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Adequacy of Radiographic Reportage in Endodontic Treatment: A Retrospective Review from a Teaching Hospital in Southwest Nigeria

Gbadebo S.O
Department of Restorative Dentistry, College of Medicine, University of Ibadan/ University College Hospital.

Okereke P.U
Faculty of Dentistry, College of Medicine, University of Nigeria, Enugu, Nigeria
Alliance for Oral Health Across Borders (AOHAB), New York, USA
American Society for Tropical Medicine and Hygiene (ASTMH), Virginia, USA
Global Leadership Dentistry and Sciences (GLDS), Washington DC, USA

Ajao E.I
Department of Oral and Maxillofacial Surgery, University College Hospital

Olasemi F.S
Department of Restorative Dentistry, University College Hospital

Abstract

Background: Understanding the patterns of documentation among endodontic caregivers, ranging from students and registrars to consultants, can provide valuable insights into systemic strengths and weaknesses within dental service delivery frameworks.

Objective: This study evaluated the adequacy of radiographic documentation in endodontic treatment, assessing the frequency of preoperative, intraoperative, and postoperative radiographs, and determining factors associated with adequate reportage.

Methods: A retrospective review was conducted on 357 patient records treated for endodontic conditions at a tertiary dental hospital. Data extracted included demographic variables, designation of the attending caregiver, radiographic documentation, diagnosis, and treatment type. Adequacy of radiographic reportage was defined by inclusion of the coronal

surface, apical structures, periodontal ligament space, and canal patency in the recorded findings. Descriptive and inferential statistics, including chi-square tests, were performed at a 5% significance level.

Results: Patients were predominantly aged 20–29 years (25.2%) and female (56.0%). Most treatments were rendered by registrars (88.2%). Although 96.9% of cases had preoperative radiographs, and 88.5% and 85.7% had master cone and obturation radiographs respectively, only 16.2% of records met the criteria for adequate documentation. Acute apical periodontitis (36.4%) was the most common diagnosis, and conventional root canal therapy accounted for 86.8% of treatments. The association between caregiver designation and adequacy of radiographic documentation was not statistically significant ($p = 0.287$).

Conclusion: While radiographs were widely utilized in endodontic care, comprehensive documentation was suboptimal. Structured training and adherence to documentation protocols are essential to improve radiographic reporting standards and ensure medico-legal accountability in clinical practice.

Keywords: Endodontic treatment, radiographic documentation, root canal therapy, dental records, audit, quality of care.

Introduction

Radiographic documentation is a fundamental component of endodontic diagnosis, treatment planning, and postoperative evaluation. The process of root canal therapy is highly dependent on radiographic evidence at each stage, from diagnosis to obturation, because it enables clinicians to assess anatomical variations, detect periapical pathologies, and evaluate the technical quality of treatment outcomes.[1,2] High-quality radiographs serve not only as diagnostic tools but also as essential records that support continuity of care, facilitate clinical audits, and fulfill medico-legal obligations.[3,4]

In endodontic practice, radiographic documentation typically includes preoperative, working length, master cone, and postoperative radiographs. These provide objective benchmarks for evaluating canal morphology, determining working length accuracy, confirming the adaptation of gutta-percha cones, and assessing the completeness of obturation.[5] Each of these images contributes to both clinical decision-making and quality assurance in endodontic treatment delivery.[6]

The quality of radiographic documentation has been identified as a critical determinant of endodontic success. Inadequate imaging or incomplete documentation may result in procedural errors, missed canals, or insufficient obturation, all of which can compromise treatment outcomes and lead to persistent periapical disease.[1,7] Moreover, the absence of proper radiographic records can undermine the defensibility of clinical decisions and reduce the accuracy of follow-up evaluations.[8] Consequently, international standards such as those proposed by the European Society of Endodontology emphasize the inclusion of radiographic documentation as a non-negotiable element of comprehensive record-keeping and clinical excellence.[5]

Despite these established guidelines, variations in the adequacy and completeness of radiographic documentation persist across clinical settings. Previous audits and retrospective studies have shown significant gaps in record-keeping practices among dental professionals and students, particularly in low- and middle-income countries, where digital radiography and standardized quality assurance frameworks are less consistently implemented.[9,10] Factors such as clinician experience, institutional workflow, and resource availability have all been linked to documentation deficiencies.[11,12]

The adequacy of radiographic documentation is therefore not only an indicator of individual clinical competence but also a reflection of institutional quality assurance and patient safety culture.[4] Understanding the patterns of documentation among endodontic caregivers, ranging from students and registrars to consultants, can provide valuable insights into systemic strengths and weaknesses within dental service delivery frameworks.

