Periapical Microsurgery: Do Root Canal–retreated Teeth Have More Dentinal Defects?

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Abstract

Introduction: This microsurgical clinical study evaluated if teeth that have undergone endodontic retreatment are associated with more dentinal defects than primary root canal–treated teeth. **Methods:** One hundred fifty-five patients who underwent periapical microsurgery treatment in a private practice setting were evaluated. The root ends were resected, and the roots were inspected for the presence of dentinal defects through the surgical operating microscope with the help of a 0.8-mm-diameter light-emitting diode probe light and methylene blue dye. The root canal treatment history (primary vs retreatment) of the teeth was documented and related to the presence or absence of dentinal defects. Bivariate analysis was performed using the chi-square test, and a multivariate analysis was performed using logistic regression to evaluate possible confounding effects of patient age, sex, and tooth location on the association between treatment and the presence of dentinal defects. **Results:** Of the 155 treated teeth, 33 were excluded (3 fractured and 30 missing treatment history). Of the remaining 122 included teeth, 73 (59.8%) had undergone primary root canal treatment and 49 (40.2%) retreatment. Sixteen teeth (22.5%) of the primary root canal group versus 33 (64.7%) of the retreatment group had dentinal defects. The proportion of retreated teeth with dentinal defects compared with primary treatment was statistically significant ($P < .001$) with a higher proportion of retreated teeth having dentinal defects. In the multivariate analysis, only the type of treatment was statistically significant ($P < .001$). **Conclusions:** This clinical study showed that root canal–retreated teeth are associated with more dentinal defects than primary root canal–treated teeth. *(J Endod 2018;■:1–5)*

Key Words

Dentinal defect, periapical microsurgery, primary root canal treatment, root canal retreatment

Significance

The presence of dentinal defects after endodontic retreatment has not yet been clinically evaluated. This is the first clinical study to show root canal–retreated teeth have more dentinal defects compared with primary root canal–treated teeth. This will help clinicians weigh their treatment options between a microsurgical approach versus retreatment of a nonhealed root canal with a good coronal seal.

Root canal retreatment is often performed when the primary root canal treatment has not resulted in healing. Retreatment outcomes have not been very favorable, and several factors have been discussed to this effect (1, 2). Retreatment requires more mechanical manipulation and further preparation of the root canal. *In vitro* studies have shown that these retreatment procedures cause more damage to the dentinal walls with increased formation of dentinal defects (3–5). Given the limitations of *in vitro* experiments (6), it is important to validate the findings of these *in vitro* studies in a clinical setting.

Dentinal defects are incomplete lines that seem to interrupt the integrity of the dentin on the root-end surface. They do not stain with methylene blue dye or cause a tactile catch with a probe (7). They can either extend from the outer root surface toward the root canal or from the inside of the root canal toward the outer root surface (8). Furthermore, light-emitting diode (LED) transilluminators have been found to improve the visualization of dentinal defects (9). A recent prospective periapical microsurgery study showed the negative impact that dentinal defects can have on outcomes (7). Dentinal defects are also known as being possible originators of the longitudinal process of vertical root fractures that have a devastating effect on teeth (10). It has been found that dentinal defects are caused after various root canal techniques, including canal instrumentation, obturation, and retreatment procedures (3, 4, 8, 11–13). Most dentinal defect research has been done through *in vitro* models with significant limitations (6, 14, 15).

The presence of dentinal defects after endodontic retreatment has not yet been clinically evaluated. Therefore, the purpose of this clinical microsurgical study was to evaluate if teeth that underwent endodontic retreatment are associated with more dentinal defects on their resected root-end surfaces when compared with primary root canal–treated teeth.

Materials and Methods

Patient/Case Selection

Patients seeking periapical microsurgery treatment in an endodontic private practice setting were consecutively enrolled in this study. Informed consent was obtained

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from each subject according to the Declaration of Helsinki, and an exempt status was approved by the UNC Institutional Review Board Office of Human Research Ethics.

Two diagnostic periapical radiographs (Gendex GX 770; Gendex Dental Systems, Lake Zurich, IL), one a straight periapical radiograph and the other a 20° distal angled view, were made with a digital sensor (Visualize HD, Gendex Dental Systems) using paralleling devices (Dentsply Rinn, Elgin, IL). Subjects with a root-filled tooth diagnosed with symptomatic or asymptomatic apical periodontitis were included. Teeth that had any of the following signs or symptoms were excluded: signs of coronal microleakage, signs of a missed canal, class 2 or more periodontal mobility, >5-mm isolated probing defects, furcation involvement, and any type of perforations or signs of vertical root fracture. Furthermore, it was recorded if the teeth had only undergone primary root canal treatment or if the teeth were endodontically retreated before the microsurgery. The treatment history of each tooth was confirmed with the primary dental provider. If the history could not be confirmed, the tooth was excluded from the study.

