Dental

An audit of surgical retrograde root canal re-treatment outcome: Part Two

G Bryce, E Richardson, N MacBeth

Introduction

Surgical retrograde root canal re-treatment (SRRCR) can be used to treat persistent chronic apical periodontitis in root canals that have failed to respond to conventional non-surgical orthograde root canal re-treatment (NSORCreT) or when such an approach is deemed impractical (1,2,3). In part one, the endodontic literature base was examined with the aim of constructing an evidence-based protocol for surgical retrograde root canal re-treatment. The second instalment of this series sought to evaluate the effectiveness of this protocol by auditing both the patient experience of the surgery and also the outcome of treatments performed.

Method

Only single-rooted teeth from the anterior maxillary and mandibular sextants were included within this audit. All treatment cases included within these audit cycles were assessed, treatment-planned and treated in accordance within the guidelines set by the strict surgical protocol determined in Part One of this series. Exclusion factors from the audit were: posterior teeth, those whose treatment was abandoned due to intra-operative factors (e.g. location of root fracture) or when necessity involved deviation from the surgical protocol. It was determined that the first cycle of audit would incorporate 20 consecutive surgical retrograde root canal re-treated teeth (on some occasions, more than one tooth was treated per patient). Teeth treated by SRRCR were reviewed one year post-operatively, in accordance with recommended guidelines (4). The clinical review of cases was undertaken as follows.

To determine the patients’ perception of the surgical procedure and the outcome of treatment, they were asked the following questions:
1. If they had suffered pain or swelling from the treated tooth or adjacent area?
2. If so, what were the specifics of their symptoms?
3. Were they happy with the outcome of the surgical retrograde root canal re-treatment?
4. In retrospect, would they still have had the procedure performed?

To determine the outcome of the surgical procedure, the patients were subsequently examined clinically and assessed for the following:
5. Presence of sinus or vertical narrow periodontal pocketing.
6. Pain initiated by palpation of the alveolar mucosa adjacent to the treated tooth.
7. Pain initiated by palpation or percussion of the treated tooth.
8. The presence of mucosal scar tissue resulting from the surgical procedure.

Periapical radiographs, using a parallel-orientated film holder, were taken with the aim of replicating the angulation of the pre- and post-operative radiographs. To reduce the impact of operator bias, the radiographic findings were evaluated separately by three authors who were calibrated to an established review technique(4,5). When disagreement arose between observers, joint analysis and discussion was undertaken until a consensus opinion was obtained. All cases were classified as: I - Complete radiographic healing (complete resolution of lesion), II - Incomplete radiographic healing (lesion reduced in size but not completely resolved), III - Failed Treatment (no change in size or increase in size of lesion).

Following clinical and radiographic assessment, the outcomes of surgical cases were classified as either:
I Successful. No abnormal signs or symptoms and complete radiographic healing observed, or:
Uncertain or Failed Treatment.
II Uncertain. The absence of signs or symptoms but incomplete radiographic healing.
III Failed Treatment. Presence of signs or symptoms or radiographic review indicating failure.

Standards

The audit aimed to evaluate both the patient’s perception
of treatment and the outcome of surgeries performed. A standard was established that 90% of patients should be happy with the treatment performed. A standard was set that 80% of cases should be classifiable as successful and that 90% of cases should survive (be classified as Category I + II).

**Results**

40 SRRCR teeth were scheduled for review over two audit cycles spanning a period of three years. Three patients left the military and could not be seen for review. This left a combined total of 37 teeth seen for review (93% recall rate); 19 teeth in the first cycle and 18 cases in the second cycle.

Examples of radiographs that were judged to indicate healed, uncertain and failed outcomes are, as follows:

I. **Healed case**
   - Fig. 1 Pre-operative
   - Fig. 2 Post-operative review

II. **Uncertain Healing**
   - Fig. 3 Pre-operative
   - Fig. 4 Post-operative review

III. **Failed Healing**
   - Fig. 5 Pre-operative
   - Fig. 6 Post-operative review

**Discussion**

The high recall rate of 93% of patients seen for one-year post-operative review was achieved by a pro-active review policy. As part of the pre-operative consent process, the importance of one-year review was highlighted to the patient and this message was reinforced post-operatively. Patient contact details were recorded and the patient contacted one month prior to their one-year review appointment, to ensure they could attend. Unfortunately, three individuals had left the military and were unwilling to attend for post-operative review. In all three cases, telephone conversations confirmed that the teeth were still in-situ and asymptomatic. Unfortunately, the absence of clinical and radiographic review resulted in these cases having to be excluded from the audit.

