Short Communication

Refining Dental Imaging Safety Protocols: A Commentary on Current Recommendations, Gaps, and Practical Concerns

Salma Tabatabaei [1], MScD; Shahram Hamedani [2], MScD;

[1] Dept. of Oral and Maxillofacial Radiology, School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran
[2] Oral and Dental Disease Research Center, School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran

KEY WORDS
Dental Radiation safety;
Imaging protocols;
CBCT guidelines;

Received: 21 September 2025;
Revised: 4 January 2026;
Accepted: 21 February 2026;

ABSTRACT

This commentary critically examines recent dental radiation safety recommendations, highlighting overlooked practical and ethical concerns. Key issues include the controversial removal of routine thyroid shielding, insufficient adaptation for low-resource settings, and restrictive guidance on cone-beam computed tomography (CBCT) use. The shift from ALARA to ALADA, while well-intentioned, may inadvertently permit excessive imaging in the absence of clearly defined diagnostic thresholds and audit mechanisms. Additionally, the lack of prioritization and manufacturer-specific dose data hampers clinical implementation. Emerging technologies such as artificial intelligence (AI), which have demonstrated potential for dose optimization, quality assurance, and decision support in dental imaging, remain underrepresented in current guidelines. The article advocates for more balanced, adaptable, and forward-looking safety protocols in oral and maxillofacial radiology.

Corresponding Author: Tabatabaei S, Dept. of Oral and Maxillofacial Radiology, School of Dentistry, Shiraz University of Medical Sciences, Ghasrodasht Street, Shiraz 7144833586, Iran.
Email: salma.tabatabaei@gmail.com

Cite this article as:

Introduction

Radiation safety is fundamental to secure clinical practice in oral health care, considering the prevalent utilization of diagnostic imaging in standard dental procedures. While radiographs are essential for diagnosis and treatment, even low-dose ionizing radiation carries risks- especially with prolonged exposure. Consequently, the dissemination and regular revision of evidence-based safety recommendations by diverse regulatory bodies and professional organizations are imperative to guarantee patient safety, practitioner adherence, and the ethical application of ionizing radiation in dental imaging.

Recent regulatory guidance and practice recommendations have been updated and published, advocating radiation safety in accordance with a comprehensive array of international and national guidelines [1-2]. These efforts represent significant progress in integrating technological advances such as digital radiography and cone-beam computed tomography (CBCT) into safety frameworks. However, careful review of these updated guidelines reveals several practical and conceptual gaps that may limit their clinical applicability and global relevance. The goal of this short communication is to bring these issues to light and suggest additional considerations that may strengthen future revisions or real-world implementation of radiation safety protocols.

Thyroid shielding and patient perception

The recommendations [1] support eliminating the routine use of thyroid and abdominal shielding in pediatric and general imaging. Although the rationale is grounded in technological advancements such as improved beam collimation and dose reduction, the recommendation remains controversial. Beyond dosimetric considerations, this approach may overlook issues related to pa-

tient communication and patient's *emotional safety*, particularly for parents of pediatric patients who often perceive shielding as a visible indicator of safety. Furthermore, the shift away from shielding contrasts with long-standing clinical practice and is not yet supported by extensive long-term outcome data in humans. As a result, both public perception and established professional habits may hinder widespread acceptance of this change. One additional concern about discontinuing the routine use of these shields is that clinicians might mistakenly apply this decision to all radiographic situations or overlook other protective strategies. A clear distinction between *not recommended routinely* and *absolutely contraindicated* must be communicated and documented.

Applicability in low-resource settings

The current panels fail to incorporate cost-benefit analysis. Recommendations need to be adapted to low-resource contexts. Recommendations such as replacing film with digital systems, periodic expert quality assurance (QA) inspections, or CBCT protocol optimization imply significant financial investment. In many underserved regions, these requirements may not be immediately feasible. Therefore, future guidelines would benefit from distinguishing between core (universally essential) and optimal (resource-dependent) recommendations, thereby enhancing global applicability without compromising patient safety.

CBCT utilization and clinical autonomy

The recommendations discourage the routine use of CBCT [1-2]. The utilization of CBCT in fields such as orthodontics, endodontics, and maxillofacial surgery is becoming increasingly standard and beneficial [3]. In research settings, CBCT is frequently regarded as a reference standard for three-dimensional assessment. Strict interpretation of restrictive guidance may limit clinician autonomy, risk under-imaging in selected cases, and potentially delay diagnosis or treatment planning. This commentary does not advocate indiscriminate CBCT use; rather, it emphasizes proportional, case-based justification grounded in clinical complexity and diagnostic need.

ALADA versus ALARA: practical challenges

The endorsement of ALADA (as low as diagnostically achievable) over ALARA (as low as reasonably achievable) for CBCT imaging [1], reflects an important conceptual shift. However, in the absence of clearly defined diagnostic acceptability thresholds, standardized auditing systems, or external oversight, ALADA may be interpreted subjectively, potentially leading to unnecessary exposure. The balance between diagnostic sufficiency and dose minimization remains challenging, and clearer operational definitions would facilitate more consistent clinical application.

Manufacturer variability and dose transparency

Although significant variability in CBCT radiation doses- reported to differ by as much as 50-fold depending on device and settings- is acknowledged in the literature [1], current recommendations rarely provide manufacturer- or system-specific information. While maintaining neutrality helps avoid commercial bias, the lack of comparative dose transparency limits clinicians' ability to make informed, safety-oriented equipment and protocol choices. This omission represents a practical limitation of existing guidelines rather than of the present commentary. Greater transparency regarding dose ranges could facilitate more effective optimization and safer clinical practice.

Periodization and practical implementation of recommendations

Articles such as the JADA 2024 review on dental radiation safety [1] contain more than 70 recommendations but offer no ranking by feasibility or impact. For busy clinicians, lack of stratified recommendations (e.g., "critical vs. ideal") may lead to partial or arbitrary adoption. Additionally, a strong reliance on region specific regulatory frameworks like U.S. regulatory references (such as FDA, OSHA, and NCRP) may reduce applicably in the settings with differing legal or infrastructural conditions. A tired or prioritized presentation of recommendations could enhance usability, facilitat4e real-world compliance and improve global relevance without compromising safety principles.

Emerging role of artificial intelligence (AI) in radiation safety

An additional aspect insufficiently addressed in recent recommendations is the integration of emerging imaging technologies, particularly artificial intelligence (AI) into radiation safety frameworks. Recent literature has demonstrated AI applications in dental imaging, including automated exposure parameter selection, field-of-view optimization, image quality assessment, and decision support [4-7]. Such tools may contribute to dose optimization, patient-specific risk assessment, and improved adherence to safety standards. At the same time,

potential challenges such as algorithmic bias, limited transparency, and over-reliance on automated systems should be acknowledged. Without systematic incorporation of AI-related considerations, current guidelines risk becoming outdated as clinical practice evolves.

Conclusion

These observations are presented with the intent of fostering constructive dialogue rather than undermining the value of existing radiation safety recommendations. By addressing issues of practicality, adaptability, and technological advancement, future guideline revisions may achieve greater clinical relevance and global applicability. Ongoing reassessment and interdisciplinary collaboration will help ensure that radiation safety frameworks evolve in parallel with advances in dental imaging practice.

Acknowledgment

None

Declarations

Funding

No external funding was received for this work

Ethics approval

Not applicable. This article is commentary and does not contain any studies with human or animal subjects performed by the any of the authors

Informed consent

Not applicable

Conflict of Interest

The authors declare no conflicts of interest related to this article

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