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Apicoetomy Practice Patterns and Diagnostic Accuracy in Periapical Lesions: Insights from a Fifteen-Year Review at the University of Port Harcourt Teaching Hospital

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Abstract

Background: Apicoectomy is a surgical endodontic procedure performed for teeth with persistent periapical infections, failed root canal treatments, or anatomical complexities that make the tooth unsuitable for non-surgical retreatment. Histopathological examination of excised periapical tissues is essential for definitive diagnosis, but this practice is often neglected in low- and middle-income countries. Limited data exist from Nigeria regarding histopathology submission rates and diagnostic concordance following apicoectomy. **Objective:** To determine the frequency of apicoectomy procedures at the University of Port Harcourt Teaching Hospital (UPTH) over a fifteen-year period, evaluate the proportion of specimens submitted for histopathological analysis, and assess the degree of concordance between clinical and histopathological diagnoses. **Methods:** A retrospective cross-sectional study was conducted at the Departments of Restorative Dentistry and Oral Pathology/Oral Diagnosis, UPTH. Clinical and histopathological records of all apicoectomy procedures performed between January 2010 and December 2024 were reviewed. Data on patient demographics, tooth type, clinical diagnosis, histopathology submission, and histopathological diagnosis were extracted. Concordance between clinical and histopathological diagnoses was analyzed using Cohen's kappa statistics. A p-value < 0.05 was considered statistically significant. **Results:** A total of 25 apicoectomy procedures were recorded during the study period. The mean patient age was 30.5 ± 13.9 years, with a slight male (52.0%) predominance. Maxillary central incisors were the most frequently treated teeth

(70.8%). Only 56% of specimens were submitted for histopathological analysis. Among these, 50% were periapical granulomas and 50% periapical cysts. Diagnostic concordance was observed in 57.1% of cases. Cohen's Kappa [κ = 0.20; (p = 0.33)], showed only slight agreement between clinical and histopathological diagnoses. **Conclusion:** The study revealed a low frequency of apicoectomy and suboptimal utilization of histopathological analysis. The slight agreement between clinical and histopathological diagnoses highlights the need for mandatory submission of all apicoectomy specimens for histopathological evaluation.

Keywords

Apicoectomy, Periapical Lesions, Histopathology, Diagnostic Concordance, Root-End Surgery, Nigeria

1. Introduction

Apicoectomy, also known as root-end resection, is a surgical endodontic procedure performed for teeth with persistent periapical infections, failed root canal treatments, or anatomical complexities that make the tooth unsuitable for non-surgical retreatment. The procedure involves the excision of the apical portion of a tooth root, followed by removal of any associated periapical pathology, and subsequent retrograde filling of the apex of the tooth to ensure a proper seal [1]-[3]. Despite the clinical importance of apicoectomies in helping to preserve the natural dentition, its rate of utilization varies significantly from one region to another, especially in low- and middle-income countries (LMICs), due to financial constraints, limited availability of the necessary microsurgical equipment, as well as patient preference for extraction [4] [5].

Many periapical lesions share overlapping clinical and radiographic features, even though they are distinct pathological entities [6] [7]. Therefore, histopathological examination of apicoectomy specimens is essential to arrive at a specific diagnosis. It is also important for medico-legal reasons [7] [8]. Histopathologic examination of periapical lesions occasionally reveals unexpected findings, including odontogenic tumors and even malignancies [8]-[10]. Although clinical guidelines recommend that all excised periapical tissues be subjected to histopathological analysis [11], many dentists still fail to submit tooth-associated specimens for histopathological evaluation [12]. This underutilization of histopathology services in such cases represents a missed opportunity to make an accurate diagnosis. It may also raise concerns about potential misdiagnosis and the risk of overlooking serious pathologies. There have been documented discrepancies between clinical and histopathological diagnoses in various medical fields. Regarding apicoectomy specimens, studies have reported varying degrees of concordance between clinical and histopathological diagnoses of periapical lesions, with concordance rates ranging from 51% to 87% [13]-[15]. For example, while most per-

iapical lesions are correctly presumed to be granulomas or cysts based on their radiographic appearance and clinical features, histopathological examination occasionally gives a diagnosis of fibrous scar tissue or other entities [10] [14]. Discrepancies like this underscore the importance of routine histopathologic analysis, especially when treatment decisions and prognoses depend on accurate diagnosis.

In Nigeria, only a few studies have reported the histopathological findings following apicoectomy procedures [6] [16] or the diagnostic concordance between clinical and histopathological findings following apicoectomy [17]. This study aims to contribute to the growing body of knowledge on the histopathological analysis of periapical tissues excised during apicoectomy. This study aimed to determine the frequency of apicoectomy procedures at the University of Port Harcourt Teaching Hospital (UPTH) over a fifteen-year period. Additionally, the study sought to determine the proportion of excised apicoectomy specimens submitted for histopathological analysis, and to evaluate the degree of concordance between clinical and histopathological diagnoses. Findings from this study will provide baseline local data on the current state of surgical endodontic practice and highlight potential gaps in histopathology utilization.

