

Incidence of periapical cysts in relation to the root canal

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During the past decade, endodontists have concluded that some periapical cysts heal with nonsurgical endodontic therapy. This opinion is based primarily on two articles. In the first study, Bhaskar¹ reported that, of 2,308 periapical biopsy specimens, 48% were granulomas and 42% were radicular cysts. The majority of these lesions were submitted by endodontists, but the reason for surgery was not given. The second study by Lalonde and Leubke² on 800 biopsy specimens disclosed that 45.2% were granulomas and 43.8% were radicular cysts. In contrast to Bhaskar's sample, only 6% of this sample involved endodontically treated teeth. Endodontists treat teeth with apical radiolucent areas on a routine basis and claim approximately 80% to 95% success. These studies show that approximately 40% of these radiolucent areas are cysts. Thus, endodontists must be healing most cysts. Implied in this reasoning is that some cysts heal, whereas others do not.

However, other studies have shown a varying and lower percentage of cysts. In studies in which the samples had no previous endodontic treatment, Morse and others³ found 23.2% cysts of 43 periapical lesions and Linenberg and others⁴ found 28% cysts of 110 lesions. In other studies that included both endodontically and nonendodontically treated teeth, Block and others⁵

found 7% (of 230 cases), Patterson and others⁶ found 14% cysts (of 150 cases) and Wais,⁷ in a random sample of 50 endodontically treated teeth, found 14% cysts. Other studies with higher and lower percentages only enhance the confusion.

As is apparent from these studies, a large discrepancy in the incidence of cysts exists. Langeland and others⁸ ascribe this variation to the investigator's definition of a cyst, the histologic criteria used, and the characteristics of the population sample. In all these studies, several parameters seem constant: all studies were done with curetted biopsy material; a cyst was usually diagnosed if a strip of epithelium was seen apparently lining a cavity; and most samples included a mixture of endodontically and nonendodontically treated teeth. The purpose of this investigation was to study the incidence of apical cysts and the relationship to the apical foramen and root canal. This study was designed to avoid using curetted material that prevents studying the anatomic relationship of the cyst to the apical region of the tooth. Our goal was to answer the question of why such a large discrepancy exists in the literature concerning the incidence of cysts.

MATERIALS AND METHODS

Thirty-five teeth that were extracted at the oral surgical services of

the Veterans Administration Medical Center, Long Beach, and the Terminal Island Navy Dental Clinic, were used. The criteria used were that the teeth when extracted must have an apical lesion completely attached to the root and no endodontic treatment had been performed. A random collection of roots of all teeth was used. All specimens were immediately fixed in 10% formalin. They were decalcified in decalcifying solution (a chelating agent in dilute HCL) for between 6½ to 8½ days, depending on the specimen size. They were processed for paraffin, and then sectioned vertically through the apical foramen and the lesion. The sections were cut from 5 to 7 μ and a step series of representative sections were taken throughout the block. The slides were stained with hematoxylin and eosin or Masson's trichrome stain.

Epithelial lesion definitions

To clarify the results and discussion the following definitions are used:

—Epithelial granuloma: an apical inflammatory lesion with proliferating strands of epithelium present, but no cavity discernible.

—“Bay” cyst: an apical inflammatory lesion with epithelium lining a cavity but interrupted by the apex protruding into the cavity.

—Cyst: an apical inflammatory

lesion with epithelium completely lining a cavity with no opening or connection to the apical foramen and root canal.

RESULTS

The statistical results of the study are summarized in the Table.

Microscopic examination of the slides showed no epithelium in 21 (60%) of the 35 lesions. Of these, two were diagnosed as acute apical abscess and the remaining 19 had various mixtures of acute and chronic inflammatory cells which were diagnosed as chronic apical periodontitis (Fig 1). Eight additional lesions (22.9%) had some strands of proliferating epithelium, but no lumen or lining activity was present. They were diagnosed as epithelial granulomas (Fig 2).