Other surgical cases that were excluded from the audit included those where vertical root fractures or communicating marginal periodontal defects were confirmed during the procedure. In addition, surgical cases that deviated from the strict operating protocol (for example, through-and-through type surgeries) were also excluded from the audit process.

**Patients’ Perception of Surgical Protocol**

It was considered appropriate to determine the impact of the surgical procedure on the patients, and they were subsequently asked two simple questions: were they happy with treatment? and, in retrospect, would they still have had the procedure undertaken? Only one paper, a retrospective audit of apicectomy procedures (6), could be found within the literature base that examined patient satisfaction following root-end surgery. In the absence of good quality evidence, it was decided to use the 90% patient satisfaction reported within this publication as the standard for the audit cycles.

It was perhaps not surprising that the only individual, within Audit Cycle One, who was unhappy with treatment, was the failed case that required further intervention. Interestingly, this same individual stated that, even though his treatment had failed, he would still have undergone the procedure and this attitude was in keeping with the 100% of individuals from the first audit cycle stating that, in retrospect, they would have had the procedure undertaken. Perhaps a more effective determination of patients’ attitude to the surgical procedure would have been gained had they been reviewed at an earlier post-operative point. However, earlier review would not have provided sufficient time to determine the outcome of treatment and this would have negated the relationship between the patient’s perspective and the success of treatment. The absence of lasting negative operative experiences would suggest that the protocol was effective in providing surgical treatment in a way that was acceptable to the patient. It can also be surmised that the high percentage of patients happy with treatment, despite success not being achieved in all cases, resulted from the effectiveness of the thorough consultation and consent.
radiographic healing (resulting in an uncertain outcome) may indicate scar tissue and not necessarily the presence of a persistent disease process (9). However, it was decided that the SRRCR protocol should aim for both clinical and radiographic signs of healing and, as a result, strict success criteria were applied. A success standard of 80% lay between the extremes of results found within loosely- and stringently-judged outcome studies. In addition, by measuring survival at 90%, comparison could be made with those studies that achieved higher success rates by employing less-stringent radiographic healing criteria.

As previously mentioned, one case failed during audit cycle one. 95% of reviewed cases presented with no signs or symptoms and a radiographic appearance that indicated signs of resolution. However, although the survival standard of 90% was met, it was disappointing that only 63% of cases were deemed to have met the criteria set for successful outcome and this did not meet the set standard of 80%. Failing to meet the set standard was examined in the following ways: was the standard set too high; were there flaws with case selection; could something be implemented into the protocol to improve success rate.

A study that used stringent criteria to assess SRRCR outcomes reported a success rate as low as 37% (8) and it is debatable whether setting a standard of 80% was over-optimistic. However, the aforementioned study retrospectively reviewed the SRRCR outcomes from a range of operators with, presumably, different levels of experience. When single-operator studies are evaluated, higher levels of success are encountered (10, 11), and it was hoped that this audit of an experienced operator would achieve similar results. It was decided, therefore, not to amend either the stringency of assessment criteria or the

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<td>6%</td>
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| Survival | | | 95% | 89% |

Table 1
The case selection for SRRR was re-examined to determine whether this had a negative impact on treatment success. Improved success rates have been recorded when at least one course of NSORCre-T® was provided prior to surgery (10). This criteria was not applied within the audit as, in many cases, SRRCR was implemented due to the impracticalities of providing a non-surgical approach; for example, the presence of post/cores obstructing the provision of NSORCre-T. The small scale of this audit made statistical analysis unrealistic but, in general, there did not appear to be any correlation between radiographic healing and the provision of pre-surgery NSORCre-T® (5 out of the 6 cases with incomplete radiographic healing had had NSORCre-T® provided prior to surgery).

It was also deemed possible that the maximal retro-preparations depth of 3mm canal space, imposed by the length of ultrasonic tip, may have had an impact on the reduced success rates found. The set 3mm length of ultrasonic tip would appear to have been determined by the maximal retro-preparation depth historically achieved with the use of slow-speed surgical burs. However, the operator felt that 3mm of retro-preparation was insufficient in many cases to adequately debride/clean out the root canal space and that the outcome may have been negatively affected by untouched residual intra-canal bacterial populations. It was therefore decided to amend the surgical protocol by adopting a new-to-the-market ultrasonic surgical tip system (AS3D, AS6D, AS9D ultrasonic tips, Satelec®, Merignac, France) that allowed systematic retro-preparation to depths of up to 9mm. The depth of retro-preparation, within the second audit cycle, would be gauged on an individual case basis but with the aim of retro-preparing as far as possible and, ideally, to a minimum depth of 6mm. It was also decided to irrigate the ultrasonic tip continuously with Corsodyl® solution, thereby increasing the volume of disinfectant solution applied within the canal space. The established regenerative effects of MTA as an obturation material (12, 13, 14) determined its continued use for the obturation of prepared cavity spaces.