2. Methods

This was a retrospective, cross-sectional study conducted at the Department of Restorative Dentistry and the Department of Oral Pathology and Oral Diagnosis, University of Port Harcourt Teaching Hospital, over a fifteen-year period from January 2010 to December 2024. Apicoectomy was operationally defined as any surgical endodontic procedure that involved resection of the root-end of a tooth, with curettage of periapical tissues, as documented in the patient case files, clinic/theatre registers, or histopathology request form. Cases were identified using procedures entered in the records as apicoectomy, root-end surgery, surgical endodontics, or apical surgery. Inclusion criteria consisted of all patients who underwent apicoectomy procedures during the study period and had available clinical records. Exclusion criteria were repeat apicoectomy procedures on the same tooth and non-endodontic periapical surgeries.

Data were collected retrospectively from patient case files, clinic registers and histopathology registers using a structured proforma. Data extracted were: patient demographics (age, sex), tooth arch, tooth type, clinical diagnosis, whether histopathological analysis was conducted, and histopathological diagnosis (if available). The clinical diagnoses were as documented in the patient's clinical records by the clinician during patient care. For cases where histopathology reports were available, a comparison was made between the clinical and histopathological diagnoses to determine concordance or discordance. Concordance between clinical and histopathological diagnoses was assessed and classified as: concordant or discordant. Diagnostic concordance was defined as complete agreement between the clinical diagnosis and the histopathological diagnosis. Discordance was recorded when the histopathological diagnosis differed from the clinical diagnosis.

Ethical approval for the study was obtained from the Ethics and Research Committee of the University of Port Harcourt Teaching Hospital [Protocol number: UPTH/ADM/90/S.11/VOL.XI/2089]. All patient data were anonymized before analysis to ensure confidentiality. No direct patient contact was involved in this study.

Data were analyzed using IBM SPSS version 25. Descriptive statistics were computed for each variable and results were expressed as frequencies and percentages for categorical variables, and means and standard deviations for continuous variables. Chi-square and Fisher's exact tests were applied to assess associations between clinical variables and histopathology submission. Cohen's kappa was used to test the level of agreement between the clinical and histological diagnoses. A p-value of < 0.05 was considered statistically significant.

3. Results

A total of twenty-five (25) apicoectomy procedures were performed between January 2010 and December 2024. All cases were thus included in the final analysis. Cases without histopathological submission were included in submission-rate analyses but excluded from clinical-histopathological concordance analysis. The age of the patients ranged from 15 to 62 years, with a mean of 30.5 ± 13.9 years. There were 12 females (48.0%) and 13 males (52.0%). Most procedures were performed on maxillary central incisors (70.8%), followed by maxillary lateral incisors (16.7%). The same frequency was recorded for maxillary premolars, maxillary molars, and mandibular central incisors (Figure 1).

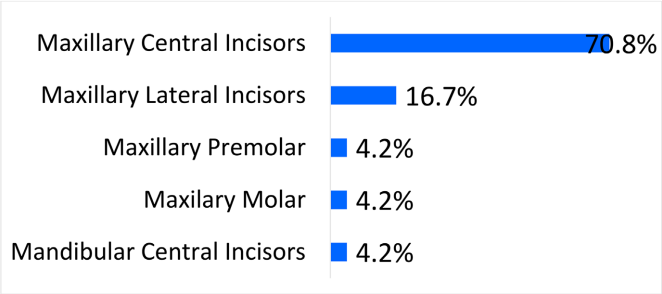

Figure 1. Tooth type on which apicoectomy was most frequently performed (Percentages were calculated using n = 24, excluding one case with missing tooth-type documentation).

Out of the 25 apicoectomy cases, only 14 specimens (56.0%) were submitted for histopathological analysis. The remaining 11 cases (44.0%) had no documented histopathology reports (Figure 2). Among the 14 submitted cases, half (50.0%) were diagnosed as periapical granulomas, while the remaining half were periapical cysts (Figure 3).

When comparing clinical and histopathological diagnoses, clinical-pathological concordance was observed in 8 out of 14 cases (57.1%), while discordance occurred in 6 cases (42.9%) (Figure 4). Notably, all discordant cases involved a presumptive clinical diagnosis of periapical or palatal cyst, in which histopathology

revealed a diagnosis of periapical granuloma (83.3%) or vice versa (16.7%) (Table 1). Diagnostic concordance between clinical and histopathological diagnoses was low. Cohen's Kappa analysis revealed slight agreement between clinical and histopathological diagnoses, $\kappa = 0.20$, 95% CI (−0.19 - 0.59), ($p = 0.33$), which was not statistically significant.

