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Oral Health Complications and Quantified Impact of Artificial Intelligence regarding Dental Caries

Kan Yeung*

Department of Oral and Maxillofacial Radiology, University of California, USA.

INTRODUCTION

Accurate delineation of individual teeth and alveolar bones from dental cone-beam CT (CBCT) images is an essential step in digital dentistry for precision dental healthcare. In this paper, we present an AI system for efficient, precise, and fully automatic segmentation of real-patient CBCT images. Our AI system is evaluated on the largest dataset so far, i.e., using a dataset of 4,215 patients (with 4,938 CBCT scans) from 15 different centers. This fully automatic AI system achieves a segmentation accuracy comparable to experienced radiologists (e.g., 0.5% improvement in terms of average Dice similarity coefficient), while significant improvement in efficiency (i.e., 500 times faster). In addition, it consistently obtains accurate results on the challenging cases with variable dental abnormalities, with the average Dice scores of 91.5% and 93.0% for tooth and alveolar bone segmentation. These results demonstrate its potential as a powerful system to boost clinical workflows of digital dentistry. Furthermore, the shape memory property of the two materials was evaluated using a U-shape bending test, and the shape recovery ratio for 60 min at 37 °C was calculated. The results indicate that TC-85 can constantly apply a light force to the teeth when used for the 3D printed clear aligners, owing to its flexibility and viscoelastic properties. In addition, it is expected that the force decay induced by repeated insertion of the clear aligners will be reduced and a constant orthodontic force will be maintained. Furthermore, its geometric stability at high temperatures and the shape memory properties provide advantages for the clinical application. Osteoporosis is becoming a global health issue due to increased life expectancy. However, it is difficult to detect in its early stages owing to a lack of discernible symptoms. Hence, screening for osteoporosis with widely used dental panoramic radiographs would be very cost-effective and useful. In this study, we investigate the use of deep learning to classify osteoporosis from dental panoramic radiographs. In addition, the effect of adding clinical covariate data to the radiographic images on the identification performance was assessed. For objective labeling, a dataset containing 778 images was collected from patients who underwent both skeletal-bone-mineral density measurement and dental panoramic radiography at a single general hospital between 2014 and 2020. Osteoporosis was assessed from the dental panoramic radiographs using convolutional neural network (CNN) models, including EfficientNet-b0, -b3, and -b7 and ResNet-18, -50, and -152. An ensemble model was also constructed with clinical covariates added to each CNN. The ensemble model exhibited improved performance on all metrics for all CNNs, especially accuracy and AUC. The results show that deep learning using CNN can accurately classify osteoporosis from dental panoramic radiographs. Furthermore, it was shown that the accuracy can be improved using an ensemble model with patient covariates. The present study aimed to detect psychological attributes of children seeking dental treatment for the first time using the strength and difficulties questionnaire (SDQ), evaluate actual child behavior during the dental treatment using Frankl Behavior Rating Scale, and test the association between these attributes and child behavior. The study was conducted on 128 children aged between 4 and 7 years attending the outpatient Pediatric Dentistry clinic for the first time. Parents were asked to answer the SDQ, then a simple restorative treatment under local anesthesia was performed for children to evaluate their behavior using Frankl Behavior Rating Scale.

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CONFLICT OF INTEREST

None

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Corresponding author Kan Yeung, Department of Oral and Maxillofacial Radiology, University of California, USA, E-mail: cayeung94123@qq.com

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