This study was designed to assess the adequacy of radiographic reportage during endodontic treatment at a tertiary care dental facility. By evaluating the frequency and completeness of preoperative, master cone, and obturation radiographs, and by analyzing their association with clinician designation, this research aims to contribute empirical evidence toward strengthening record-keeping standards and promoting adherence to international endodontic documentation guidelines.

Materials and Methods

Study Design

This study employed a retrospective descriptive design to evaluate the adequacy of radiographic documentation in endodontic treatment. The investigation was conducted through the review of clinical records and radiographs of patients who had undergone root canal treatment and subsequent definitive restorations at a tertiary dental care center over a five-year period. The study adhered to the principles of the Declaration of Helsinki (World Medical Association, 2013)[13], and ethical clearance was obtained from the Institutional Research Ethics Committee of the

host institution, University of Ibadan/University College Hospital Ethics Review Committee (UI/EC/25-0541).

Study Setting

The study was carried out at the Department of Restorative Dentistry, University college Hospital, Ibadan, a tertiary dental care facility that provides comprehensive endodontic and restorative services to a diverse patient population. The department serves as both a referral and training center, with clinical procedures performed by dental students, house officers, registrars, and consultants under varying degrees of supervision.

Study Population and Sampling

The study population consisted of patients who received endodontic treatment between January 2018 and December 2022 and subsequently had definitive coronal restorations documented in their records. A total of 357 complete patient records that met the inclusion criteria were reviewed.

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Eligibility Criteria

To be included, patients had to have nonsurgical endodontic treatment with radiographic records and complete demographic and clinical data. Records were excluded if they had missing radiographs or incomplete documentation, or if the teeth had been managed surgically or were part of complex maxillofacial cases. Treatments done outside the study facility were also excluded.

Data Collection and Variables

Data were extracted using a structured proforma designed to capture both demographic and clinical information. The demographic variables included patient age, sex, marital status, and occupation. Clinical variables included the designation of the attending caregiver (registrar, house officer, consultant, or student), diagnosis, type of endodontic treatment rendered, and duration of follow-up.

Assessment of Radiographic Adequacy

The evaluation of each patient's radiographic series was based on three key criteria from established endodontic quality assurance standards. The assessment examined the condition of the coronal surface, checking for the presence of a coronal seal or communication with the pulpal chamber. It also looked at the state of the apical structures, including the root filling's apical termination and periapical bone pattern. Additionally, the periodontal ligament space and canal patency were evaluated, ensuring clear visualization of the canal and surrounding ligament space accordingly as they are relevant to the treatment. These criteria are grounded in standards from the European Society of Endodontology, the study by Ng et al. and Lin et al.[1,5,9]

For a case to be adjudged as having adequate radiographic documentation, all three aspects of coronal, apical, and periodontal assessment had to be explicitly mentioned in the radiographic report. If any one of these elements was missing or inadequately described, the documentation was categorized as inadequate.

Data Management and Statistical Analysis

Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequencies and percentages, were generated for categorical variables such as age group, sex, occupation, caregiver designation, and adequacy of radiographic documentation.

A chi-square test of independence was used to evaluate associations between the designation of the caregiver and adequacy of radiographic documentation. Statistical significance was set at $p < 0.05$. Results were presented in tables and narrative form for clarity and consistency.

Results

General Characteristics of the Study Population

A total of 357 patient records that met the inclusion criteria were reviewed. The age of the patients ranged from 10 to 85 years, with a mean age of 38.7 ± 15.2 years. The largest proportion of patients fell within the 20–29-year age group (25.2%), followed by the 30–39-year group (17.4%) and the 50–59-year group (16.0%). Only a small proportion of the study population was aged 70 years and above (5.1%).