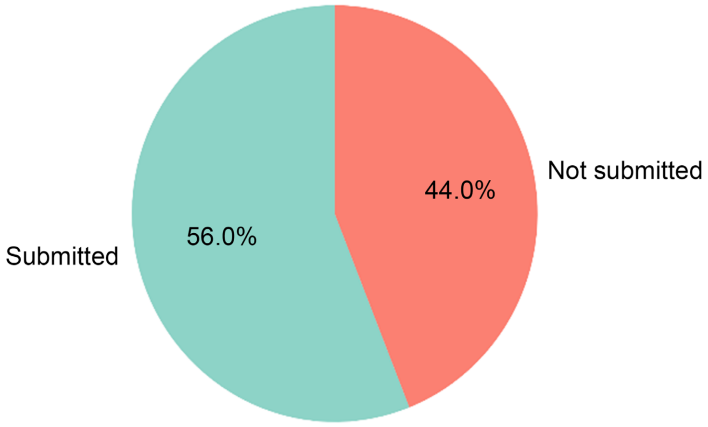

Figure 2. Histopathology submission rate following apicoectomy.

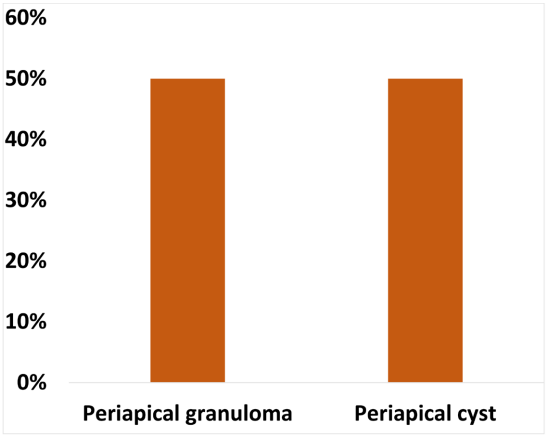

Figure 3. Histopathologic diagnoses of periapical lesions following apicoectomy.

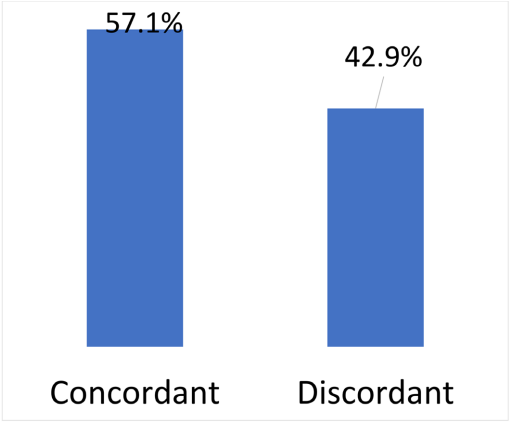

Figure 4. Diagnostic concordance between clinical and histopathological diagnosis.

Table 1. Clinical-histopathological diagnostic agreement in periapical lesions.

Clinical diagnosis	Histopathologic diagnosis		
	Periapical granuloma	Periapical cyst	Total
Periapical granuloma	2	1	3
Periapical cyst	4	6	10
Palatal cyst	1	0	1
Total	7 (50%)	7 (50%)	14 (100%)

Associations between categorical variables and histopathology submission were analyzed using Chi-square or Fisher's exact tests where appropriate. No significant association was found between submission of tissue for histopathology and the patient's age, sex, or tooth type.

4. Discussion

The present study provides an insight into the frequency, pattern and diagnostic practices associated with apicoectomy procedures at a tertiary hospital in southern Nigeria. We observed a low overall frequency of apicoectomy, a sub-optimal rate of utilization of histopathology, and low diagnostic concordance between clinical and histopathological diagnoses.

Over the 15-year study period, only 25 apicoectomy procedures were recorded. However, similarly low frequencies have been reported by previous studies in Nigeria. Gbadebo *et al.* [17] reported 25 cases over 22 years, while Sede and Omoregie [6] reported 13 cases over a 3-year period. The reasons for this low frequency may be multifactorial: firstly, there is a low level of awareness of tooth-preserving options, which is further compounded by patients' preference for tooth extraction rather than complex endodontic treatment, especially in LMIC settings [4] [17] [18]. Moreover, low coverage by Health Insurance Schemes of the apicoectomy procedure, and the need for out-of-pocket payment often limits the patronage of this procedure by prospective patients due to financial constraints [19]. Additionally, in Nigeria, many patients present late with advanced periapical disease, often with associated tooth fracture or extensive caries, where tooth preservation becomes less desirable [20]. The remarkably low frequency seen in this study contrasts sharply with reports from developed countries [21] [22].