Of the remaining six lesions, three (8.6%) had definite epithelial linings of cavities but were open to the root canal system. The epithelium appeared to be attached to the side of the root and surrounded the apex like a sack. The root end itself was

surrounded by the cavity. This was termed a bay cyst (Fig 3). The remaining three (8.6%) specimens showed complete epithelialization around a cavity with no opening into the apical foramen and root canal. In these lesions, the root is surrounded by chronic inflammatory tissue or proliferating strands of epithelium. There is no opening or connection of the root canal to the epithelial-lined cavity. These were diagnosed as cysts (Fig 4).

DISCUSSION

The size of the sample (35 lesions) is relatively small and may also be skewed. This study is limited to teeth with lesions remaining attached after

extraction. For example the bay cysts may have a relatively weak attachment to the tooth; thus, on extraction the lesion may pull away from the tooth and result in a smaller number for use in our study. Nevertheless, significant information can be gained from the study.

The definitions of apical epithelial lesions are included to distinguish and specify the differences between lesions. The working definition of a cyst is a "closed cavity lined by epithelium containing liquid or semi-solid material." This is taken to mean a three-dimensional cavity with no openings. However, when they were studied in relation to the apical foramen, two different epithelial-lined lesions were observed. The

Table • Incidence of cysts in relation to apical foramen.

	No.	%
Chronic apical periodontitis	19	54.3
Acute apical abscess	2	5.7
Epithelial granuloma	8	22.9
Bay cyst	3	8.6
Apical cyst	3	8.6
Total	35	100.1

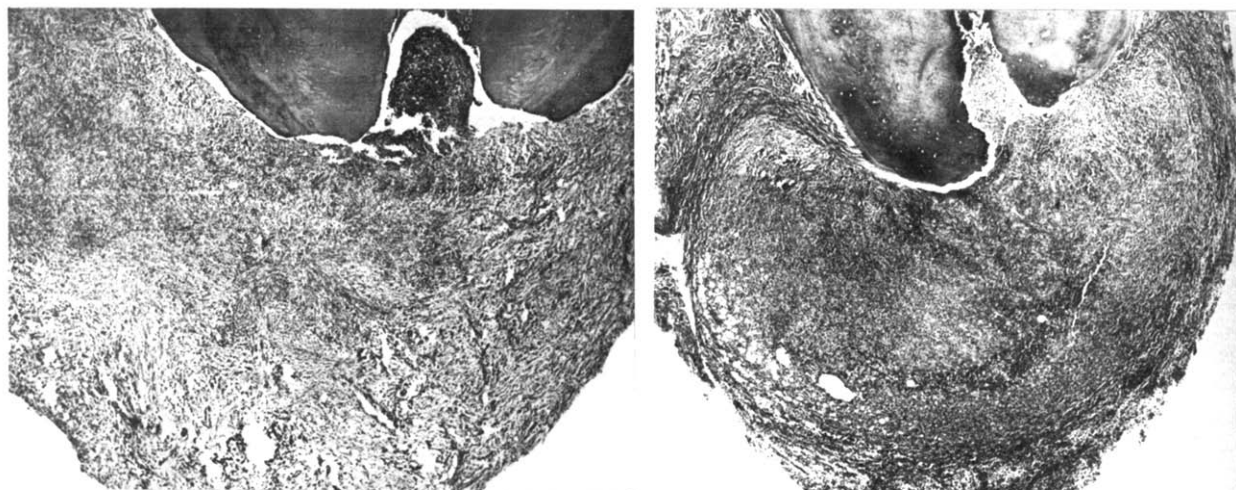


Fig 1—Left, chronic apical periodontitis without epithelium (H&E, orig mag $\times 40$). Right, chronic apical periodontitis without epithelium (Masson's stain, orig mag $\times 20$).

