

Outcomes of Endodontic Microsurgery Using a Microscope and Mineral Trioxide Aggregate: A Prospective Cohort Study

Zu-Hua Wang, DDS,* Ming-Ming Zhang, DDS,* Ji Wang, DDS,[†] Lan Jiang, DDS,[‡] and Yu-Hong Liang, DDS, PhD*[§]

Abstract

Introduction: The aim of this study was to investigate the outcome of endodontic microsurgery and analyze the prognostic factors. **Methods:** Our prospective cohort study included 98 teeth in 81 patients. An endodontist performed all surgical procedures using endodontic microsurgical approaches. The treated teeth were recalled and examined clinically and radiographically at least 1 year after surgical treatment. The outcome was determined based on clinical and radiographic results. Radiographic healing was classified into 4 categories: complete, incomplete, uncertain, and unsatisfactory healing. An analysis of predictors was performed using multivariate logistic regression. **Results:** At recall, 74 of the 98 teeth (75.5%) were examined 12 to 30 months after surgery; 71 of the 74 teeth were analyzed clinically and radiographically, and 3 teeth had been extracted. On periapical radiographs, 55 (74.3%) of the 74 teeth showed complete healing, whereas 12 (16.2%) demonstrated incomplete healing. Together the percentage of complete and incomplete healing was 90.5% (67/74), and all 67 teeth were clinically normal. Uncertain healing was observed in 3 teeth (4.1%), one of which was symptomatic with swelling and sinus tract involvement and the other 2 were asymptomatic. The remaining 1 tooth (1.4%) showed unsatisfactory healing and was asymptomatic. The use as an abutment was found to be a negative factor associated with patient outcome ($P < .05$; odds ratio = 22; confidence interval, 20.47–23.53). **Conclusions:** The combined rate of complete and incomplete healing of teeth 12 to 30 months after endodontic microsurgery was 90.5%. The use as an abutment may have a negative effect on treatment outcome. (*J Endod* 2017; **■**:1–5)

From the *Department of Cariology and Endodontology and [†]First Clinical Division, Peking University School and Hospital of Stomatology, Beijing, China; [‡]Center of Stomatology, China-Japan Friendship Hospital, Beijing, China; and [§]Department of Stomatology, Peking University International Hospital, Beijing, China.

Address requests for reprints to Dr Yu-Hong Liang, Department of Cariology and Endodontology, Peking University School and Hospital of Stomatology, Beijing, China 100081. E-mail address: leungyuhong@sina.com
0099-2399/\$ - see front matter

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Endodontic surgery is performed to manage post-treatment periapical pathology when orthograde retreatment is impractical or unlikely to eliminate the

cause of previous failures, such as infection in apically inaccessible areas, extraradicular infection, foreign body reactions, or radicular true cysts (1, 2).

The development of endodontic microsurgical devices and materials has led to the introduction of magnification and illumination devices, microinstruments, ultrasonic tips, and biocompatible materials (3). Compared with the traditional approach of using surgical burs and amalgam as root-end filling material (4, 5), the advantages of this modern approach include smaller osteotomies; shallower root resection angles; and easier identification of the isthmus, canal fins, lateral canals, and cracks, all of which make this approach more precise and less invasive (2, 3).

It has been speculated that the clinical outcomes of endodontic microsurgery are more successful and predictable than traditional approaches (6). The success rates of traditional endodontic surgery range from 44%–75% (7–9), whereas the success rates of endodontic microsurgery vary considerably from 57%–97% (10–15). Apart from patient selection, follow-up periods, and healing evaluation criteria, the treatment protocols, including magnification devices, root-end filling materials, and the experience of the surgeon, may also contribute to the variation in the success rate (16, 17).

Endodontic microsurgery has been used clinically in China for only about 10 years. Although in different countries many studies have been published evaluating the outcomes of endodontic microsurgery, there are few reports in the literature on the outcomes in the Chinese population.

The aim of this prospective cohort study was to assess the outcome and predictors of endodontic microsurgery performed using a microscope and mineral trioxide aggregate (MTA) by a single experienced endodontist in an adult Chinese population.

Materials and Methods

Patient Selection

The study protocol was approved by the ethics board of Peking University Health Science Center, Beijing, China (no. PKUSSIRB-2013057).

Patients requiring endodontic surgery were selected according to the following criteria between June 2011 and January 2013 at the Department of Cariology and Endodontics of Peking University School of Stomatology. All selected teeth showed radiographic evidence of periapical bone loss and had not received previous endodontic surgery. Teeth with fractures or perforations were excluded. Informed consent was obtained from all patients before treatment. In total, 98 teeth in 81 patients were included in the study. Then, the surgery was performed by a single endodontist according to the designed procedure.

Surgical Procedure

All surgical procedures were performed using an operating microscope (OPMI PICO; Carl Zeiss, Göttingen, Germany). Briefly, patients were anesthetized using 4%

Significance

We assessed the outcome and predictors of endodontic microsurgery performed using a microscope and MTA in an adult Chinese population.