The mean age of 30.5 years in this study is consistent with reports that apicoectomy is most frequently performed in young to middle-aged adults [1] [17] [22]-[24], who may show better motivation for tooth retention and cosmetic preservation. The nearly equal gender distribution observed aligns with previous studies suggesting no significant sex predilection in apicoectomy patients [15] [17]. The maxillary central incisors were the most frequently treated teeth (70.8%), corroborating previous studies from Nigeria and other parts of the world [15] [17] [21] [24]. This is because maxillary anterior teeth are the most commonly affected by

trauma, with subsequent pulpal necrosis necessitating endodontic surgery [25]. Also, their relatively straightforward root morphology and ease of surgical access further explain their predominance [26]. In contrast, posterior teeth, often have limited accessibility, and are less frequently subjected to apicoectomy, particularly in resource-limited settings where advanced surgical magnification and instruments are not readily available [27].

Only 56% of apicoectomy specimens in this study were submitted for histopathological evaluation, which is similar to previous findings [17]. In a recent study, 85.63% of dentists reported not submitting tooth-associated lesions for histopathological examination [12]. This suboptimal utilization of histopathology may reflect institutional or attitudinal factors. In many health institutions in Nigeria, there are no clear policies mandating the submission of all excised tissues for pathology, so patients frequently fail to submit excised apicoectomy specimens for histopathological analysis due to the additional cost implications. In addition, clinicians often see periapical lesions as innocuous, and such overconfidence in their clinical diagnosis means they do not insist on histopathological confirmation. This practice is harmful as it undermines vigilance for rare but clinically significant pathologies, and as previous studies have found, unexpected histopathological findings, including malignant neoplasms, may be seen in periapical biopsies [10] [28] [29]. Kaplanoglu *et al.* [30] recently noted that histopathological confirmation of periapical lesions significantly improved diagnostic precision. This emphasizes the need for tissue evaluation by an Oral Pathologist in all cases of apicoectomies. Institutional policies mandating submission of all excised tissues for pathology, and better interdisciplinary collaboration between the Endodontist, Oral &Maxillofacial Surgeon and Oral Pathologist may significantly improve specimen submission rates [31] [32].

The level of diagnostic agreement between the clinical and histopathological diagnoses in this study was low. Cohen's Kappa coefficient demonstrated only slight agreement ($\kappa = 0.20$, $p = 0.33$), which was not statistically significant. Clinically diagnosed "periapical cysts" frequently turned out to be granulomas on histology. Conversely, occasional lesions presumed to be granulomas were confirmed as cysts, similar to some previous studies [6] [17] [21]. Such poor concordance aligns with previous studies that have reported low to moderate agreement between clinical and histopathological diagnoses of periapical lesions [14] [15] [22] [24]. and collectively suggest that clinical and radiographic parameters alone may not be reliable in distinguishing between periapical granulomas and periapical cysts [8] [14], highlighting the indispensable role of histopathology in confirming diagnoses, and improving diagnostic accuracy. However, Cohen's Kappa coefficient may have been affected by the small sample size as well as the imbalance between the clinical and histopathological diagnostic categories. Inaccurate clinical diagnosis tends to overestimate or underestimate the prevalence of specific periapical pathologies, thus limiting the ability to correlate lesion type with treatment outcome. Routine submission of excised apical tissues for histopathological

evaluation should therefore be encouraged.

The findings from this study highlight an urgent need to improve the utilization of histopathology services following apicoectomy procedures, especially considering the levels of clinical vs histopathological discordance in diagnoses. There is a need to improve interdisciplinary collaboration between clinicians and pathologists. Integrating routine histopathology submission into clinical protocols will enhance diagnostic precision, facilitate early detection of atypical lesions, and support evidence-based patient management. Future studies should employ larger, multicentric designs and include outcome assessments to evaluate the long-term success of apicoectomy procedures relative to histopathological diagnosis.

6. Limitations

This study had some limitations that should be considered when interpreting the findings. First, the sample size was relatively small, which limits the generalizability of the findings to other populations or institutions. However, the small sample size reflects the low frequency of apicoectomy procedures in the study environment. Secondly, variability in clinical diagnosis and documentation among different clinicians could have influenced the observed diagnostic concordance rates. Additionally, the study did not assess treatment outcomes or long-term prognoses relative to histopathological diagnosis, which would have provided further insight into the clinical significance of diagnostic discrepancies. Despite these limitations, the study provides valuable baseline data on the utilization of histopathology services and diagnostic accuracy in apicoectomy practice in a Nigerian tertiary hospital and highlights areas for improvement in surgical endodontic care.

Conflicts of Interest

The authors declare no conflicts of interest.

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