There was a slight predominance of female patients, who constituted 56.0% of the sample, compared with 44.0% male patients. Most patients were married (56.6%), while 40.6% were single. Widowed and separated individuals accounted for less than three percent of the total.

With respect to occupational distribution, students represented the largest single group (28.3%), followed closely by individuals employed in the public sector (27.2%) and those who were self-employed or engaged in business activities (23.8%). Health professionals, religious leaders, and retirees comprised smaller fractions, while construction workers and agricultural professionals represented the least frequent occupational categories, accounting for less than two percent each.

Table 1. Demographic Characteristics of Patients Who Received Endodontic Treatment (N = 357)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	10–19	31	8.7
	20–29	90	25.2
	30–39	62	17.4
	40–49	55	15.4
	50–59	57	16.0
	60–69	44	12.3
	70–79	16	4.5
	80 and above	2	0.6
	Total	357	100.0
Sex	Male	157	44.0
	Female	200	56.0
	Total	357	100.0
Occupation	Student	101	28.3
	Civil/Public Servant	97	27.2
	Self-Employed / Business	85	23.8
	Retired	22	6.2
	Health Professional	12	3.4
	Religious Leader	12	3.4
	Legal/Justice Professional	7	2.0
	Agricultural Professional	4	1.1
	Construction/Skilled Trade	5	1.4
	Academic/Researcher	6	1.7
	Private Sector/Miscellaneous	6	1.7
	Total	357	100.0

Designation of Caregivers Providing Endodontic Treatment

Analysis of caregiver designation revealed that most endodontic procedures were performed by registrars, who accounted for 88.2% of all cases. House officers provided treatment in 10.1% of cases, while consultants managed 1.1% of the treatments. Only two cases (0.6%) were attended to by undergraduate dental students under supervision. This distribution demonstrates that the majority of endodontic interventions within the study period were delivered by mid-level dental professionals engaged in specialist training.

Table 2. Designation of Caregiver Attending to Endodontic Patients

Designation	Frequency (n)	Percentage (%)
Registrar	315	88.2
House Officer	36	10.1
Consultant	4	1.1
Student	2	0.6
Total	357	100.0

Radiographic Documentation During Endodontic Treatment

Radiographic documentation was examined at the preoperative, master cone, and obturation stages of treatment. Preoperative radiographs were present in 96.9% of all cases, indicating that almost all patients had baseline radiographic evaluation before commencement of canal instrumentation. Master cone radiographs, which confirm the fit of the obturation material prior to final filling, were documented in 88.5% of cases. Obturation radiographs, taken immediately following canal filling, were available for 85.7% of patients.

However, when evaluated against the established criteria for adequacy, only 58 cases (16.2%) were adjudged to have complete and adequate radiographic documentation. The remaining 299 cases (83.8%) lacked one or more essential elements. In most inadequate records, the missing components were either the description of apical termination or the assessment of the periodontal ligament space.

Table 3. Radiographic Documentation During Endodontic Treatment

Designation	Frequency (n)	Percentage (%)
Registrar	315	88.2
House Officer	36	10.1
Consultant	4	1.1
Student	2	0.6
Total	**357**	**100.0**

Note: *Adequacy defined as documentation including the coronal surface, apical structures, and periodontal ligament space or canal patency.*

Types of Treatment and Duration of Follow-up

As shown in table 4, the majority of patients (86.8%) received conventional root canal treatment involving cleaning, shaping, and obturation of the root canal system. A smaller proportion (7.3%) underwent root canal treatment followed by placement of a post and crown. Other treatment variants included non-vital bleaching (2.2%), re-treatment of previously obturated canals (1.7%), and root canal therapy combined with surgical intervention such as apical surgery (1.1%). Only two patients (0.6%) received root canal treatment in conjunction with other conservative dental procedures, while one patient (0.3%) had a crown placement without prior root canal treatment recorded.

The duration of post-treatment follow-up was predominantly short term, as 96.4% of patients returned for follow-up within six months of obturation. Only 13 patients (3.6%) had extended follow-up periods exceeding six months.

