Alveolar Bone Classification in Cone-beam Computed Tomographic Images Using Deep Learning Techniques

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Abstract

Alveolar bone classification is crucial for pre-surgical implant planning, encompassing implant design and drilling protocol selection. The widely accepted Lekholm and Zarb's (L&Z) classification categorizes cross-sectional alveolar bone into four types based on cortical bone width and trabecular bone density on cone-beam computed tomography (CBCT), but it lacks numerical guidelines for evaluation. Consequently, this study aimed to test a deep learning (DL) model for alveolar bone classification on CBCT and align it with L&Z's classification. Two oral and maxillofacial radiologists classified 1,000 cross-sectional slices of CBCT into 4 groups according to L&Z's classification for training DL models, including AlexNet, GoogLeNet, and ResNet-50, while another 100 slices were used for testing DL models. DL models were trained at 50 Epochs with 0.01, 0.001, and 0.0001 learning rates (LR). The highest accuracy of the model was observed in GoogLeNet (LR = 0.0001) at 82%, followed by ResNet-50 (LR=0.001) at 80%, and GoogLeNet (LR = 0.001) at 78%, respectively. The highest sensitivity and specificity of the model were observed in GoogLeNet (LR = 0.0001) at 81.87% and 93.85%, respectively. In conclusion, DL models could be considered ~~as~~ diagnostic tools for classifying cross-sectional alveolar bone in CBCT.

***Keywords*:** *Alveolar Bone, Dental Implant, CBCT, Deep Learning*