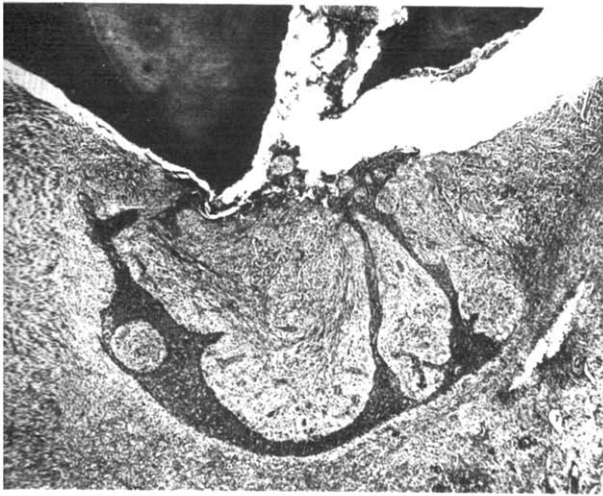


Fig 2—Top, root apex with epithelial granuloma attached (Masson's stain). Bottom, root apex with epithelial granuloma (Masson's stain, orig mag $\times 40$).

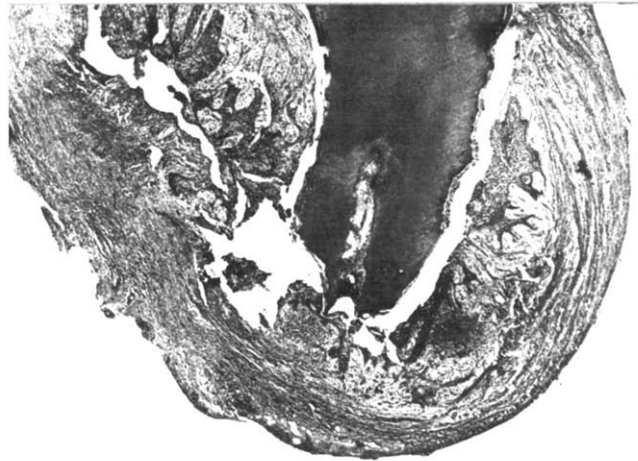
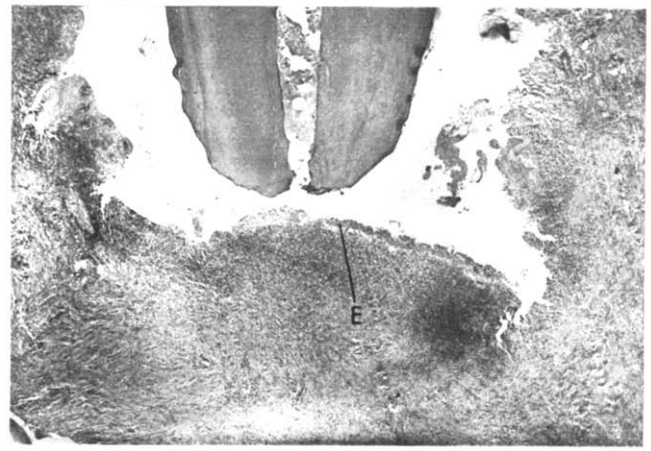


Fig 3—Top, root apex in cavity lined by epithelium (H&E, orig mag $\times 20$); E indicates epithelium. Bottom, root apex in cavity lined by epithelium (Masson's stain, orig mag $\times 20$).

