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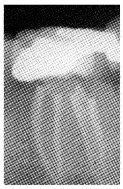

CLINICAL ARTICLE

A preliminary study on the technical feasibility and outcome of retrograde root canal treatment

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Abstract

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Aim To investigate the technical feasibility and outcome of retrograde root canal treatment.

Summary Endodontic access cavity preparation in abutment teeth may jeopardize the retention of the coronal restoration leading to prosthodontic failure. In such cases leaving the crown intact and performing retrograde root canal treatment might be an alternative approach. The potential to promote healing with retrograde endodontic treatment, and the technical feasibility to shape, clean and fill the canal was evaluated retrospectively. The study consisted of 21 incisors, canines and premolar teeth followed-up clinically and radiographically from 6 to 48 months. In 14 teeth the canals were completely negotiated. These cases were all judged as completely healed. In five cases no canal could be explored by files and a conventional ultrasonic root-end preparation and filling was performed. Two of these were classified as completely healed and three as 'uncertain'. In 2 two-rooted premolars a combination was performed with complete instrumentation of the buccal canal and the ultrasonic root-end preparation of the palatal root. One case was judged as a failure and the other was classified as completely healed. The results from this preliminary evaluation of retrograde root canal treatment are promising and merit a randomized clinical trial.

Key learning points

- Abutment teeth with vital pulps may develop pulp necrosis and apical periodontitis in 10% of cases.
- Endodontic access preparation through an artificial crown may weaken its retention and jeopardize the longevity of a bridgework.
- Retrograde root canal treatment is often feasible in maxillary teeth.
- Results from this preliminary study suggest that treatment outcome for retrograde and orthograde root canal treatment is similar.

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Introduction

Studies indicate that an infected necrotic pulp and reactive periapical inflammation is found in approximately 10% of prosthodontic abutment teeth (Bergenholtz & Nyman 1984, Karlsson 1986, Valderhaug *et al.* 1997). In such cases root canals generally are identified and negotiated through the crown. However, the access preparation influences retention and might provoke loosening of the crown and cause a prosthodontic failure (McMullen *et al.* 1990, Mulvay & Abbott 1996). To avoid such complications the present report describes a retrograde approach to root canal treatment which leaves the crown intact. The procedure is influenced by a technique originally suggested for surgical retreatment by Nygaard-Östby (1971) and clinically evaluated by Reit & Hirsch (1986). The aims of the present report were to (i) explore the technical feasibility of a similar procedure used in endodontically untreated abutment teeth with apical periodontitis and (ii) make a preliminary evaluation of its potential to promote periapical healing.

Report

Case selection

The files of the specialist clinic of Endodontology at Gothenburg Public Dental Health Service were searched for the period 1998–2005. In 21 teeth (18 maxillary incisors, canines and premolars, and 3 mandibular incisors and canines), in 21 patients, retrograde root canal treatment was attempted. All teeth served as abutments in bridgework and had clearly visible radiographic signs of apical periodontitis.

Treatment procedures

Flap design and surgical access

Cases were anaesthesized with two to three 1.8 mL cartridges of Xylocain (Lignocaine 20 mg/mL + adrenalin 12.5 μg/mL, AstraZeneca, Södertälje, Sweden). Triangular flaps were raised using marginal sulcular or papilla base incisions (Velvart 2003). Bone covering the periapical lesion was removed with round burs in a low-speed handpiece under continuous saline spray, and periradicular soft tissue was excised by curettes. Bleeding was controlled by using a haemostatic sponge (Spongostan, Johnson & Johnson, Gargrave, North Yorkshire, UK) moistened with four drops of 1 mg/mL adrenaline placed in the periapical bone crypt for 2 min.

Retrograde root canal treatment

Approximately 2 mm of the root tip was removed, and the canal identified and explored with a size 10 K file, with the handle detached (Dentsply DeTrey, Konstanz, Germany) and held in a haemostat (Fig. 1). If needed, additional bone tissue was removed to facilitate instrumentation. The canal was enlarged and cleaned with Hedström files with handles removed (Dentsply DeTrey, Konstanz, Germany) up to size 35–40 held in the haemostat. The canal was irrigated with buffered 0.5% sodium hypochlorite (Dakin's solution, pH 9,

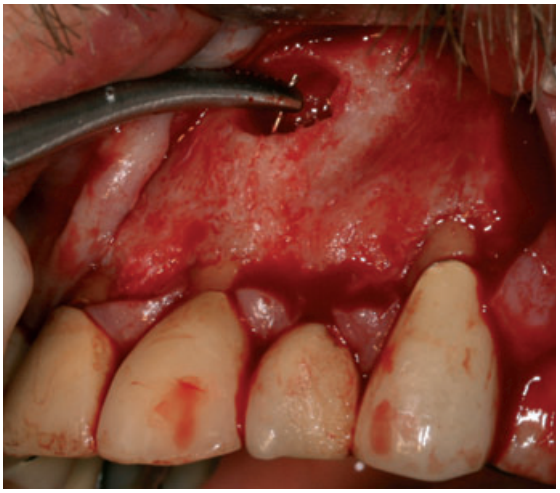

Figure 1 a Clinical picture showing flap design and retrograde instrumentation with a Hedström file held in a haemostat.

