Assessment of Constant Periapical Lesions and Their Connection with Endodontic Failures after Apical Microsurgery

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Background: Periapical lesions can be appreciated in the teeth that have undergone root canal treatment leading to more complications. Radiographic as well as histological evaluation is important for definitive diagnosis. Aim: The aim of this study was to examine the histology of constant periapical radiolucent lesions that are associated with root canal treated teeth and also to find association between histological findings and radiographic size of lesion as well as existence or nonappearance of a radiopaque lamina. Materials and Methods: The study included 60 incisors and canines allotted for apical microsurgery. Two observers studied the diameter of periapical radiolucent lesions and the existence or nonappearance of radiopaque lamina. During apical microsurgery, biopsy specimens were collected and after tissue processing oral pathologist examined the specimen under a light microscope. Histological features of the specimen were taken into consideration, and the diagnosis of abscess, cyst, granuloma, and scar tissue were given. Pearson’s chi-square test was used to study the established relationship between histological diagnosis and lesion size. Results: Results indicated that 68.33% of lesions were granulomas, 23.33% were cysts, 5% were abscesses, and 3.33% were scar tissue. Conclusion: According to histological results, most of the lesions in this study were granulomas, followed by cysts. Abscesses and scar tissues were rare.

Keywords: Histopathological diagnosis, microsurgery, periapical cyst, periapical granuloma, radiographic

INTRODUCTION

It is a complex and challenging process to treat endodontically treated teeth with unrelenting periapical lesions. The occurrence of unnoticed extra root canals, canal blockage, perforations, ledge formation, broken instrument, and unrectifiable post

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in the canals can make difficulties for retreatment procedures. Despite the fact that root canal retreatment can give effective outcomes,[1,2] sometimes lesions do not repair; in such cases surgical treatment such as periapical surgery and further extraction are the only options left.[3]

Many times, periapical lesion still persists due to complete evacuation of infection and at this point the treatment is considered as unsuccessful.[4] Periapical lesions can exist after treatment in tooth where root canal is accurately cleaned and restored but still periapical periodontitis persists, as a nonsymptomatic radiolucency.[5]

Six potential factors have been depicted due to which there are no symptoms of periapical periodontitis after root-canal treatment: continuous intraradicular infection, foreign body reactions caused due to root-filling material, extraradicular infection (principally actinomycosis), presence of endogenous cholesterol crystals that continue to irritate the tissue periapically, true cystic lesions, and scar tissue.[6] Persistence of microorganisms in the root canal system is the main cause of apical periodontitis.[5]

Only on the basis of radiographs alone apical periodontitis could not be classified into either cystic or noncystic lesions.[7,8] Histopathological evaluation is important for definitive diagnosis of periapical lesions.[9]

The aim of the study was to examine the histology of constant periapical radiolucent lesions that are associated with root canal treated teeth and also to find association between histological findings and radiographic size of lesion as well as existence or nonappearance of a radiopaque lamina.

**Materials and Methods**

This retrospective study was conducted on 60 patients who underwent apical microsurgery at ABC Hospital from January 2014 to December 2017. Approval was taken from institutional ethics committee and patients were enrolled after written consent. Patients were thoroughly explained about the procedure in their vernacular language.

**Inclusion criteria**

The inclusion criteria of the study were as follows:

1. Root-canal-treated single-rooted anterior incisors and canines with persistent periapical lesions

**Exclusion criteria**

The exclusion criteria of the study were as follows:

1. Teeth with advanced periodontal disease, vertical root fracture, and post-perforation

2. Tooth destroyed by apical curettage and during the removal of root tip

**Methods**

Preoperative periapical radiographs were taken by using the standardized long-cone paralleling technique and positioning equipment and under standard exposure settings. Two radiologists by using calibrated reference images as described by Ricucci et al.[10] evaluated digital images. Extent of periapical lesions was calculated at their widest horizontal or vertical diameters. Along with it existence or lack of radiopaque lamina on radiograph was recognized. The radiological examinations were performed without any knowledge of the results of histological diagnosis.

Excisional biopsy was carried out with minimal damage to surrounding structures. The specimens were fixed in 10% neutral-buffered formalin and processed for paraffin embedding. 4-µm-thick sections of specimens were sectioned using a microtome. After staining with hematoxylin and eosin, sections were examined under a light microscope by an oral pathologist according to the histopathological criteria defined by the World Health Organization (WHO) and specimens were diagnosed as periapical granuloma, periapical cyst, abscess, and scar tissue.

**Statistical analysis**

Interobserver agreement was analyzed by the κ test. Pearson’s chi-square test was used to analyze relationships between histological diagnosis and lesion size with a significance level of $P = 0.05$. The statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software program, version 20.0, SPSS Inc., Chicago, IL, USA.

**Results**

Among the total 60 samples, 32 were from male patients and 28 were from female patients. The mean age was 32.16 years, with a range of 15–60 years. Maximum number of endodontic failure cases have been seen in maxilla than mandible. [Table 1, Graph 1].

Among 60 radiographs of periapical lesions, 7 had radiopaque lamina. Among lesions having radiopaque lamina, five were granulomas and two were cysts. Four lesions with radiopaque lamina had diameters 10–20 mm, and three had diameter of 6–9.9 mm.

