ORIGINAL RESEARCH PAPER

Dentistry

CONE BEAM COMPUTED TOMOGRAPHY EVALUATION OF PERIAPICAL CYSTS: A RETROSPECTIVE CASE SERIES OF ELEVEN PATIENTS

KEY WORDS: Periapical cyst, CBCT, Cone beam computed tomography, Periapical radiolucency

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ABSTRACT

Background:- Periapical cysts are the most common odontogenic cysts arising from inflammatory processes associated with non-vital teeth. Conventional radiographs provide limited two-dimensional information, often making differentiation from other periapical lesions challenging. Cone beam computed tomography (CBCT) offers three-dimensional assessment and improved diagnostic accuracy. **Aim:** To evaluate the cone beam computed tomography characteristics of periapical cysts and to assess the diagnostic utility of CBCT in their radiographic assessment. **Materials And Methods:** A retrospective observational case series was conducted on 11 CBCT scans diagnosed radiographically as periapical cysts. Lesions were assessed for location, size, shape, border definition, internal structure, cortical bone involvement, and effect on adjacent anatomical structures. Descriptive statistical analysis was performed. **Results:** Most lesions were located in the maxillary anterior region. All cases demonstrated well-defined corticated margins with homogeneous internal radiolucency. Cortical plate expansion was observed in the majority of cases, while root resorption was evident in several lesions. CBCT enabled accurate assessment of lesion extent and cortical integrity. **Conclusion: -**CBCT provides superior diagnostic information compared to conventional radiography in the evaluation of periapical cysts by accurately depicting lesion size, borders, cortical involvement, and relationship with adjacent structures.

INTRODUCTION

Periapical cysts are inflammatory odontogenic cysts that develop as a consequence of chronic periapical inflammation associated with non-vital teeth. They originate from the epithelial rests of Malassez and represent a significant proportion of periapical pathologies encountered in routine dental practice.

Conventional intraoral periapical radiographs remain the primary imaging modality for detecting periapical lesions. However, their two-dimensional nature limits the assessment of lesion size, cortical bone involvement, and proximity to vital anatomical structures. Differentiating periapical cysts from granulomas and other periapical pathologies solely on conventional radiographs remains unreliable. Cone beam computed tomography (CBCT) has revolutionized maxillofacial imaging by providing high-resolution, three-dimensional visualization with relatively low radiation dose. CBCT enables precise evaluation of lesion morphology, cortical plate integrity, and spatial relationships, thereby improving diagnostic confidence and treatment planning.

The present study aims to evaluate the CBCT imaging characteristics of periapical cysts through a retrospective analysis of eleven cases.

MATERIALS AND METHODS

Study Design and Setting

This retrospective observational case series was conducted in the Department of Oral Medicine and Radiology at Rajasthan Dental College and Hospital Jaipur, Rajasthan, India after obtaining Institutional Ethical Committee approval.

Study Duration -CBCT scans acquired over a period of three months were reviewed.

Sample- A total of 11 CBCT scans diagnosed radiographically as periapical cysts were included in the study.

Inclusion Criteria

- Well-defined periapical radiolucent lesions measuring ≥3mm
- Lesions associated with non-vital teeth
- Presence of corticated or sclerotic borders
- Patients aged 18 years to 50 years
- Adequate CBCT image quality

Exclusion Criteria

- Periapical lesions <3 mm in diameter
- Non-odontogenic cysts and tumors
- Poor-quality or incomplete CBCT scans
- Previously surgically treated periapical lesions

CBCT Imaging Protocol

CBCT Acquisition Protocol

All CBCT scans were obtained using a standardized imaging protocol: - CBCT unit: carestream 8200 3D Field of View (FOV): Small to medium (localized region) -5*8 ,Exposure parameters: As per manufacturer-recommended protocol ,Patient positioning: Standardized upright position. Scans were reconstructed using proprietary CBCT software to obtain axial, coronal, sagittal, and cross-sectional views. Image Analysis Procedure All CBCT images were analyzed in a controlled viewing environment with standardized monitor resolution and ambient lighting conditions. Image brightness and contrast adjustments were permitted to optimize visualization.

