Outcomes of Endodontic Micro-resurgery: A Prospective Clinical Study

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Abstract

Introduction: This study examined the outcomes of endodontic resurgery by using current microsurgery techniques on failed teeth with previous endodontic surgery. Another goal was to determine any significant outcome predictors of endodontic surgery by determining the causes of failure in the first endodontic surgery. **Methods:** The data were collected from patients in the Department of Conservative Dentistry at the Dental College, Yonsei University in Seoul, Korea between March 2001 and May 2009. All 54 teeth that required surgical retreatment were included in this study. All surgical procedures were performed by using an operating microscope and biocompatible root-end filling materials such as mineral trioxide aggregate (MTA) or Super EBA. The patients were recalled every 6 months for 2 years and every year thereafter to assess the clinical and radiographic signs of healing. **Results:** The recall rate was 77.8% (42 of 54 patients). Of the 42 cases recalled, 39 cases were included in the success category, giving an overall success rate of 92.9%. The most common possible causes of failure were no root-end filling and incorrect root-end preparation. **Conclusions:** The use of microsurgical techniques and biocompatible materials such as MTA and Super-EBA resulted in a high clinical success rate, even in endodontic resurgery. *(J Endod 2011;37:316–320)*

Key Words

Cause of failure, clinical outcome, endodontic resurgery, microsurgery, prospective study, success rate

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Nonsurgical endodontic treatment needs essential debridement to disrupt and remove a microbial infection of the root canal system (1). This treatment is a procedure for the prevention or healing of apical periodontitis with a high degree of success. In recent studies and reviews, favorable outcomes of up to 74% were reported even for necrotic teeth with apical periodontitis (2).

However, for various reasons, endodontic failure still occurs, and further treatment, either surgically or nonsurgically, is needed (3, 4). Nonsurgical retreatment is considered as the first treatment option in the management of persistent apical periodontitis (5). Endodontic surgery is indicated when nonsurgical retreatment is impractical or unlikely to improve on a previous result (6). In particular, only surgical intervention might resolve the problem when a persistent lesion is related to a periapical cyst or complexity of the canal anatomy (7, 8).

With the traditional technique that is the procedure before the accommodation of operating microscope in endodontic field, the success rate of endodontic surgery is 37.4% (9), which is lower and not superior to those of nonsurgical retreatment (10). However, in recent years, a technique that includes the use of a dental operating microscope, microinstruments, ultrasonic tips, and more biologically acceptable root-end filling materials has been introduced (8, 11). This modern technique increases the success rate, with reported successful outcomes of all microsurgical approaches of approximately 90% (12–14).

When endodontic surgery fails, the best treatment strategy to correct the problem is determined by possible causes of failure (15). For this correction, further treatment including extraction, nonsurgical endodontics, resurgery, or intentional replantation is needed (16). Nonsurgical retreatment is considered the first choice of treatment when improper or defective root filling is the cause of failure, and the root canal is accessible and negotiable. Otherwise, most cases that fail postsurgically should be repeated surgically or extracted (17). However, there are few reports relating to resurgery of a persistent lesion that fails to heal after the initial endodontic surgery. Some studies reported that resurgery has a very poor success rate and might often be contraindicated (18, 19).

Therefore, this prospective clinical study examined the outcomes of endodontic resurgery with microsurgery technique of failed teeth with previous endodontic surgery. In addition, the significant outcome predictors for endodontic surgery were investigated by determining the causes of failure of the first endodontic surgery.

Materials and Methods

Case Selection and Inclusion/Exclusion Criteria

The data were collected from patients in the Department of Conservative Dentistry at the Dental College, Yonsei University in Seoul, Korea between March 2001 and May 2009. All patients were examined for inclusion and a full history, and the clinical and radiographic examinations were undertaken to determine whether the tooth for which they had requested surgical retreatment was suitable.

The clinical criteria were the following: (1) history of a prior surgical treatment according to the patient's own reports and a marked root-end filling in the radiograph or an indication of a root-end resection; (2) referral with prior surgical treatment history from the referring practitioner's records; and (3) no clinical signs or symptoms that could link the lack of healing to periodontal disease or radicular fractures or perforations.

Of the 57 teeth that had undergone previous endodontic surgery, 3 teeth were excluded during surgery. There was a vertical fracture on 2 teeth, and 1 tooth had insufficient space for a root-end preparation because of the long post. Table 1 lists the distribution of cases.

All 54 patients were placed on a preoperative regimen of antibiotics and anti-inflammatory drugs. Oral amoxicillin (250 mg) 3 times daily was prescribed starting 1 day before surgery and continued for a total of 7 days. Ibuprofen (400 mg) was administered 1 hour before and after surgery in all patients.

