Prevalence of Internal Inflammatory Root Resorption

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Abstract

Introduction: Internal inflammatory root resorption is regarded as rare because it is only occasionally detected in clinical or radiographic examination of teeth. However, inflammation is supposedly an important etiologic factor of internal resorption. Therefore, we tested the hypothesis that there is no difference in the presence of internal resorption between teeth with vital, healthy pulp and teeth with a history of pulp inflammation. **Methods:** Thirty teeth with no previous root canal treatment that were to be sequentially extracted from adult patients were diagnosed for their pulpal status (ie, healthy, pulpitis, or necrosis). After extraction, the teeth were split buccolingually, and both halves were exposed to 6% sodium hypochlorite for 10 minutes under constant shaking to remove all organic debris covering the root canal walls. The specimens were washed in water and prepared for scanning electron microscopy to examine the root canals for the presence of internal resorption. **Results:** The null hypothesis of this study was rejected. None of the 9 teeth with healthy pulps revealed signs of internal resorption. Four of the 8 teeth with pulpitis (50%) and 10 of the 13 teeth with necrotic pulps (77%) had internal resorption ($P < .01$). The average number of resorptive lesions in the affected necrotic teeth was 2.4, whereas in teeth with pulpitis and internal resorption, the average number of lesions was 1.25. The amount of resorption was always <100-μm deep; the length of the lesions varied from 200 μm to >1 mm. Most lesions (15) were detected in the middle third of the root, followed by the apical third (13). Only 1 internal resorptive lesion was detected in the coronal third of the root canal. **Conclusions:** Internal resorption was a frequent finding in teeth with pulp inflammation or necrosis. *(J Endod 2012;38:24–27)*

Key Words

Endodontics, internal inflammatory root resorption, necrosis, pulpitis, resorption, scanning electron microscopy

Internal inflammatory root resorption destroys dental hard tissue by odontoclast activity (1, 2). Internal resorption starts inside the root canal and requires at least partially vital pulp tissue. If the resorption is not detected and remains untreated, it can potentially grow larger and eventually perforate the root from inside. When internal resorption is detected early enough, the treatment is usually successful, and the long-term prognosis of the affected tooth is good. Only when a significant amount of tooth structure has been destroyed and/or the resorption is close to the marginal bone (coronal third of the root) will weakening of the tooth have a negative impact on the prognosis of the treatment.

Internal root resorption is regarded as rare, but the frequency of internal resorption is not well known. Many of the published articles on internal resorption are case reports (3, 4), with an emphasis on the treatment of the resorption. In some studies, the occurrence of internal resorption has been estimated to be between 0.01% and 1% (1). Thoma (5) reported internal root resorption in 1 out of 1,000 teeth. However, Cabrini et al (6) detected internal resorption by histological examination in 8 out of 28 teeth (28%) 49 to 320 days after calcium hydroxide pulpotomy. In another study of 33 autotransplanted maxillary canines, 17 (55%) developed internal resorption during the follow-up time of 6 years (7). The results of these studies point to inflammation as an important factor in the etiology of internal resorption. Inflammation was also reported as the primary cause of internal resorption in the classic animal studies by Wedenberg and Lindskog (8–10), who exposed pulps of monkey teeth to Freund's adjuvant (inflammation) or to Freund's adjuvant and oral bacteria (inflammation + infection). A histological and scanning electron microscopic study on resorption in teeth with apical granulomas and cysts showed that apical resorption was a common finding and that intracanal resorption was also often found (11). The resorption zones of the external and intracanal sides of the foramina seemed to be interconnected. The study concluded that intracanal resorption may be quite common; however, exact numbers were not given (11).

The goal of the present study was to examine the occurrence of internal resorption in teeth with healthy and diseased pulps using a scanning electron microscope with high magnification. The null hypothesis was that there is no difference in the occurrence of internal resorption between teeth with vital, healthy pulp and teeth with a history of inflammation and necrosis.

Materials and Methods

Thirty teeth with healthy (9 teeth), inflamed (8 teeth with irreversible pulpitis), or necrotic pulps (13 teeth with apical lesion) were chosen for the study. The inclusion criteria were that the whole root and at least part of the crown of the tooth were still present and no endodontic treatment had been done. The teeth were to be extracted for a variety of reasons such as pain, impossible to restore, or economic reasons. The study was approved by the ethical board of the university, and informed consent was obtained from the patients. A comprehensive oral examination was completed by 1 of the authors (C.G.), and the periodontal pocket depth of each tooth was

