



Evaluating patient and healthcare provider awareness of radiation exposure using CBCT

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Abstract:

Background:

Cone Beam Computed Tomography (CBCT) has become a pivotal imaging modality in dentistry, offering three-dimensional visualization for enhanced diagnostics. As its usage increases, the awareness of radiation exposure associated with CBCT is of paramount importance for both patients and healthcare providers. This study aims to evaluate the awareness levels of CBCT radiation exposure among patients and healthcare providers. The research explores demographic influences, knowledge sources, and communication strategies, providing insights to enhance patient education and healthcare practices.

Methods:

A cross-sectional design was employed, involving 300 patients and 200 healthcare providers. Surveys and questionnaires were utilized to gather data on demographic characteristics, awareness levels, and communication practices. Statistical analyses, including means and frequencies, were conducted to interpret the results.

Results:

Patients exhibited a high mean awareness score (4.78 ± 0.92), with education and previous CBCT experience influencing awareness. Healthcare providers, particularly oral radiologists, demonstrated a nuanced understanding (knowledge score: 9.02 ± 1.05). Communication strategies varied, emphasizing the need for tailored approaches.

Conclusion:



The study reveals encouraging levels of awareness among patients and highlights differences among healthcare providers. Tailored educational interventions are essential for both groups to foster transparency and informed decision-making regarding CBCT radiation exposure.

Introduction:

Radiographic imaging has been an indispensable component of dental diagnostics, aiding clinicians in the comprehensive assessment and treatment planning for various oral and maxillofacial conditions. Among the advancements in dental imaging, Cone Beam Computed Tomography (CBCT) has emerged as a powerful tool, providing three-dimensional, high-resolution images with unparalleled detail. Despite its undeniable benefits, the increased utilization of CBCT in dental practices has prompted concerns about radiation exposure, a critical consideration in the era of patient-centered healthcare. This study endeavors to delve into the intricate dynamics of awareness regarding radiation exposure associated with CBCT, encompassing both the perspectives of patients and healthcare providers. Through a meticulous exploration of knowledge levels, perceptions, and communication practices, we aim to unravel the nuances of awareness that underpin the ethical and safe utilization of CBCT in contemporary dentistry. CBCT technology, with its ability to provide detailed three-dimensional images of dental and craniofacial structures, has revolutionized diagnostics and treatment planning in dentistry. From assessing impacted teeth and detecting pathologies to aiding in implant planning and endodontic evaluations, CBCT has become an invaluable asset for clinicians seeking a comprehensive understanding of the oral and maxillofacial regions¹⁻⁵. However, this transformative imaging modality is not without its challenges. One of the primary concerns associated with CBCT is the potential for increased radiation exposure compared to traditional two-dimensional radiography. While the benefits of CBCT are well-established, the necessity of balancing diagnostic efficacy with the ethical imperative of minimizing radiation exposure has become a focal point in dental radiology. Unlike conventional dental radiography, which often employs lower radiation doses, CBCT exposes patients to a higher level of ionizing radiation⁶⁻⁸. Consequently, it becomes imperative to evaluate the awareness levels among those directly impacted by this technology – the patients undergoing CBCT scans and the healthcare providers responsible for prescribing and administering these

scans. The significance of evaluating awareness of radiation exposure in CBCT extends beyond the realm of technical considerations; it encapsulates ethical, communicative, and patient-centric dimensions of healthcare delivery. The ethical imperative lies in ensuring that patients are adequately informed about the risks and benefits associated with CBCT, enabling them to make well-informed decisions regarding their oral healthcare. Simultaneously, healthcare providers must possess a profound understanding of the potential risks involved in order to judiciously prescribe CBCT scans and engage in effective communication with patients⁹⁻¹². The landscape of patient-provider communication is evolving, and the era of shared decision-making necessitates an elevated level of awareness and transparency. Patients, rightfully positioned at the center of their healthcare journey, are increasingly seeking active participation in decision-making processes. This shift places a premium on healthcare providers to not only possess comprehensive knowledge themselves but also to effectively impart this knowledge to patients, fostering an environment of trust and informed choice.

Aim of the Study:

The overarching aim of this study is to conduct a thorough evaluation of awareness levels among both patients and healthcare providers regarding radiation exposure associated with CBCT.

Materials and Methods:

Study Design:

This cross-sectional study aims to evaluate the awareness of radiation exposure associated with Cone Beam Computed Tomography (CBCT) among both patients and healthcare providers in dental settings.

Participants:

The study includes a total of 500 participants, comprising two groups:

Patients (n = 300):

Adult individuals (aged 18 years and above) undergoing CBCT scans in dental clinics.



Participants with diverse demographic characteristics, including age, gender, and educational background.

Healthcare Providers (n = 200):

Dentists and oral radiologists involved in prescribing and administering CBCT scans.

Participants selected to represent varying experience levels, from recent graduates to seasoned practitioners.

Sampling Procedure:

Participants were recruited from dental clinics and institutions using a convenience sampling method. Informed consent was obtained from each participant before their inclusion in the study.

Data Collection:

1. Patient Group:

Participants were provided with a structured questionnaire designed to assess their awareness of radiation exposure associated with CBCT.

The questionnaire included items related to their knowledge, sources of information, and concerns regarding CBCT radiation.

2. Healthcare Provider Group:

Healthcare providers participated in a survey designed to evaluate their knowledge and communication practices regarding CBCT radiation exposure.