Surgical Procedure

With the exception of incisions, flap elevation, and suturing, all surgical procedures were performed by using an operating microscope (OPMI PICO; Carl Zeiss, Göttingen, Germany). All clinical procedures were the same as those reported in a previous study (14) and were carried out by the same operator.

Briefly, the osteotomy was performed after the anesthetization flap was reflected. After removing the soft tissue debris, an additional 2- to 3-mm root tip with a 0- to 10-degree bevel angle was sectioned with a 170 tapered fissure bur under copious water irrigation. The resected root surfaces were then stained with methylene blue and inspected with micromirrors (ObturaSpartan, Fenton, MO) under 20× to 26× magnification to examine the cleanness of the root-end preparation and search for other overlooked anatomical details. The root-end preparation extending to 3 mm into the canal space along the long axis of the root was made by using KIS ultrasonic tips (ObturaSpartan) driven by a piezoelectric ultrasonic unit (Spartan MTS; ObturaSpartan). The isthmuses, fins, and other significant anatomical irregularities were identified and treated with the ultrasonic instruments. Two root-end filling materials were chosen, Super EBA (Harry J. Bosworth, Skokie, IL) or ProRoot mineral trioxide aggregate (MTA) (Dentsply, Tulsa, OK). The wound site was closed and sutured with 5 × 0 monofilament sutures, and a postoperative radiograph was taken.

Assessment of Possible Cause of Failure in the Previous Surgery

During the surgical procedure, the surface of the apical root to be resected was assessed after hemostasis. The surface was examined and recorded carefully with 26× magnification to determine the state of previous endodontic surgery by using an operating microscope. The possible causes of failure were defined as follows: no root-end filling, no root-end filling; missing canal, root-end filling in one canal and another canal not treated; leaky canal, a gap between the previous root-end filling and dentin or obvious leakage after methylene blue staining; isthmus, an isthmus that was not treated; incorrect root-end preparation, the preparation was off from the long axis of the canal or had an insufficient depth of 3 mm in the radiographs.

TABLE 1. Distribution of Cases

Variables	No. of teeth
Age (y)	
<29	13
30–39	23
40–49	7
50–59	7
>60	4
Sex	
Male	20
Female	34
Tooth type	
Maxillary, anterior	29
Premolar	9
Molar	2
Mandibular, anterior	9
Premolar	2
Molar	3
Signs and symptoms	
Sinus tract	33
Swelling	6
Pain on chewing or palpation	6
Increased lesion	9

TABLE 2. Distribution of Cases Related to Recall Period

Recall period	No. of teeth
1 year	13
>2 years	29
No response	12

Clinical and Radiographic Evaluation

The patients were recalled every 6 months for 2 years and every year thereafter to assess the clinical and radiographic signs of healing. On every recall visit, a routine examination was performed to identify and evaluate any signs and/or symptoms or loss of function, tenderness to percussion or palpation, subjective discomfort, mobility, sinus tract formation, or periodontal pocket formation.

The radiographic findings, which were taken from 3 angles (straight and 20 degrees mesial and distal) were evaluated independently by 2 examiners by using the same criteria used by Molven et al (20, 21). The evaluation was performed at least 1 year after surgery.

The 2 examiners standardized the evaluation criteria before the case analyses, so that their results were based on the same evaluation methods and conditions. Cohen kappa statistical analysis was obtained to measure interexaminer variability. Disagreement on clinical outcome was resolved by discussion until an agreement between the 2 examiners was reached. The healing classifications were as follows: (1) complete healing, the reestablishment of the lamina dura; (2) incomplete healing; (3) uncertain healing; and (4) unsatisfactory healing.

Assessment of Outcome

The criteria for a successful outcome included the absence of clinical signs and/or symptoms and radiographic evidence of complete or incomplete healing (21). The criteria for failure included any clinical signs and/or symptoms and radiographic evidence of uncertain or unsatisfactory healing (20).

Results

Of the 54 cases treated, 42 cases came for recall after a period of 12 months. A recall rate of 77.8% (42 of 54 patients) was obtained. Table 2 presents the distribution of cases in relation to the recall period. Table 3 lists the distribution of the healing categories. The kappa value was 0.76, which shows the agreement between the 2 examiners was good. Of the 42 cases recalled, 39 cases were included in the success category, 33 and 6 with complete and incomplete healing, respectively. The overall success rate of the cases in all classified groups was 92.9%.

TABLE 3. Treatment Outcome by Combined Radiologic and Clinical Criteria

Category of healing	Number	Percentage
Complete healing	33	78.6
Incomplete healing	6	14.3
Uncertain healing	1	2.4
Unsatisfactory healing	2	4.8