



Especialidade: RADIOLOGIA

TÍTULO: AUTOMATED DETECTION AND CLASSIFICATION OF PERIAPICAL BONE RAREFACTIONS IN PANORAMIC RADIOGRAPHS: A DEEP LEARNING-BASED APPROACH

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RESUMO: Introduction: Periapical pathologies manifest radiographically as periapical bone rarefactions (PBRs), which exhibit subtle morphological variations. These features make diagnosis challenging, even for experienced radiologists, highlighting the need for supportive tools. Objective: To develop a deep learning (DL) model for the detection and classification of PBRs in panoramic radiographs (PRs).

Methodology: This project was approved by the Institutional Ethics Board (7,540,020). A total of 22,338 digital PRs from the dental imaging service of the University of Fortaleza (2017–2024) were reviewed. After screening, 2,527 images were classified into four groups and used to train and test three DL strategies. A Multi-Head Self-Attention module was incorporated to enhance performance, and Grad-CAM/Grad-CAM++ were applied for model interpretability. Results: In binary classification of healthy versus diffuse PBRs, Xception and DenseNet121 architectures, with or without attention, achieved the best performance, with accuracy above 68% and sensitivity up to 76%. Discussion: This stage of the model focused on incipient diffuse PBRs, the real diagnostic challenge. Performance matched comparable literature reports, demonstrating DL's potential for supporting early diagnosis. Future refinements will address circumscribed PBRs, with validation by dentists for real-world performance. Conclusion: This is the first model in the Americas for automated classification of PBRs in PRs. It can support early diagnosis and assist in training and decision-making in dental imaging.

Descritores: Periapical Bone Rarefaction, Artificial Intelligence, Deep Learning, Convolutional Neural Networks, Panoramic Radiographs