Definition of Dentinal Defect

To avoid confusion in terminology, the definitions of the 2 groups, "intact" and "dentinal defects," were used according to Shemesh et al (8). An intact root was classified as a root-end resected dentin without any lines or cracks on either the external surface of the root or within the internal root canal wall. The dentinal defects group was defined as any line that disrupted the integrity of the dentin on the root-end surface that extended either from the external root surface toward the root canal or from within the root canal lumen toward the outer root surface. The dentinal defects did not stain with methylene blue dye and did not result in a tactile catch with an explorer. A defect that stained to methylene blue dye or had a tactile sensation was termed as a root fracture and was excluded from the study.

Surgical and Examination Phase

Every step of the periapical microsurgery was performed under a surgical operating microscope (Global G6 Microscope; Global Surgical Corporation, St Louis, MO), except for the suturing (16, 17). The same board-certified endodontist did all of the evaluations of the root-end resected surfaces.

Anesthesia of the soft tissue was administered and confirmed with a DG16 explorer (Hu-Friedy, Chicago, IL) and a full thickness periosteal flap was raised. The bone preparation was performed under continuous irrigation with saline (16, 18), granulation tissue at the periapical area was removed with a curette, and hemostasis in the crypt was obtained with Racellet epinephrine pallets (Pascal Co, Bellevue, WA) used with pressure for 5 minutes. Using a high-speed surgery handpiece under continuous irrigation, 3 mm of the root ends were resected using a 169L surgical length carbide bur (Brasseler USA, Savannah, GA) as perpendicular as practical to the long axis of the roots (19). After confirming complete resections and after direct vision was established, a carbide Endo Z bur (Brasseler USA) was used to polish each root tip surface in preparation for

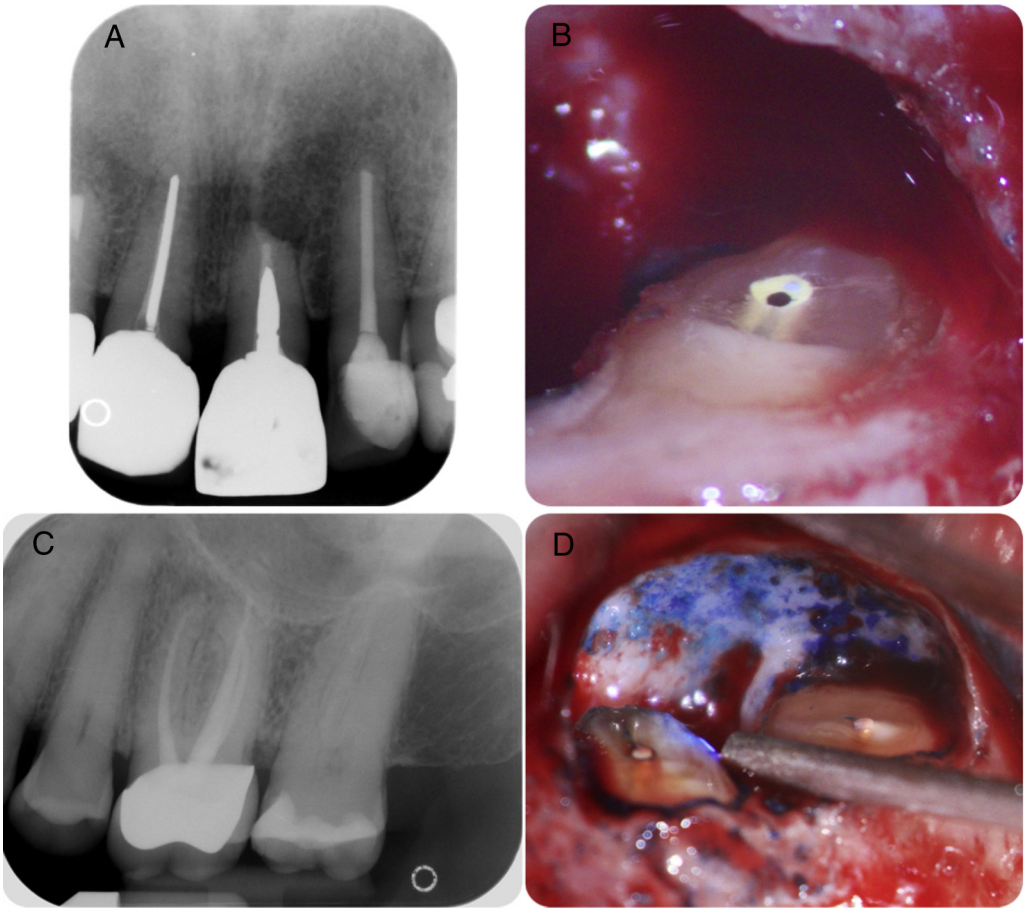

Figure 1. (*A* and *B*) Pre-operative radiograph of a retreated upper left central incisor with the root tip seen through the microscope showing a dentinal defect. (*C* and *D*) Pre-operative radiograph of a primary treated upper left first molar with the root tips seen through the microscope showing an intact root surface confirmed with the help of a 0.8-mm head diameter LED transillumination light.