Table 4. Distribution of Treatment Types and Follow-Up Duration

Treatment Type	Frequency (n)	Percentage (%)
Root Canal Treatment (Simple)	310	86.8
RCT with Post and Crown	26	7.3
RCT with Non-Vital Bleaching	8	2.2
Re-Treatment of RCT	6	1.7
RCT with Surgical Intervention (e.g., Apical Surgery)	4	1.1
RCT with Other Conservative Treatment	2	0.6
Crown Only (No RCT)	1	0.3
Total	357	100.0
Follow-Up Duration		
Short Term	344	96.4
Extended Term	13	3.6
Total	357	100.0

Relationship Between Caregiver Designation and Adequacy of Radiographic Documentation

A chi-square test of independence was conducted to determine whether the adequacy of radiographic documentation was associated with the designation of the attending caregiver. Among the 315 cases handled by registrars, 50 (15.9%) met the criteria for adequate documentation. Of the 36 cases treated by house officers, six (16.7%) had adequate documentation, while two of the four cases treated by consultants were deemed adequate. None of the two cases managed by students met the adequacy threshold.

The relationship between caregiver designation and adequacy of radiographic documentation was not statistically significant ($\chi^2 = 3.80$, $p = 0.287$).

Table 6. Association Between Designation of Caregiver and Adequate Radiographic Documentation

Designation of Caregiver	Adequate Documentation (n)	Inadequate Documentation (n)	Total (n)	p-value
Registrar	50	265	315	0.287
House Officer	6	30	36	
Consultant	2	2	4	
Student	0	2	2	
Total	58	299	357	

Discussion

This study evaluated the adequacy of radiographic documentation during endodontic treatment within a tertiary dental care facility, using retrospective data from 357 patient records. The findings reveal a high frequency of preoperative, master cone, and obturation radiographs, yet a strikingly low rate of complete radiographic adequacy. Although the majority of cases demonstrated adherence to the basic requirement of preoperative imaging, only 16.2% fulfilled all criteria for comprehensive documentation, which included explicit evaluation of the coronal surface, apical structures, and periodontal ligament space or canal patency.

Radiographic Documentation and International Standards

The observed pattern aligns with previous audits indicating that while radiographs are routinely taken during endodontic treatment, their documentation is often incomplete or lacking in detail.[3,9] International guidelines, such as those from the European Society of Endodontology[5], emphasize that radiographic documentation should include preoperative, working length, master cone, and postoperative images to enable accurate diagnosis, procedural monitoring, and quality assurance. Failure to adequately describe these radiographic findings undermines the clinical and medico-legal integrity of dental records.[1,4]

The relatively high frequency of preoperative radiographs (96.9%) found in this study is consistent with literature from teaching hospitals where pre-treatment imaging forms part of standardized protocols.[6,7] However, the sharp decline in documentation completeness suggests that clinicians often omit interpretive commentary or omit intermediate imaging stages, especially master cone and obturation radiographs. This trend may reflect clinical workload, insufficient audit feedback, or limited supervision of documentation practices.[14,15]

Comparable studies conducted in academic institutions have reported similar challenges. Lin et al. (2022) observed that only 14.8% of student-performed root canal treatments had complete radiographic documentation, despite 90% of cases having at least one radiograph.[9] Yeoh et al. (2025) likewise noted that inadequate reporting of canal obturation length and apical termination was the most common deficiency in endodontic records among undergraduate and postgraduate trainees.[10] Studies in the United Kingdom and Scandinavia have similarly identified inconsistent adherence to documentation standards, even among experienced clinicians.[8,16]

Such findings collectively highlight that the challenge of maintaining comprehensive radiographic reportage transcends geography and institutional context. In many low- and middle-income countries, the problem is exacerbated by limited digital archiving systems, insufficient staff training, and inconsistent application of quality assurance frameworks.[17,18]

Clinical and Educational Implications

The low rate of adequate documentation observed in this study has important implications for both clinical governance and dental education. From a clinical perspective, incomplete radiographic reportage compromises the capacity for retrospective treatment evaluation, continuity of care, and evidence-based audit. Inadequate documentation of apical and periapical findings also increases the risk of undetected pathology and procedural errors.[1,2]

From an educational standpoint, the predominance of registrars in clinical service delivery highlights the need for reinforced supervision and structured audit systems. Regular feedback on

radiographic quality and structured templates for documentation may improve adherence to standard criteria. Similar interventions have been shown to enhance record completeness and diagnostic accuracy in endodontic training programs.[3,4]

Furthermore, adopting electronic dental record systems with integrated imaging modules could standardize radiographic evaluation and facilitate longitudinal quality audits.[4] Calibration exercises between clinicians and radiology staff may also ensure uniformity in assessing canal patency, apical termination, and coronal restoration integrity, parameters crucial for judging radiographic adequacy.

