[3] Odontoclasts in association with fibro-vascular tissue initially penetrate the tooth through a small entry point and spread via numerous resorptive channels.[4,5] These channels may interconnect apically with the periodontal ligament.[6]

Diagnosis of ECR can be challenging and detection is often by an incidental radiographic finding. The affected tooth usually remains asymptomatic until a late stage because the pre-dentine and odontoblast layer surrounding the root canal is resistant to resorption.[7] Clinically, the lesion may present as a cavitation of the enamel, irregularity in the gingival contour and/or pinkish discolouration of the overlying crown. The cavity feels hard to probe and may bleed excessively from the inflamed resorptive tissues.[8,9] However, often there are no visible signs, particularly in the early stages.

The radiographic appearance of ECR varies considerably depending on the size and nature of the lesion. It typically appears as an irregular, asymmetrical radiolucency through which the root canal outline is traceable.[10] Previous case reports have highlighted that cone beam computed tomography (CBCT) can be useful in diagnosis and management of ECR. It can provide a more accurate representation of the size, location and nature of lesion compared to conventional radiographs.[6,11-15]

Treatment aims to inactivate the resorptive process by removing the resorptive tissue and blood supply (nutrient source) to existing odontoclasts. This can be carried out non-surgically or surgically depending on the size of the lesion, and endodontic treatment may be necessary if the ECR has perforated the root canal. The resorptive defect must be completely sealed to prevent revascularisation and further clastic action.[4,6] Therefore,

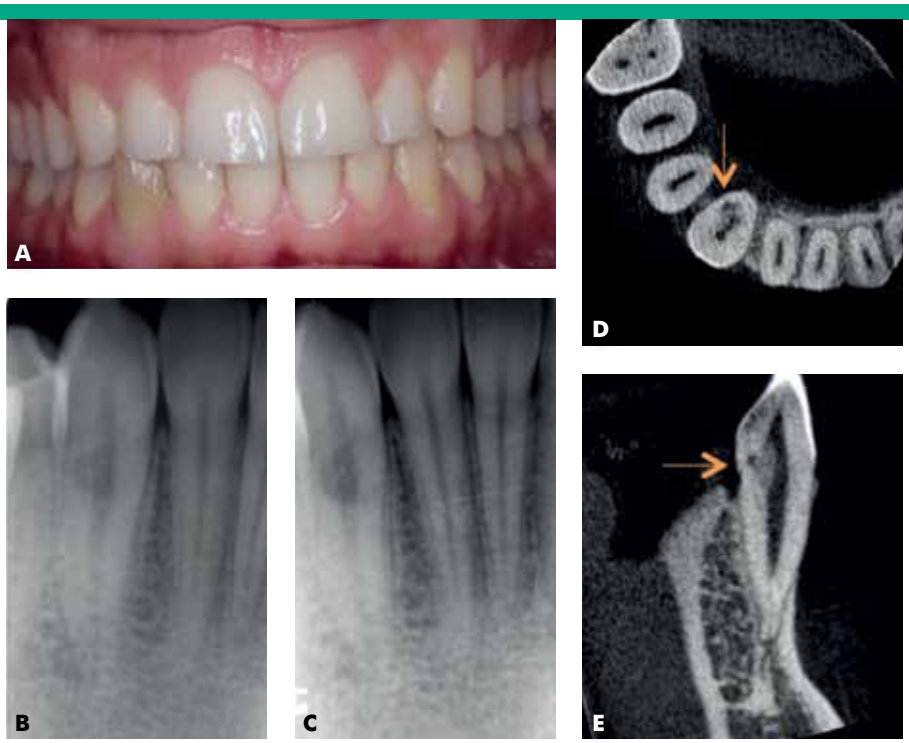


Figure 1: Preoperative assessment
A. Preoperative photograph showing discoloured LR3
B-C. Parallax preoperative PA radiographs reveal ECR
D-E. CBCT showing ECR has been initiated distally and extends circumferentially around the root canal. Arrow indicates the small initiation site of the ECR lesion

effective management is dependent on good visualisation and accessibility of the lesion. Extraction may be required if the ECR is too extensive or not completely accessible.[1]Guided tissue regeneration[16] and forced orthodontic extrusion[17] have been sometimes used when treating advanced lesions.

Intentional replantation (IR) consists of purposefully extracting a tooth, correcting the defect and replanting it into its original socket.[18] Although IR was previously regarded as a procedure of 'last resort'[19,20] it has gained renewed interest over recent years.

