# Incidence of Periradicular Pathoses in Endodontic Treatment Failures

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Biopsy reports from 150 periradicular tissue specimens obtained from teeth refractory to nonsurgical endodontic therapy were reviewed. The specimens were submitted by postdoctoral dental students in the Department of Endodontics, and the biopsy reports were prepared by oral pathologists at the University of Texas Health Science Center at San Antonio. The study found that 59.3% of the periradicular lesions were granulomas, 22% cysts, 12% scars, and 6.7% other pathoses. The majority (56%) of endodontically treated cases which failed to heal were recognized within 2 yr after the completion of therapy. The most common location for surgical retreatment was the anterior maxilla, followed by the posterior maxilla, the posterior mandible, and the anterior mandible. The periapical granuloma was the predominant pathosis at each location.

The incidence of periradicular pathoses continues to be a source of disagreement among investigators. A review of the literature indicates that the relative frequency of periapical cysts and granulomas was established either by the histological examination of periradicular tissue specimens or the exhaustive review of biopsy reports. In some of these studies (1-4), the incidence of periapical cysts approaches or exceeds the incidence of periapical granulomas. In other studies (5-9), the periapical granuloma is clearly the more predominant pathosis. Langeland et al. (10) suggest that the variation in the reported incidence of periradicular pathoses may be attributed to differences in the methods of sample selection and histopathological diagnosis utilized in each study. The periradicular tissue specimens examined in previous studies were usually submitted by a diverse group of contributors who performed surgery for a variety of reasons, and the specimens were often obtained from both endodontically and nonendodontically treated teeth with periapical rarefactions.

Since early investigators believed that periapical cysts would not heal following nonsurgical endodontic therapy, the presence of a suspected cyst was an indication for surgical intervention. Today, it is generally accepted that endodontic surgery is indicated only when nonsurgical therapy has failed to bring about healing and nonsurgical retreatment is contraindicated or unlikely to improve the prognosis. Thus, the periradicular tissue specimens previously studied may not accurately represent the pathoses currently biopsied during surgical endodontics. The incidence of periradicular pathoses among teeth in which nonsurgical endodontic treatment has failed to bring about healing deserves more attention.

In 1967, Seltzer et al. (11, 12) histologically examined 87 peripheral tissue specimens obtained from endodontic cases which failed to heal. The incidence of periapical cysts and granulomas were 51% and 45%, respectively. In 1988, Stockdale and Chandler (9) reviewed 1108 histopathology reports of periradicular tissues obtained from teeth in which nonsurgical endodontic treatment failed to result in healing. The incidence of periapical cysts was low (16.8%). Recently, periapical tissue specimens from 150 endodontic cases which failed to heal were histologically studied by Lin et al. (13). Only 19% of the specimens in this study were identified as periapical cysts. The discrepancy existing between these studies might be resolved by further investigation. The purpose of this study was to determine the incidence of periradicular pathoses in endodontic cases which have failed to heal after nonsurgical endodontic therapy.

#### MATERIALS AND METHODS

The study reviewed 150 biopsy reports from the Oral Pathology Laboratory at the University of Texas Health Science Center at San Antonio. The reports were of periradicular tissues obtained at the time of periradicular curettage and were submitted between the years of 1977 and 1991 by postdoctoral dental students in the Department of Endodontics at the University of Texas Health Science Center at San Antonio. Endodontic surgery was performed when teeth failed to respond to nonsurgical therapy and nonsurgical retreatment was contraindicated or unlikely to improve the prognosis. The criteria used to evaluate these cases which were not healing included the development or persistence of adverse clinical signs and symptoms, such as pain or swelling, sensitivity to percussion or palpation, and/or the presence of a draining sinus tract. Additional criteria included the enlargement of an existing rarefaction or the development of a new radiolucent lesion. Teeth with advanced periodontal disease or vertical root fractures were excluded from the study.

The specimens were received in 10% neutral buffered formalin, processed for routine histological examination, em-



Fig 1. Periradicular tissue specimen diagnosed as a periapical cyst. A distinct cavity is completely lined by epithelium (hematoxylin and eosin; original magnification ×20).



Fig 2. Periradicular tissue specimen diagnosed as a periapical cyst. An incipient cavity is completely lined by epithelium (hematoxylin and eosin; original magnification  $\times 100$ ).

bedded in paraffin, and serially sectioned at 6  $\mu$ m. The following information was provided on the Tissue Examination Request submitted with each specimen: (a) biographical information on the patient, including age, sex, race, and occupation; (b) clinical history, including the duration and growth of the lesion, the presence of symptoms, and pertinent medical and dental history and familial data; (c) clinical appearance and surgical findings; and (d) clinical impressions or differential diagnosis.

Representative sections were stained with hematoxylin and eosin and examined by one of five oral pathologists who prepared a tissue report of the specimen. A diagnosis of periapical cyst was made in the presence of a distinct (Fig. 1) or incipient (Fig. 2) cavity lined completely or partially (Fig. 3) by epithelium. If the specimen consisted of granulation tissue with varying degrees of epithelial proliferation, but did not demonstrate cavitation, a diagnosis of periapical granuloma was made (Fig. 4). The tissue report included the following information: (a) biographical information on the patient, including the specimen code designated by the Oral Pathology Laboratory; (b) the final diagnosis; (c) the clinical history provided on the Tissue Examination Request; (d) a gross



FIG 3. Periradicular tissue specimen diagnosed as a periapical cyst. A distinct cavity is partially lined by epithelium (hematoxylin and eosin; original magnification ×40).



Fig 4. Periradicular tissue specimen diagnosed as a periapical granuloma. Epithelial proliferation is observed in the absence of cavitation (hematoxylin and eosin; original magnification  $\times 100$ ).

description of the received specimen; and (e) a microscopic description of the representative section.