Apoteket Production and Laboratory Company, Göteborg, Sweden). Following instrumentation the canal was dried with paper points and filled with sealer (AH plus, Dentsply DeTrey, Konstanz, Germany) and thermo plasticized gutta-percha (Ultrafil, Coltène Whaledent Inc., Cuyahoga Falls, OH, USA). A matched single cone of gutta-percha (Dentsply DeTrey, Konstanz, Germany) (n = 15) was inserted into the warm gutta-percha in the canal as the final step.

In cases where the canal could not be explored by files, a 3-mm deep ultrasonic root-end preparation (Satelec, Merignac, France and Sybron Endo, Orange, CA, USA) was created, and the cavity sealed with either SuperEBA (Bosworth Company, Skokie, IL, USA) (n = 3) or MTA (ProRoot; Dentsply Maillefer, Ballaigues, Swizerland) (n = 2).

A surgical microscope (OPMI ORL, Carl Zeiss AG, Germany) was used in most cases during the surgical procedure.

Evaluation and follow-up

Radiographs were taken with a beam-aiming device and paralleling technique. The length of the root filling was determined by measuring on the radiographs. The part of the canal cleaned and filled was judged in the radiograph and expressed as a proportion of the complete root length. Outcome in terms of periapical healing was evaluated clinically and radiographically. The radiographs were assessed independently by two observers according to the criteria suggested by Rud *et al.* (1972). In cases of disagreement, consensus was reached by a joint re-evaluation as suggested by Molven *et al.* (1987). The follow-up period varied from 6 to 48 months.

Results

In 14 cases (67%) it was possible to explore, clean and fill the canal in accordance with the suggested technique (Table 1). The accessibility to the canal was judged from the radiographs as the length of the root filling in proportion to the root length. Complete healing was judged to be present in all teeth instrumented and filled in line with the protocol (Figs 2 and 3). In 2 two-rooted maxillary first premolars a combination of complete canal instrumentation (buccal root) and ultrasonic root-end preparation (palatal

Table 1 Number of treated central incisors (I1), lateral incisors (I2), canines (C), first premolars (P1) and second premolars (P2)

			Outcome			Filled proportion			
Tooth	Treatment		CH	U	Us	1/1	3/4	1/2	1/4
Maxilla									
I1	Canal	2	2	–	–	–	2	–	–
	Root end	1	–	1	–				
I2	Canal	2	2	–	–	–	2	–	–
	Root end	–	–	–	–				
C	Canal	5	5	–	–	–	5	–	–
	Root end	–	–	–	–				
P1	Canal	2	2	–	–	2	–	–	–
	Root end	3	1	2	–	2			
	Combination	2	1	–	1				
P2	Canal	1	1	–	–	–	1	–	–
	Root end	–	–	–	–				
Mandible									
I2	Canal	1	1	–	–	–	–	–	1
	Root end	1	1	–	–				
C	Canal	1	1	–	–	–	–	1	–
	Root end	–	–	–	–				
Σ	Canal	14	14	–	–	2	10	1	1
	Root end	5	2	3	–	2			
	Combination	2	1	–	1				

Complete canal instrumentation ('canal') was attempted but not always possible. In those cases a root end preparation was performed
Healing results were classified as complete healing (CH), uncertain (U) or unsatisfactory (Us)

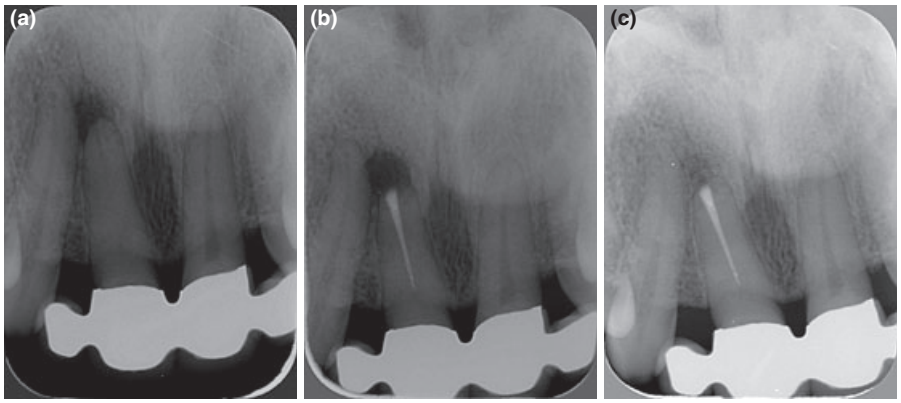

Figure 2 (a) A 32-year-old woman with aplasia of the maxillary lateral incisors. Pulp necrosis and apical periodontitis were diagnosed in the right central incisor. (b) Immediate postoperative radiograph. (c) The 1.5-year follow-up shows a resolution of the periapical radiolucency.

root) was performed. One of these cases was judged as a failure after 1 year (relapse of fistula). Two of the five teeth in which only root-end ultrasonic preparations were performed were regarded as completely healed, and three cases showed uncertain healing (Table 1).