Recent case studies have shown that IR can be a useful alternative to apical surgery when access is difficult or adjacent anatomical structures increase the risk of conventional therapy. This includes roots in close proximity to the inferior alveolar nerve, mental nerve or maxillary sinus, a thick buccal plate or lingual root inclination, lingual surfaces of mandibular molars or palatal surfaces of maxillary molars, limited mouth opening and poor patient cooperation.[21-23] IR has also been used to treat palatal root grooves[24,25] vertical root fractures[26] and iatrogenic complications.[27,28]

IR has been suggested as a potential treatment option for ECR[29,4] but its use has rarely been reported.[30] It can potentially be used to treat lesions that would otherwise be inaccessible and require extraction. This report describes a case of ECR being managed successfully using IR.

Case Report

A 22-year-old Caucasian man was referred to endodontic department at Guy's Dental Hospital (London, UK) in October 2014. The patient initially presented to the emergency department with symptoms of severe constant pain from lower right three (LR3), which was exacerbated by heat. The unusual radiographic appearance had prompted the referral to the endodontic department.

The patient's medical and dental history was not relevant. Clinical examination revealed a minimally restored and well maintained dentition. The LR3 was discoloured, tender to percussion and gave an exaggerated response to electric and thermal sensibility tests. The periodontal probing depths were within normal limits. Although there were no clinical signs of ECR, periapical radiographs showed an extensive lesion. A CBCT revealed the resorption was initiated interdentally and extended circumferentially around the root canal. There was also interdental and lingual alveolar bone loss associated with the defect (see Figure 1). A diagnosis of irreversible pulpitis and ECR was reached for LR3.

Conventional surgical repair of the resorptive defect was considered difficult and unpredictable due to the interdental position and lateral spread of the ECR. It would not have been possible to achieve adequate access and visualisation of the lesion. The patient was keen to proceed with treatment and in view of these limitations, opted for an intentional replantation technique to manage the defect.

Management

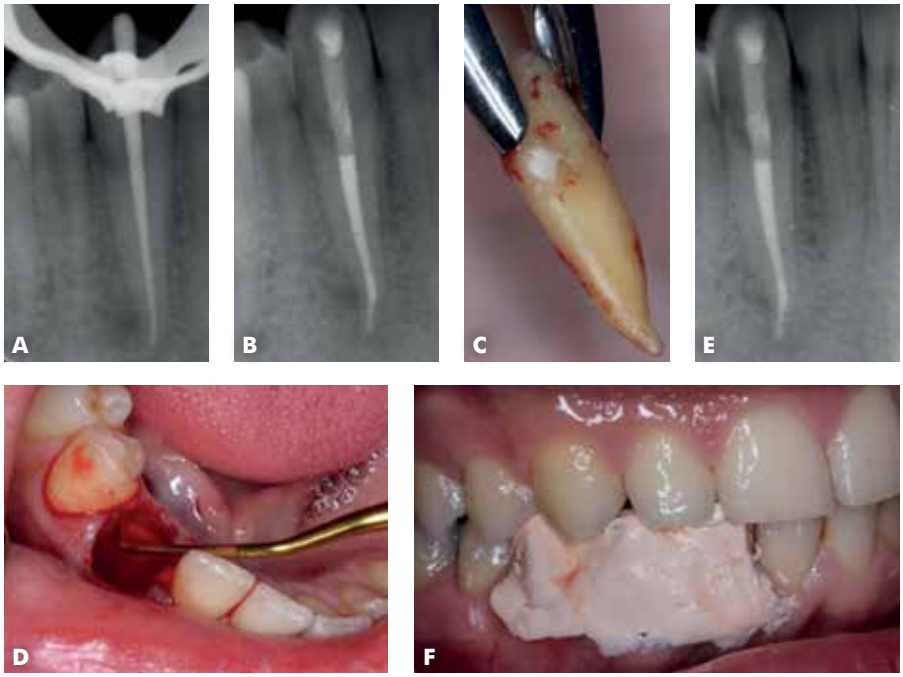
Root canal treatment of LR3 was carried out using microscope magnification. The lesion could not be seen internally from the root canal. Chemo-mechanical debridement was completed using hand and rotary instruments with 1% sodium hypochlorite and 17% EDTA. The endodontic treatment was carried out over two visits using calcium hydroxide as an interim dressing. The LR3 was obturated with gutta-percha and a zinc oxide eugenol-based sealer using a warm vertical condensation technique. A composite core was placed apical to the lesion to minimise the risk of external leakage (see Figure 2).