Relationship Between Clinician Designation and Documentation Adequacy

The absence of a statistically significant association between caregiver designation and adequacy of radiographic documentation suggests that deficiencies in documentation are systemic rather than individual. Similar patterns have been observed in multi-center studies where both students and experienced clinicians demonstrated comparable shortcomings.[9,10] This finding underscores the importance of institutional culture and quality assurance systems in shaping clinical documentation practices.

Recommendations

The findings of this study underscore the need for structured interventions to improve the adequacy and completeness of radiographic reportage in endodontic treatment. The following actionable recommendations are proposed to strengthen radiographic documentation practices and promote sustainable quality assurance across clinical, academic, and institutional levels.

A. Clinical Practice Recommendations

Adopt standardized radiographic documentation templates: All endodontic case records should include structured templates that prompt clinicians to document the condition of the coronal surface, apical structures, and periodontal ligament space or canal patency for every radiographic stage viz preoperative, master cone, and obturation. This approach has been shown to significantly improve completeness of documentation and reduce omission errors.[1,3]

Institute mandatory radiographic quality checks: Before case closure, clinicians should verify that all required radiographs are present and properly interpreted. A sign-off protocol by supervising specialists should be implemented to ensure compliance with institutional standards for radiographic adequacy.

Utilize digital radiography and image enhancement tools: Transitioning from conventional film to digital imaging platforms facilitates standardized viewing, improved contrast, and consistent archiving. Integration with electronic record systems also supports auditability and medico-legal traceability.

Strengthen interdepartmental collaboration: Regular consultation between restorative clinicians and oral radiologists can ensure accurate interpretation and improve consistency in documentation, particularly in evaluating apical termination, periapical status, and canal patency.

B. Educational and Training Recommendations

Integrate radiographic documentation into endodontic training curricula: Both undergraduate and postgraduate programs should explicitly assess radiographic documentation as a component of clinical competency. Students should be taught not only to acquire high-quality images but also to record diagnostic interpretations systematically.

Conduct continuous professional development (CPD) workshops: Periodic workshops should be organized to reinforce the importance of comprehensive documentation and familiarize clinicians with evolving digital radiography technologies and interpretation standards.

Implement peer-review and feedback mechanisms: Regular case reviews, where radiographic documentation is audited and discussed in peer groups, can promote reflective learning and continuous quality improvement.

Encourage calibration exercises: Calibration sessions between students, registrars, and consultants should be conducted at least biannually to ensure uniformity in interpretation and scoring of radiographic adequacies, as supported by studies demonstrating improved inter-examiner reliability after such exercises.

Conclusion

This study revealed that while most endodontic cases were accompanied by preoperative, master cone, and obturation radiographs, only a small proportion met the criteria for adequate

documentation encompassing the coronal surface, apical structures, and periodontal ligament space or canal patency. The overall adequacy rate of 16.2% underscores a substantial gap in radiographic reportage, suggesting systemic shortcomings in clinical supervision, documentation culture, and institutional audit mechanisms. The absence of a significant association between caregiver designation and documentation adequacy indicates that these deficiencies are not confined to a specific cadre but reflect a wider institutional trend requiring structural intervention.

To enhance the quality and completeness of endodontic documentation, dental institutions should implement standardized radiographic reporting templates, conduct periodic quality audits, and integrate radiographic assessment into clinical training and evaluation. Strengthening documentation practices is vital not only for improving treatment outcomes and patient safety but also for ensuring accountability and medico-legal protection. Establishing national or institutional guidelines aligned with international standards will help promote uniformity, foster continuous quality improvement, and elevate the overall standard of endodontic care delivery.

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