Radiographic Evaluation Parameters

Each lesion was systematically evaluated under the following categories:

1. Anatomical Characteristics- Jaw involved (maxilla or mandible), Region (anterior, premolar, molar)

2. Lesion Dimensions - Maximum mesiodistal, super inferior, and buccolingual dimensions (in mm)

3. Lesion Morphology- Shape (round, ovoid, irregular) ,Border characteristics (well-defined corticated / non-corticated)

4. Internal Structure- Internal density (homogeneous hypodensity), Presence or absence of septations

5. Cortical Bone Involvement- Buccal and/or lingual cortical plate expansion, Cortical thinning, Cortical perforation

6. Effects on Adjacent Structures- Root resorption (presence and type), Tooth displacement, Maxillary sinus involvement (floor elevation, mucosal thickening), Inferior alveolar canal proximity or displacement

Diagnostic Criteria For Periapical Cysts -
Radiographic diagnosis was established based on CBCT features consistent with previously published criteria:Lesion diameter ≥3mm ,Well-defined corticated margin ,Homogeneous internal radiolucency ,Association with a non-vital tooth ,These criteria were adapted from standard oral radiology textbooks and CBCT-based studies.

Observer Assessment And Reliability- CBCT scans were independently evaluated by two experienced oral and maxillofacial radiologists with more than five years of experience in CBCT interpretation.

Inter-observer agreement was assessed Discrepancies were resolved through joint re-evaluation and consensus
Data Recording All findings were recorded in a pre-designed structured data collection sheet, ensuring uniformity and reproducibility of observations.

Statistical Analysis - Data were entered into Microsoft Excel and analyzed using descriptive statistical methods:- Continuous variables expressed as mean ± standard deviation, Categorical variables expressed as frequency and percentage, Statistical analysis was performed using SPSS software (version 22).

Ethical Considerations -Ethical approval was obtained from the Institutional Ethics Committee, Patient confidentiality was maintained through anonymization of data ,As a retrospective study, no additional radiation exposure was involved

Methodological Strengths- Standardized CBCT evaluation protocol, Detailed multi-parameter lesion assessment, Use of experienced observers.

Methodological Limitations - Small sample size, Absence of histopathological confirmation, Retrospective nature of the study

RESULTS-
TOTAL 11 CBCT ANALSIS

Table -1 Showing Region And Cyst Occurrence In This Study

MAXILLA	6
MANDIBLE	5
MAXILLARY ANTERIOR REGION	5
POSTERIOR MAXILLARY REGION	1
ANTERIOR MANDIBULAR REGION	4
POSTERIOR MANDIBULAR REGION	1

Table 2- Showing Age , Sex And Region Of Cyst Formation

S. No	Age Of Patient In Years	Sex Of Patient	Region
1	26	FEMALE	MAILLARY POSTERIOR
2	30	MALE	MAXILLARY ANTERIOR
3	29	MALE	MAILLARY ANTERIOR
4	30	FEMALE	MANDIBULAR ANTERIOR
5	35	MALE	MAXILLARY ANTERIOR
6	21	FEMALE	MAXILLARY ANTERIOR
7	21	FEMALE	MANDIBULAR ANTERIOR
8	34	FEMALE	MANDIBULAR POSTERIOR
9	32	MALE	MANDIBULAR ANTERIOR
10	22	FEMALE	MAXILLARY ANTERIOR
11	42	MALE	MANDIBULAR ANTERIOR

Among the eleven cases evaluated, the majority of periapical cysts were located in the maxillary anterior region. Lesion size ranged from moderate to large, with all cases exceeding 3 mm in diameter. All lesions exhibited well-defined corticated margins and homogeneous internal radiolucency. Cortical plate expansion was observed in most cases, predominantly involving the labial cortical plate. Root resorption of the associated tooth was evident in several lesions, while displacement of adjacent teeth was occasionally noted. In maxillary lesions, proximity to the maxillary sinus was clearly visualized using CBCT.

CBCT enabled precise delineation of lesion boundaries and accurate assessment of cortical bone involvement in all cases.

DISCUSSION
Periapical cysts represent the most prevalent inflammatory odontogenic cysts of the jaws and arise as a sequela of chronic pulpal inflammation. Radiographic differentiation of periapical cysts from granulomas and other periapical pathologies remains a diagnostic challenge, particularly when relying solely on conventional two-dimensional imaging modalities. The present case series highlights the diagnostic value of cone beam computed tomography in the detailed evaluation of periapical cysts.

In this study, all lesions demonstrated a minimum diameter of 3 mm with well-defined corticated margins, a feature commonly regarded as suggestive of cystic pathology. Previous studies have emphasized lesion size as an important, though not absolute, criterion for diagnosing periapical cysts. Nair and colleagues have suggested that larger lesions are more likely to represent true cysts rather than granulomas, which tend to be smaller and less corticated. The consistent presence of corticated borders in the present series supports the inflammatory cystic nature of the lesions evaluated.