**Discussion**

The main function of endodontic procedure is to deal with restorative problems encountered in the diseased tooth, consequently empowering function, cosmetics, removing any signs, and symptoms of inflammation,
allowing repair of bone in apical lesions.**10-12** Hence, it must be clear with the diagnosis of lesion that what kind of lesion is influencing the bone, which can be possible only through biopsy with histopathological examination. Granulomas are mostly asymptomatic and develop due to pulp necrosis. Granulomatous tissue consists of a chronic inflammatory infiltrate and reparative elements, which replaces resorbed bone.**13** Periapical lesions develop due to increased hydrostatic pressure in the fluid, which shore up increased osteoclast activity.**14**

There is no doubt that appropriate endodontic diagnosis depends on thorough analysis of clinical features and radiographic assessment of periapical tissues but other things such as patient’s past medical history and natural history of present complaint must be taken into account.**15,16**

In this study, overall 60 samples were taken; among them, 32 were from male patients and 28 were from female patients. In this study, majority of males’ teeth underwent endodontic failure as compared to females’ teeth. Akbar**17** and Bamise et al.**18** also reported more endodontically failed teeth in males as compared to females in their studies. This creates the impression that male patients were more diligent about visiting the dentist for follow-up examinations as compared to females.**18**

The mean age of patients in our study is 32.16 years, with a range of 15–60 years. Age of the patient influences the outcome of root canal treatment.**19** Most commonly the unsuccessful root canal treatments were more in youngsters. Reason behind this was explained by Dummer and McGinn**19** that the older patients have good prognosis of root canal therapy due to tight apical foramina, absence of auxiliary canals, and thicker periapical bone. Restricted root canals in older people are well obturated as compared to younger ones with canals having large diameter. However, complications also occur in treating root canals where with time the canal narrows down due to deposition of mineralized tissue and decrease in healing capacity of older patients.**18**

In this study, histopathological investigation of 60 periapical lesions showed 14 (23.33%) periapical cysts. The findings of our study are similar to the study conducted by Caliskan et al.,**10** who reported 21.5% of radicular cysts. Ramachandran et al.**20** in their study reported 15% of lesions as cysts.

On histological examination, 41 (68.33%) periapical lesions in this study were diagnosed as granulomas. The findings of our study are in concordance with Ricucci et al.,**10** Schulz et al.,**21** and Sede and Omorogie,**22** who found that periapical granulomas are more common than periapical cysts on histological examination of the lesions from periapical region.

Rees**23** and Fernandes and De Ataide**24** stated that lesions having large size radio graphically are usually cysts. Mortensen et al.**25** observed that if the lesion measured more than 1.5 cm, then it could securely classified into cyst. So it is feasible to recount larger lesions as cysts, having worse progression. As per Saraf et al.**16** larger size granulomas could transform into cyst that makes the teeth an endodontic failure.

Despite the fact that there was an expanded predominance of cysts among lesions having large size, the radiographic diameter was not viewed as a reliable adjuvant for final diagnosis of periapical lesion.**2**

Thinking about the histological diagnoses in the present examination, 45% of lesions having diameter of 2–9.9 mm were granulomas and 6% were cysts; nevertheless, 23.33% of lesions having diameter within range of 10–20 mm were granulomas and 13.33% were cysts. A statistically significant relationship was observed between the type and size of a lesion [Table 2].

Presence of a radiopaque lamina and dislodging of nearby structures may favor a diagnosis of cyst,**25** but periapical lesions cannot be differentiated into cyst or granuloma on the basis of the existence or nonappearance of a radiopaque lamina.**5,10** In the present investigation, radiopaque lamina was seen in seven lesions, of which five were granulomas and two were cysts with diameters in between 6 and 20 mm, recommending that granulomas can reach large size irrespective of the existence radiopaque lamina [Table 3].
The number of diagnosed abscesses was 5%, which is less as compared to sample size of 60 cases examined in this study. These findings are in accordance with the studies conducted by Calıskan et al.[2] and Schulz et al.,[21] who reported abscess frequencies of 4.3% and 5%.

This study indicated that scar tissue is an exceptional entity, with merely 3.3% of periapical radiolucent lesions diagnosed as scar tissue. The results of our study are in accordance with the studies conducted by Calıskan et al.[2] and Schulz et al.,[21] who reported scar tissue frequencies of 2.2% and 1%.

**CONCLUSION**

Conventional radiography may lead to misdiagnosis and unnecessary surgery for the patient; there is a need for advanced imaging and histopathological analysis to give improved quality of diagnosis, treatment planning, and prognosis. In this study, according to histological results most of the lesions in this study were granulomas, followed by cysts. Abscesses and scar tissues were rare. It was also concluded that histological diagnosis is the most reliable aid to differentiate between periapical cysts and granulomas.

**Limitations**

The extent of periapical lesion size on radiograph and existence of radiopaque lamina were not sufficient enough to differentiate between periapical cyst and granuloma. Due to less number of cysts present in our study, it could not be concluded if radiographic lesion size can be used as diagnostic adjuvant for cyst identification. Thus, a sample size with more number of subjects is needed to arrive at accurate conclusion.

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**Conflicts of interest**

There are no conflicts of interest.

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