Discussion

Apical surgery procedures might result in aesthetic side-effects such as gingival recession and visible scar tissue formation. It is important that the patient is informed about these

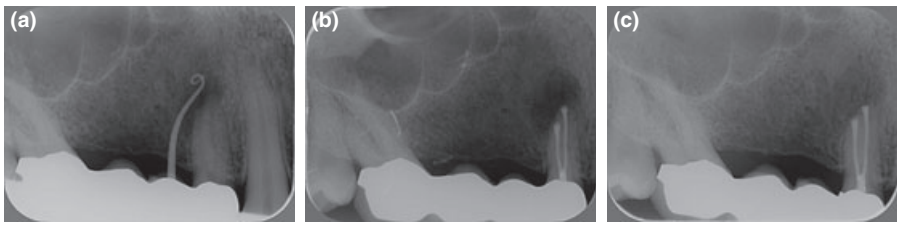

Figure 3 (a) A 48-year-old male with a fistulous tract in the region of the maxillary first right premolar. A radiograph showing a gutta-percha cone inserted in a buccal sinus tract to the periapical radiolucency of tooth 14. (b) The situation immediately postoperatively. (c) Two years postoperatively. The radiograph shows complete periapical healing.

risks. However, studies have shown that with a good soft tissue management and a microsurgical approach the risks are small (Velvart & Peters 2005). In the present study no such aesthetic complications were reported by the patients.

In the majority (67%) of the treated cases it was possible to find and instrument the root canal. However, the technique was attempted mostly in maxillary teeth (86%) and no molars were included. Maxillary molar teeth offer substantial technical obstacles partly because of their position in the dental arch and partly because of the presence of a palatal root. The most frequently treated tooth in this study, the maxillary first premolar, is often two-rooted. In the study 5 two-rooted teeth were treated. Complete instrumentation of both canals was possible only in one of them. In two cases the buccal root was instrumented to full length, whereas an ultrasonic root-end preparation was performed in the palatal root. Hence, depending on its position the palatal root in maxillary premolars may be available for retrograde root canal instrumentation.

To provide space for the instruments the bone crypt was occasionally enlarged, especially in the mandibular cases which were covered by a thick layer of cortical bone. To avoid excessive bone removal the use of prebent ultrasonic files (Velvart 2003) might be an alternative to the suggested 'hand instrumentation' technique used in the present cases.

Files were detached from the handle by bending backwards and forwards in a haemostat until separation occurred. In some cases the initial access to the root canal was facilitated by a limited ultrasonic preparation. The cleaning and shaping of the canal was performed gently and carefully in order not to contaminate the periapical tissues with intracanal infectious material. Before a new file was introduced the canal was irrigated with a buffered 0.5% sodium hypochlorite solution. As sodium hypochlorite has the potential to be cytotoxic (Hulsmann & Hahn 2000) utmost care was taken to keep the irrigant strictly within the canal, and a suction device was held close to the instrumentation area. The periapical tissues were frequently flushed with saline to remove infectious material and to neutralize any intra-canal irrigant that may have leaked out of the canal.

The canals were filled with gutta-percha and sealer. The combination of a master cone and thermo plasticized injectable gutta-percha was simple to use. The dimension and taper of the master point was important. If a very small cone was used it was difficult to press the gutta-percha point into the canal when sealer and the thermo plasticized gutta-percha were present. In the study DeTrey's X-Long Large gutta-percha points with a taper of approximately 0.05 were used. The tip was typically cut 1–3 mm before the cone was placed in the canal. After the injection of the gutta-percha the master point was immediately inserted into the canal before setting of the soft material commenced.

All teeth in which complete retrograde instrumentation and filling was feasible showed complete periapical healing. In contrast, only two of the five cases healed, where canal

instrumentation was not possible and was replaced by ultrasonic root-end preparation only. These findings are in accordance with Reit & Hirsch (1986) who reported healing in 78% of teeth in which canals were possible to negotiate in full and only in 50% when this goal was not accomplished.

The most probable explanation for unsatisfactory healing after endodontic surgery is that microorganisms survived within the root canal system and that the root-end filling did not prevent the microbes promoting a periapical inflammatory reaction. Danin *et al.* (1999) placed root-end fillings of glass ionomer cement in ten teeth with apical periodontitis and necrotic pulps. At the 1 year follow-up five teeth had complete or incomplete healing even though samples revealed persisting viable microorganisms in nine teeth. The finding indicates that healing might occur despite the microorganisms remaining in the root canal. However, if the sealing capacity of the root-end filling is lost over time the intracanal microbiota will again be exposed to the periradicular tissues and cause a reactive inflammation. It may be hypothesized that the proposed protocol will reduce such a risk. The results from this preliminary evaluation of retrograde root canal treatment are promising and motivate a randomized clinical trial which is now in progress.

Conclusions

Surgical root canal treatment was found to be feasible in most incisors and canines and in some maxillary two-rooted premolars. Healing results from this retrospective analysis motivate a future randomized clinical trial.

Disclaimer

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