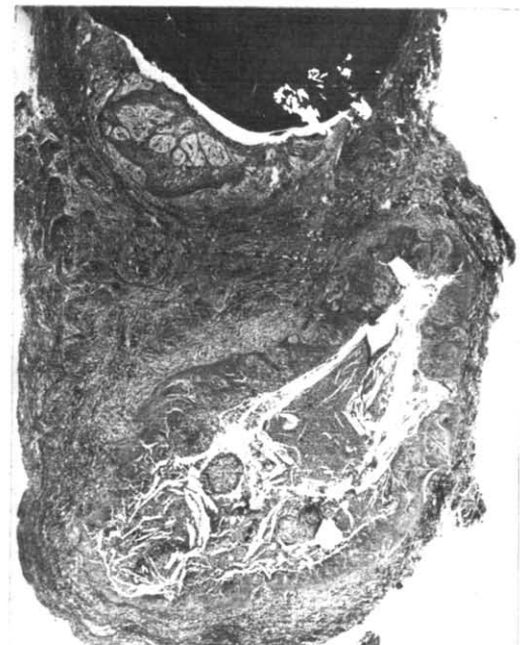
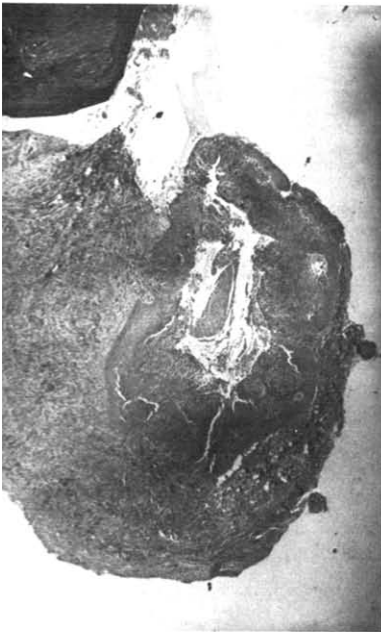


Fig 4—Three sections made from same case. Left, section showing epithelial-lined cavity completely separated from apical foramen (H&E, orig mag $\times 20$). Middle and right, sections taken before and after cutting through apical foramen. Epithelial-lined cavity showed no connection with apical foramen or with epithelium immediately below root end (Masson's stain, orig mag $\times 20$).

step serial sections showed cysts that had no connection with the apical foramen. As other epithelial lesions did show an opening or communication with the apical foramen, a different term, bay cyst, was used.

Why do some cysts not heal?

The finding of distinct types of epithelial lesions may be critically related to healing potential. As the bay cyst is open to the root canal (the source of irritation), it seems reasonable that an alteration in the canal contents may have an effect on the cavity or lumen and thus on the surrounding epithelium. By contrast, the cyst seems to be a self-sustaining lesion that is no longer dependent on the source of irritation from the canal. Thus, changes in the root canal would appear not to directly affect the three dimensional cyst cavity or its epithelial lining. Cysts elsewhere in the body usually do not heal without surgical intervention. This would account for the clinical impression that some cysts heal whereas others do not.

Why the discrepancy in cyst incidence?

Some of the epithelial granulomas have epithelium lining the apical root end, as can be seen in Figure 2 left. If this lesion is curetted and examined microscopically, the specimen could give the appearance of a strip of epithelium, apparently lining what may have been a cavity, and thus could be diagnosed as a cyst. From our statistics, this could be as high as 22.9%. Also, if the bay cyst is

curetted and then cross-sectioned in such a way as to include two sides of the lesion, microscopically it could also appear as a completely epithelial-lined cavity or cyst. Only step serial sections would disclose the area formerly occupied by the root. Further, the curetted lining could give the appearance of a strip of epithelium apparently lining a cavity and again be diagnosed as a cyst. This could add 8.6% to the misdiagnosis of cyst. From our statistics then, if the epithelial granulomas, which could give the impression of a cyst, and the bay cysts are added to the true cysts, as many as 40.1% could possibly be diagnosed as cysts. This is a distinct possibility as all the reported studies were based on curetted biopsy material. This could account for the high incidence of cysts and the variation in all the studies using curetted biopsy material.

SUMMARY

The study shows the occurrence of two types of epithelial-lined cavities related to the apical foramen. The incidence of true cysts is low, in our study 8.6%. As our sample size is small, this figure is probably an approximation. From the potential of healing, the true cyst may not heal with nonsurgical endodontic therapy. The bay cysts may heal with nonsurgical endodontic therapy, as they may be extensions of epithelial granulomas and statistically should be listed with them.

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