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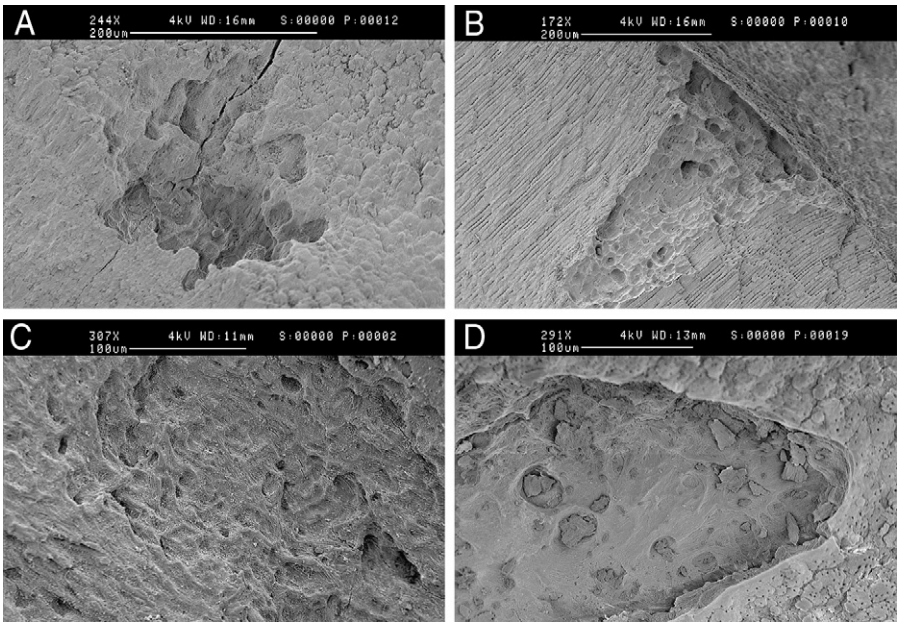

Figure 1. Scanning electron microscopic images of internal resorption in the examined teeth. (*A*) A small internal resorptive lesion in the coronal third of a tooth with necrosis. (*B*) Resorption in the middle third of a root canal involving a lateral canal (necrotic tooth). (*C*) A lesion with internal resorption in the middle third of a root canal in a tooth with pulpitis. (*D*) The apical end of a 1-mm-long resorption lacuna in a necrotic tooth. Typical imprints of the odontoclastic cells can be seen in all 4 resorptions.

measured. A radiograph was available for all of the teeth (this is an extraction requirement). Fifteen patients were included in this study. The pulp was diagnosed as healthy when there was no apical radiolucency or pain, the tooth reacted positively to a cold test or an electric pulp test, and there were no caries deep into the dentin. Criteria for pulpitis were as follows: the tooth was vital with no apical lesion but had a deep caries lesion extending close to or into the pulp; many teeth in this group also were painful. The diagnosis of necrotic pulp was determined when there was a periapical radiolucency on the radiograph and the tooth did not react to a cold test or electric pulp test (12). The age of the patients ranged from 17 to 61 years, with a mean age of 41.9 years. Six of the teeth were from male patients, and 24 were from female patients. The study material included 11 anterior teeth, 9 premolars, and 10 molars.

After extraction, the teeth were kept at 4°C in 0.01% sodium hypochlorite until processed further. The apical foramen was localized in each tooth, and buccal and lingual grooves were prepared using a 0.3-mm-thick diamond disk. The teeth were then split in the buccolingual direction so that half of the root canal was exposed in each half. The specimens were then each treated in 10 mL 6% NaOCl for 10 minutes under constant shaking to remove all organic debris and predentin from the root canal walls. Pilot experiments had shown this treatment to be effective in revealing all dentin walls in the root canals. Specimens were dehydrated in the following graded ethanol series: 50%, 70%, and 80% for 5 minutes each and then 100% ethanol for 30 minutes. The specimens were dried in a critical point dryer (Tousimis Research Corporation, Rockville, MD) and mounted, sputter coated with gold/palladium, and viewed with a scanning electron microscope (Stereoscan 260; Cambridge Instruments, Cambridge, UK) at 7 to 9 kV at a magnification of 200 to 2,000×. Areas of internal root resorption can be readily detected by their rough, irregular borders and the characteristic honeycomb appearance of the resorption lacunae created by the individual odontoclast cells. All such areas were documented and photographed. The null hypothesis was tested using the Fisher exact test (SPSS for Windows 11.0; SPSS, Chicago, IL), when necessary, at a significance level of $P < .05$.

Results

Altogether, 60 longitudinal half-sections of the teeth were examined by a scanning electron microscope throughout the length of the canal. Internal resorption was not detected in any of the 9 teeth that were diagnosed with a healthy pulp before extraction. Four of the 8 teeth (50%) with pulpitis had internal resorption, whereas 10 of the 13 teeth with necrotic pulps (77%) had lesions of internal resorption in the root canal walls ($P < .01$) (Fig. 1 and Table 1). The average number of separate resorptive lesions in teeth with necrosis (with resorption) was 2.4, with the majority being found in the middle third of the canal (14/24) (Table 2). None of the apical lesions seemed to continue out of the canal to join a possible external apical resorption. Teeth with pulpitis and with an internal resorption had an average of 1.25 lesions, most of them (4 of 5) in the apical third of the root canal. Two of the 29 lesions were at the orifice of a lateral canal involving part of the root canal side of the lateral canal (Fig. 1*D*). All 29 resorptions were <100 μm deep; the length of the lesions varied from 200 μm to over 1 mm.

TABLE 1. Occurrence of Internal Resorption in Teeth with Different Pulpal Status

	N	Resorption (%)	No resorption (%)
Teeth with healthy pulp	9	0	9 (100)
Teeth with pulpitis	8	4 (50)	4 (50)
Necrotic teeth	13	10 (77)	3 (23)
Total	30	14	16

There were significant differences on the occurrence of resorption among different pulpal status of teeth (Fisher exact test, $P < .01$).