The IR was planned two weeks after the endodontic treatment was completed. The patient was asked to rinse with 0.2% chlorhexidine gluconate for one minute to disinfect the surgical site. Following local anaesthesia, the LR3 was atraumatically extracted using elevators and forceps. Pressure was applied mainly above the cemento-enamel junction (CEJ) to minimise damage to the periodontal ligament (PDL) and surrounding alveolar bone.

Two operators were required to ensure the procedure was carried out as quickly as possible.

The first operator focussed on the extracted tooth; the LR3 was held using forceps above the CEJ and the lesion was identified under microscope

Figure 2: Intraoperative photographs and radiographs
A. Master cone PA
B. PA taken immediately following root canal treatment. The composite core was placed apical to the resorptive defect
C. LR3 was held using forceps above the CEJ. The ECR defect was removed and cavity repaired using GIC
D. Curettage of alveolar defect associated with ECR
E. PA radiograph taken immediately following replantation to check LR3 has been correctly repositioned
F. Periodontal (Coe-Pak) dressing



magnification. A minimal preparation was created to remove the lesion using a sterile bur and the cavity restored using glass ionomer cement. During this time, the second operator carefully debrided the alveolar lesion and removed the resorptive tissue using a curette (see Figure 2). Sterile gauze was used to cover the socket and prevent contamination with saliva.

The tooth was replanted into the socket within 12 minutes and finger pressure used to compress the buccal and lingual plates together. LR3 was stabilised using a periodontal dressing (Coe-Pak) and correct repositioning was verified clinically and using a periapical radiograph (see Figure 2). Postoperative instructions were given, which included rinsing with 0.2% chlorhexidine gluconate three times daily and a soft diet.

Review

The patient was recalled after seven days for removal of the periodontal dressing and review of the surgical site. He had experienced minimal postoperative discomfort and the soft tissues were healing well. A painless vascular epulis appeared two weeks after surgery around LR3 due to poor oral hygiene in this area. Oral hygiene was reinforced and another review planned two weeks later. There was only a slight improvement at the next visit, so supra-gingival scaling and resection of the inflamed tissues was carried out. Following this, healing

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Figure 3: Interdental papillae
A-B. Immediately following replantation
C. Two weeks postoperatively an epulis appeared
D. Epulis surgically removed - four weeks postoperatively
E. Five weeks postoperatively
F. Three months postoperatively
G-H. 18 months postoperatively showing interdental papilla has reformed

was uneventful and the interdental papillae reformed and appeared healthy (see Figure 3).

The patient was recalled again at 3, 6, 12 and 18 months. At these review appointments LR3 was not tender to percussion or palpation. Tooth mobility, periodontal probing depths and percussion sounds were all within normal limits. Radiographic examination revealed no periapical radiolucency or evidence of inflammatory or replacement resorption (see Figure 4).

Discussion

Much of our understanding of the biological principles of IR is from animal studies and research following traumatic tooth avulsion.[31-33] An acute inflammatory reaction is expected following tooth replantation resulting in surface resorption. This process is self-limiting because odontoclasts require constant stimulation for clastic activity to continue.[34] However, this resorption can expose numerous dentinal tubules causing a communication between the root surface and pulp space. If the pulp of the tooth is necrotic and infected, the bacteria and their toxic by-products are able to penetrate the tubules and cause inflammation in adjacent periodontal tissues. This provides a continuous stimulus for clastic cells and can lead to extensive root surface damage in the form of external inflammatory resorption.[35] In this report, LR3 was endodontically treated prior to IR to prevent this type of resorption occurring.

Surface resorption is followed by healing within two to three weeks. The type of healing that occurs depends on the number of viable PDL cells remaining in the extraction socket and on the root surface. It has been reported that if less than 20% of the root surface is damaged, the cells of the adjacent periodontium can repopulate the area resulting healing with cementum-like tissue and reattachment of the PDL.[36] This will result in partial or complete restoration of tooth contour and has minimal clinical relevance.[37,38] A larger area of damage has shown to cause osteoblasts to adhere to the denuded surface and result in external replacement resorption (ERR). This a continual, irreversible process and the root is gradually replaced by bone.[31] The first radiographic sign of ERR is the disappearance of the periodontal ligament space, followed by a moth-eaten appearance and replacement by bone.[39]

ERR progresses at the same rate as bone turnover and is dependent on the patient's age.[38] This can be a concern in younger, growing patients because it can cause infra-occlusion leading to alveolar malformation and aesthetic problems in the future.[40] However, in an adult patient, the process is very slow and the tooth can last for many years before failure occurs. During this time the patient maintains their natural tooth and the alveolar ridge is preserved.