The implementation of increased depth of retro-preparation may account for the improved success rate seen within the second cycle of audit. The success rate within this cycle improved to 83% and met the set standard. Unfortunately, two treatments failed within this cycle and this led to the survival standard of 90% not being met. A further two patients were lost from review due to their leaving the military and it is believed that this factor skewed the results and led to the standard not being met.

Other studies indicate that the number of cases that can be classified successful increases when review is continued over longer time-frames (10, 15). It is therefore likely that many of the audited cases that were deemed “uncertain healing” at one-year review will subsequently be classified as successful in future years. It is also probable that complete regeneration of the periradicular architecture will not be achieved in other “uncertain healing” cases and that repair will occur in the form of scar tissue. Although scar tissue may leave a persistent periradicular radiolucency, some studies would suggest that the individual is no more likely to suffer further symptoms than if complete healing had occurred (9).

There are different opinions as to when the majority of failures occur, with some stating that most will present within the first 12 months (10) and other studies indicating that failure via restorative problems or refractory periodontitis occurs with longer-term follow-up (3). It will be important to follow up these audited cases over the forthcoming years to determine the long-term outcome of teeth treated using this SRRCR protocol.

Observations from the audit
Outside of the main aims of the audit, other points were noted that are worth consideration. Post-operative pain was not considered to be a complication and the majority of patients stated that, after 48 hours, they ceased taking their prescribed pain medicaments. In addition, no reports of post-operative infections, relating to the surgical site, were recorded and this would suggest that it was correct not to prescribe prophylactic antibiotics.

With regards to the surgical technique, both incision methods (intra-sulcular and papilla-based techniques), were judged to be effective in promoting post-operative healing and were in keeping with the findings of other studies (1, 16). No patient complained about the appearance of their labial mucosa at the one-year review point and, in general, aesthetics were not deemed to have been compromised by the surgical procedure.

It has been reported that periapical lesions of greater than 5mm diameter are associated with increased failure rate (4, 7). Within this audit, xenogenic bovine bone (Bio-oss®) was utilised for alveolar defects that were greater than 10mm. However, the influence of bone grafting in improving healing outcome was unclear with no obvious trends observed; some cases showed complete healing whilst others found Bio-oss® still evident and incomplete alveolar remodeling at the one-year review.

Conclusion
Within the limitations imposed by the small size of this audit, the employment of a strict SRRCR protocol can achieve high success rates. Randomised controlled trials are required to assess the impact of increased depth of retro-preparation on outcome.

Summary of revised surgical protocol
Pre-operative Management
Clinical assessment: as per Royal College of Surgeons of England guidance.
Radiographic assessment: two periapical radiographs taken with paralleling technique using ring holders, at different angles.

Treatment planning: as per Royal College of Surgeons of England guidance.

Propylactic medications: nil.

Pre-operative disinfection: 30mL Corsodyl® solution to be used as a mouthrinse for 1 min.

Local anaesthesia solution: 2% lignocaine with 1:80000 Ad.

**Intra-operative Management**

Magnification and visualization: Operating microscope + micro-surgical instruments.

Soft tissue management: Papilla-based or intra-sulcular with vertical relining incisions.

Alveolar bone removal: bone removed using a high-speed handpiece with Lindemann bone bur/ saline irrigation.

Intra-operative haemastasis: sterile cotton gauze pellets soaked in 2% lignocaine with 1:80000 Ad.

Root resection: 3mm of apical root resected at 90 degrees to vertical axis, using high-speed handpiece with tungsten carbide fissure bur.

Retrograde root-end preparation: maximum depth achievable (ideally to minimum depth of 6mm) using ultrasonic AS3D, AS6D + AS9D tips with irrigation using Corsodyl® solution.

Curettage: sample to be sent to histopathology.

Cavity obturation: MTA placed using a Lee Block. Checked with periapical radiograph.

Regenerative procedures: Bioss® and Bioguide® to be used when diameter of defect over 10mm

Wound closure: 6.0 Ethilon® sutures

**Post-operative Management**

Pain management: Ibuprofen (400mg TDS) + codeine phosphate/paracetamol 2x500mg QDS) 5 days.

Complications management: Corsodyl® mouthrinse.

Suture removal: 7-10 days post-operatively.

Radiographic review: 1 year post-operatively.

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**References**


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**Authors**

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