The tissue reports were forwarded to the Department of Endodontics, along with a prepared slide of each specimen. The prepared slides were examined by the authors for agreement with the final diagnosis appearing on the tissue reports. If there was any disagreement with the final diagnosis, an oral pathologist was consulted to reexamine the slide. The following data were recorded from the biopsy reports used in the study: (a) age, sex, and race of the patient; (b) the tooth or teeth operated on; and (c) the final diagnosis of the periradicular tissue specimen. If the observation period following the completion of nonsurgical therapy was indicated on the report, it was also recorded.

#### RESULTS

The periradicular tissue specimens were obtained from 79 male patients and 71 female patients. The patients ranged in age from 13 to 80 yr, with the majority being in the fourth (24%), fifth (21%), and third (19%) decades of life. The

maxillary anterior region was the most common (47.3%) location for biopsies, followed by the maxillary posterior (28.7%), mandibular posterior (15.3%), and mandibular anterior (8.7%) regions. The number of periapical cysts, granulomas, and other pathoses diagnosed at each location is reported in Fig. 5. The diagnostic frequencies of the various periradicular pathoses demonstrated little variation among anatomical locations (Fig. 6).

Of the 150 biopsy reports reviewed, 59.3% were periapical granulomas, 22% were periapical cysts, and 12% were periapical scars. The remaining biopsy reports (6.7%) included three lateral periodontal cysts, two periapical abscesses, two foreign body reactions, and a chronic sinus tract, myxomatous tissue, and calcified tissue fragments.

The observation period following the completion of nonsurgical therapy was recorded on 113 biopsy reports. The data indicated that the majority (56%) of failures were surgically retreated within 2 yr following the completion of nonsurgical endodontic therapy. Surgical retreatment was performed on the remaining failures after periods of more than 6 yr (31%), 2 to 4 yr (15%), and 4 to 6 yr (11%). The distribution of periradicular pathoses with respect to the observation period following nonsurgical therapy is presented in Fig. 7.

### DISCUSSION

The results of this study indicated that the periapical granuloma was the predominant pathosis among teeth that were refractory to nonsurgical endodontic therapy. The diagnosis of periapical cyst was made in only 22% of the biopsy reports reviewed. This is in close agreement with Lin et al. (13), who observed well-defined apical cysts in 19% of the endodontic treatment failures studied. In contrast, Seltzer et al. (11, 12) reported that the periapical cyst was the predominant pathosis in endodontic treatment failures. Lin et al. used Strindberg's (14) criteria of failure; modifications of which were used in the present study. In the studies by Seltzer et al. (11, 12), endodontic treatment failure was determined if "adverse clinical symptoms or radiographic findings" were present. Although the criteria of failure and observation periods were not specifically reported, the authors emphasized that the diagnosis of endodontic treatment failure was made by experienced endodontists.

Langeland et al. (10) were the first to suggest that the incidence of periradicular pathoses may be influenced by the methods of sample selection and histopathological diagnosis. Unless these factors are controlled, comparisons between the reported incidence of periradicular pathoses are of little value. In previous studies, periradicular tissue specimens were obtained from teeth in which nonsurgical endodontic therapy had not been performed. Although the results of these studies were fundamental in establishing the argument that some cysts heal with nonsurgical endodontic therapy, their criteria for case selection are dated with respect to current concepts in endodontic surgery. According to Simon (15), the "bay" cyst may respond to nonsurgical therapy since its lumen is in direct communication with the root canal system. The sample populations previously studied most likely included these bay cysts, which account for 8.6% of the periradicular pathoses observed in teeth that have not been endodontically treated (15).



Fig 5. The number of periradicular pathoses diagnosed at each anatomical location.



Fig 6. The incidence of periradicular pathoses by anatomical location.



Fig 7. The number of periradicular pathoses diagnosed at each observation period.

The incidence of periradicular pathoses may also be influenced by variations in the surgical technique used to biopsy the tissue specimen. Periradicular curettage of a periapical cyst may result in the disruption of the epithelial lining, and if fluids and semisolid materials are allowed to escape from the lumen, the cyst cavity will collapse and the specimen may be misdiagnosed as a periapical granuloma with epithelial proliferation. Conversely, periradicular curettage of a periapical granuloma may result in artifactual separation within the proliferating epithelium. If the specimen presents as a strip of epithelium partially lining an incomplete cavity, it may be misdiagnosed as a periapical cyst. Finally, the histopathological diagnosis of any periradicular tissue specimen requires serial sectioning for accuracy.

The anatomical region most commonly operated on was the anterior maxilla, followed by the posterior maxilla, the posterior mandible, and the anterior mandible. These results were identical to those of Spatafore et al. (4), who reported that the periapical granuloma was the predominant lesion at each location except the posterior mandible. In the study by Spatafore et al. (4), the periapical granuloma was the predominant pathosis at each anatomical location.

Indications for endodontic surgery are currently restricted to teeth in which nonsurgical therapy has failed to bring about healing and nonsurgical retreatment is contraindicated or unlikely to improve the prognosis. In a recent article, Vire (16) reported that true endodontic failures were rare among endodontically treated teeth that were extracted, but they became evident more quickly than prosthodontic or periodontal failures. They also found the average amount of time that elapsed between obturation and extraction was 20.6 months. This is in close agreement with our observation that the majority of failures were recognized within the first 2 yr.

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We are sternly cautioned (Allergy 47:20) that allergy to reindeer is no laughing matter in Lapland. Well, OK, I won't laugh. But if I have to choose one thing to be allergic to ....

William McMaster