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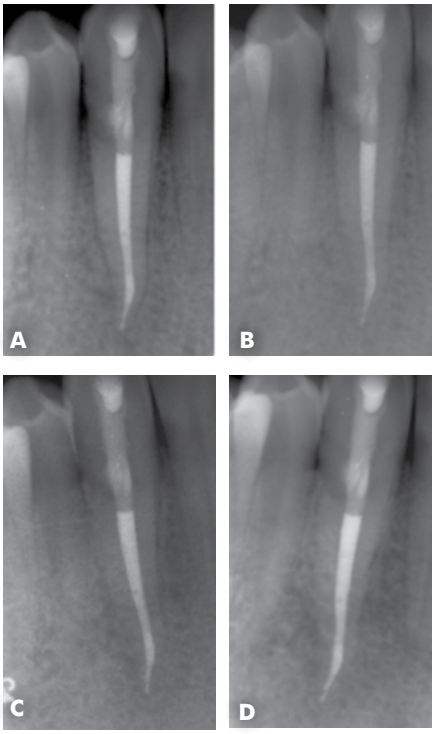

Figure 4: Review PA radiographs
A. One-month review
B. Three-month review
C. 12-month review
D. 18-month review

PDL cells are progenitor cells and can differentiate into fibroblasts, cementoblasts and osteoblasts. Differentiation into osteoblasts can lead to bone induction adjacent to the replanted site.[41] This can be useful when treating ECR where there is often an alveolar bone defect associated with the lesion. Bone induction could potentially lead to improved aesthetics and is beneficial if implants are indicated in the future.

Treatment for ERR is rarely successful and eventually the crown of the tooth will require extraction.[38] Therefore, during the IR procedure care was taken to minimise damage to the PDL cells. Elevators were carefully used to mobilise LR3 so forceps could be used to extract the tooth atraumtically and with minimal risk of root fracture. Force was mainly applied coronal to the CEJ during the extraction to limit mechanical trauma. The procedure was rehearsed and two operators were utilised to limit the extra-oral time. An extra-oral time of greater than 30 minutes has shown to increase the possibility of root resorption.[39,42-44] A glass ionomer cement (GIC) restoration was used because it is less technique-sensitive than composite and avoids excessive drying of the root surface. A light cure is not required, and can radiate heat and can potentially dehydrate viable PDL cells. Etch can also be difficult to control during the washing stage. Healing appears to be more favourable when a tooth is replanted into an extraction socket compared to being transplanted into an artificially created socket. This is because the socket of an extracted tooth contains PDL cells on the walls.[41] Therefore, curettage was carefully limited to the ECR bone defect.

A periodontal dressing was used postoperatively to protect and stabilise the tooth.[18,41,45] Other studies have used sutures[22], orthodontic wire or fibre-splints[30] to stabilise teeth. Splinting in generally not recommended if the tooth is stable because physiological mobility helps prevent ERR.[46-48] They also tend to be plaque retentive and should be avoided if possible. There appears to be conflicting opinions in the literature regarding antibiotic prescribing following IR. This report demonstrated pre- or postoperative antibiotics were not required, similar to a few other studies.[21,45]

At an 18-month recall the tooth was clinically sound with no radiographic evidence of inflammatory or replacement root resorption. Andreasen et al[33] conducted a study

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of 400 traumatically avulsed teeth and demonstrated that inflammatory and replacement resorption is usually detectable after one to two months. Therefore, a one-year observation period is likely to be sufficient to detect any pathological changes that will occur.

CBCT provided essential information about the location, size and circumferential spread of the lesion required to formulate a treatment plan. IR allowed excellent visualisation and access of the ECR lesion, which would otherwise have been inaccessible due to its interproximal location. The resorptive defect could clearly be seen using a microscope and it was possible to assess if there were additional apical channels communicating with the root surface. The procedure was relatively straightforward and required minimal patient cooperation.

An 81% success (n=31) over 22 years[18] and 95% success (n=151) over three years[42] has been demonstrated for IR. A recent systematic review demonstrated an 88% mean survival rate.[49] This demonstrates that with careful case selection IR can provide an alternative reliable option to treat cases that cannot be managed by conventional methods. The procedure has shown to be fast, minimally invasive and associated with little postoperative discomfort. It can also provide immediate function and is more cost-effective than an implant.[22,45,50] The main risks of the procedure include the root fracture during extraction and root resorption.[18]

Conclusion

CBCT imaging was invaluable in the diagnosis and management of this case and should be considered for the treatment planning of ECR lesions. Intentional replantation should be considered a viable treatment option when ECR is inaccessible and not possible to restore using conventional surgical techniques.