CBCT enabled precise assessment of lesion morphology, revealing predominantly round to ovoid shapes with homogeneous internal radiolucency. This uniform internal density is characteristic of fluid-filled cystic cavities and contrasts with the more heterogeneous appearance often observed in granulomatous lesions. Conventional radiographs may obscure these subtle internal features due to superimposition and limited contrast resolution.

Cortical plate involvement was a prominent finding in the majority of cases. CBCT clearly demonstrated labial or buccal cortical expansion and thinning, features that are frequently underestimated or entirely missed on periapical or panoramic radiographs. The ability of CBCT to detect early cortical perforation has significant clinical implications, particularly in surgical planning and risk assessment. These findings align with earlier CBCT-based studies that reported superior detection of cortical changes compared to two-dimensional imaging.

Root resorption of the associated tooth was observed in several cases in the present series. CBCT provides accurate visualization of root surface integrity, allowing differentiation between pressure-induced external resorption and inflammatory resorption. This distinction is clinically relevant, as it influences both endodontic prognosis and surgical decision-making. Tooth displacement, when present, further supported the expansile nature of cystic lesions.

In maxillary cases, CBCT proved indispensable in evaluating

the relationship between periapical cysts and the maxillary sinus. Mucosal thickening, sinus floor elevation, or sinus wall erosion were readily identified, findings that are often indistinct on conventional radiographs. Accurate assessment of sinus involvement is critical in preventing intraoperative complications and in determining the need for adjunctive surgical approaches.

An important advantage of CBCT highlighted in this study is its role in treatment planning. Three-dimensional visualization assists clinicians in deciding between nonsurgical endodontic management, apical surgery, or enucleation. Moreover, CBCT imaging aids in monitoring lesion healing and bone regeneration following treatment.

Despite its advantages, CBCT has inherent limitations. It cannot provide definitive histopathological diagnosis, and radiographic features alone cannot completely distinguish cysts from granulomas. Additionally, radiation exposure, although lower than medical CT, remains higher than conventional intraoral radiography. Therefore, CBCT should be judiciously prescribed, particularly in accordance with the ALARA principle.

The present study is limited by its small sample size and the absence of histopathological correlation, which restricts definitive diagnostic confirmation. However, as a retrospective CBCT-based case series, it provides valuable insight into characteristic imaging features of periapical cysts and reinforces the adjunctive role of CBCT in complex or ambiguous periapical lesions.

Future studies with larger sample sizes and histopathological validation are recommended to further establish standardized CBCT criteria for differentiating periapical cysts from other inflammatory periapical lesions.

CONCLUSION

Cone beam computed tomography is a valuable imaging modality for the evaluation of periapical cysts. It provides accurate three-dimensional information regarding lesion size, borders, cortical involvement, and relationship with adjacent structures, thereby enhancing diagnostic confidence and aiding in effective treatment planning.

IMAGES

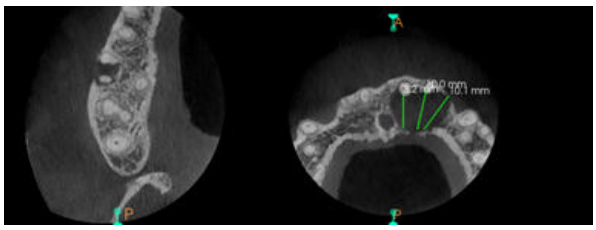

IMAGE -1

IMAGE -2

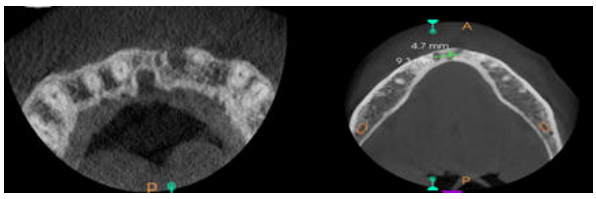

IMAGE -3

IMAGE -4

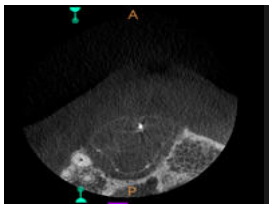

IMAGE -5

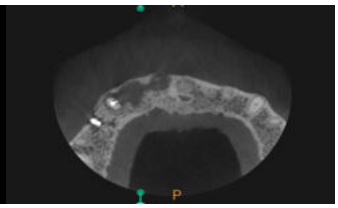

IMAGE -6

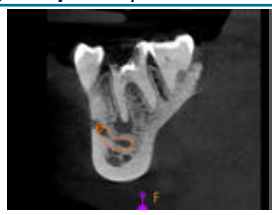

IMAGE -7

IMAGE -8

Conflict Of Interest - None declared.

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