Clinical Research

TABLE 1. Radiographic Outcome Determined by Rud et al's and Molven et al's Criteria

Radiographic outcome	Number (%)
Complete healing	55 (74.3)
Incomplete healing	12 (16.2)
Uncertain healing	3 (4.1)
Unsatisfactory healing	1 (1.4)
Unknown (extracted teeth)	3 (4)

articaine with 1:100,000 epinephrine (Primacaine; Acteon Pharma, Bordeaux, France). Sulcular or mucogingival incisions were chosen depending on the tooth type and esthetic requirements of the case. Sulcular incisions were performed in 94 cases. Mucogingival incisions were chosen in the other 4 anterior teeth. Osteotomy was established with fissure burs (Lindemann H161 Burs; Brasseler USA, Savannah, GA) under copious water spray. Then, the granulation tissue was removed and sent for biopsy. A 3-mm root tip with a 0°–10° bevel angle was sectioned and irrigated with sterile distilled water. Epinephrine pellets (Racellet; Pascal Co, Bellevue, WA) were applied with light pressure to control local bleeding in the bone crypt. The resected root surfaces were stained with methylene blue and inspected using a micromirror (KMIR3; Obtura Spartan, Algonquin, IL) under 20 to 26× magnification to identify

anatomic details. The root-end preparation extending 3 mm into the canal space along the long axis of the root was created using ultrasonically energized tips (Kis Tips, Obtura Spartan). Significant anatomic irregularities, such as isthmuses, cracks, or fins, were also repaired using the ultrasonic instrument. ProRoot MTA (Dentsply Tulsa Dental Specialties, Tulsa, OK) was used for the root-end filling material. The wound site was sutured with 5-0 monofilament sutures (NC165; UNIK Surgical Sutures MFG Co, Taipei Hsien, Taiwan), and a postoperative radiograph was taken. The sutures were removed 4 to 7 days after the procedure, and the healing progress was checked and recorded. All clinical procedures were performed by 1 experienced endodontist.

Clinical and Radiographic Evaluation

Patients were recalled for a follow-up examination at least 1 year after surgery. To reach a high recall rate, the endodontist who treated the patients encouraged them to return for follow-up through multiple telephone calls. At the recall examination, the clinical data, including subjective discomfort, swelling, sinus tract formation, tenderness to palpation or percussion, mobility, periodontal pocket formation, and the quality of coronal restoration, were recorded.

Periapical radiographs (PA) were obtained with the digital imaging system Digora Optime (Soredex, Helsinki, Finland) using a

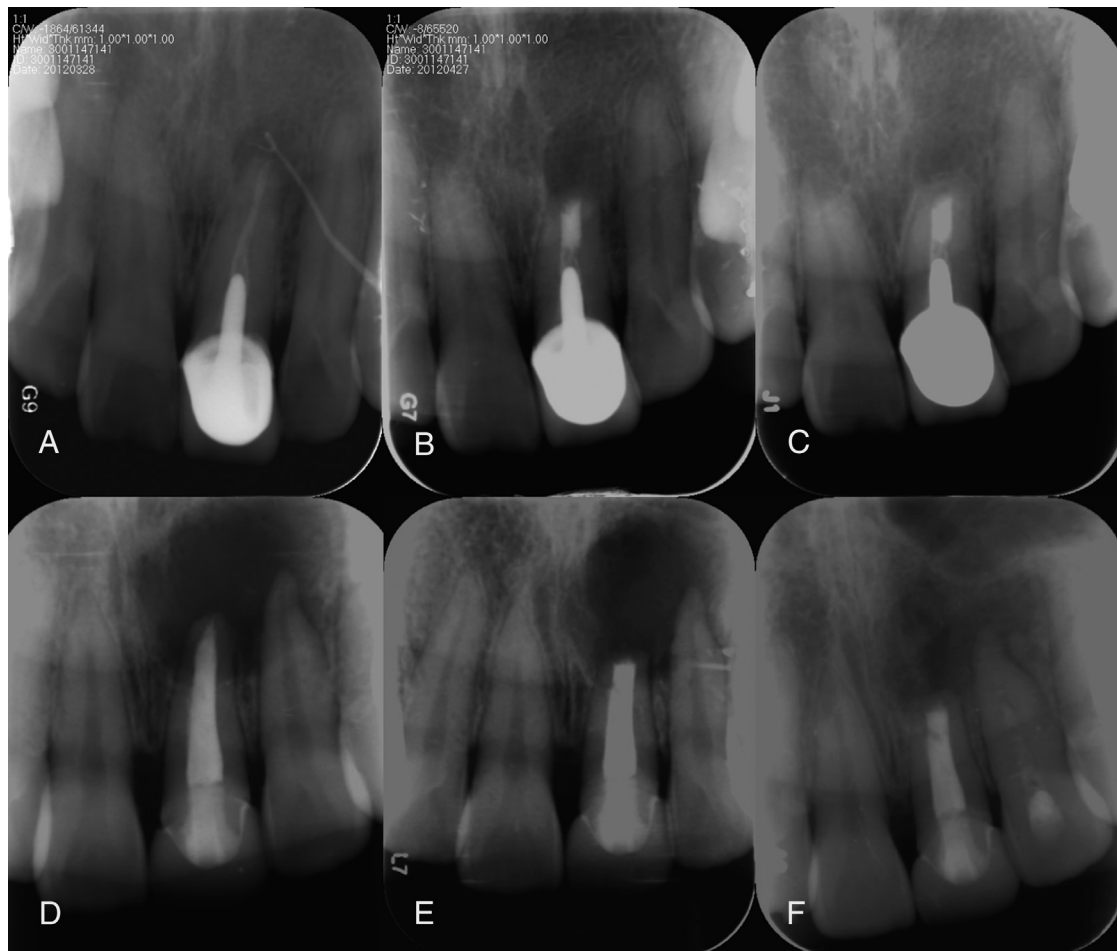


Figure 1. Examples of complete and incomplete healing. (A and D) The preoperative condition, (B and E) the immediate postoperative condition, and (C and F) the follow-up. (A–C) Reformation of the normal width and lamina dura around the apex (C) 20 months after the operation showed complete healing of the periapical lesion. (D and E) The 12-month postoperative radiograph showed that the radiolucency had decreased and the outline of the radiolucency was irregular in a case showing incomplete healing.

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