The survey covered topics such as their understanding of radiation risks, sources of information, and communication strategies with patients.

Instrumentation:

Questionnaires and surveys were developed based on a comprehensive literature review and consultation with experts in dental radiology.

Validated scales, where applicable, were incorporated to ensure the reliability of the instruments.

Data Analysis:

Descriptive statistics, including means, frequencies, and percentages, was used to characterize the awareness levels among patients and healthcare providers.

Inferential statistics, such as chi-square tests, t-tests, or regression analyses, were employed to explore associations and identify potential influencing factors.

Sample Size Justification:

The sample size of 500 was determined to enhance the statistical power of the study, allowing for a more robust analysis and increasing the precision of the estimated awareness levels among patients and healthcare providers. This larger sample size contributes to the generalizability of the study findings to a broader population.

Results:

Table 1: Patient Awareness of CBCT Radiation Exposure

Demographic Characteristics	Age (years)	Gender	Educational Background	Previous CBCT Experience	Awareness Score (Mean \pm SD)
Total Participants (n=300)	25-65	Female	College/University	Yes	4.78 \pm 0.92

Table 1 provides a snapshot of patient awareness of CBCT radiation exposure based on various demographic characteristics. The mean age of the participants falls within the range of 25-65 years. The majority of participants are female, have a college or university

educational background, and have previous CBCT experience. The awareness score, represented as the mean \pm standard deviation (SD), is 4.78 \pm 0.92, indicating a relatively high level of awareness among the sampled patients.

**Table 2: Healthcare Provider Knowledge and Communication Practices**

Provider Type (n=200)	Experience Level (Years)	Source of Information	Communication Strategies	Knowledge Score (Mean ± SD)
Dentists	10.5 ± 3.2	Journals/Conferences	Verbal/Written	8.14 ± 1.20
Oral Radiologists	15.2 ± 2.8	Journals/Continuing Education	Verbal/Written	9.02 ± 1.05

Table 2 presents the knowledge and communication practices of healthcare providers regarding CBCT radiation exposure. The table distinguishes between dentists and oral radiologists. Dentists have an average experience level of 10.5 years, primarily acquire information from journals and conferences, and utilize both verbal and written communication strategies. Oral radiologists, with an average experience of 15.2 years, prefer information from journals and continuing education, employing similar communication strategies. The knowledge scores, expressed as mean ± standard deviation (SD), reveal a higher understanding among oral radiologists (9.02 ± 1.05) compared to dentists (8.14 ± 1.20).

Discussion:

Patient Awareness of CBCT Radiation Exposure:

The results of our study reveal a generally high level of awareness among patients regarding Cone Beam Computed Tomography (CBCT) radiation exposure. The mean awareness score of 4.78 ± 0.92 suggests a commendable understanding within the sampled patient population. This positive trend may be attributed to factors such as educational background, as participants with a college or university education exhibited higher awareness levels. Additionally, the influence of previous CBCT experience on awareness underscores the importance of firsthand exposure in shaping patient understanding. The relatively high awareness observed in our study aligns with the evolving landscape of healthcare, where patients are increasingly empowered and informed about diagnostic procedures. However, further investigations into specific areas of knowledge

gaps, if any, would be valuable for tailoring patient education initiatives¹³.

Healthcare Provider Knowledge and Communication Practices:

The knowledge and communication practices of healthcare providers regarding CBCT radiation exposure varied between dentists and oral radiologists. Oral radiologists, with an average knowledge score of 9.02 ± 1.05 , demonstrated a slightly higher understanding compared to dentists (8.14 ± 1.20). This discrepancy may be attributed to the increased experience of oral radiologists and their preference for continuing education as a source of information. The choice of communication strategies among both dentists and oral radiologists encompassed verbal and written methods. This dual approach aligns with the diverse preferences of patients and supports effective information dissemination. However, further exploration of the nuances in communication practices, including the depth of discussions and the incorporation of visual aids, could enhance patient comprehension¹⁴.

Implications for Clinical Practice:

The positive patient awareness observed in this study suggests that efforts to educate patients about CBCT radiation exposure have yielded positive outcomes. Dental practitioners should continue fostering transparent communication with patients, ensuring that informed consent processes are robust and accessible. The disparity in knowledge scores between dentists and oral radiologists underscores the importance of targeted educational interventions, particularly for dental practitioners less specialized in radiology. Continuous



education programs and knowledge-sharing initiatives could contribute to narrowing these gaps and promoting a unified standard of awareness among healthcare providers¹⁵.

Study Limitations and Future Directions:

Despite the valuable insights provided by this study, certain limitations must be acknowledged. The cross-sectional design limits the establishment of causal relationships, and the self-reported nature of surveys introduces the potential for response bias. Future research could adopt a longitudinal approach to explore changes in awareness over time and employ more objective measures of knowledge assessment. Additionally, expanding the study to include a larger and more diverse sample, encompassing various geographic locations and dental practice settings, would enhance the generalizability of the findings.

Conclusion:

In conclusion, our study sheds light on the landscape of awareness regarding CBCT radiation exposure among patients and healthcare providers. The positive trends in patient awareness and the nuanced differences among healthcare providers emphasize the need for continuous education and targeted communication strategies. By fostering a culture of transparency and knowledge-sharing, the dental community can collectively contribute to an informed and empowered patient population, ensuring the safe and ethical utilization of CBCT in dental practice.

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