laboratory examined MM architectural changes during maximum intercuspation.

Objective: This work is an extension of our earlier studies in that it incorporates border jaw movements. It is hypothesized that a prototype in vivo ultrasonography protocol that will detect MM architectural changes during mandibular protrusion and lateral excursion can be developed.

Materials and Methods: The study was on the development of a prototype in vivo ultrasonography protocol based on cadaveric data.

Results: A protocol was successfully developed by identifying optimal probe positions and sites to visualize the MM laminae in mandibular protrusion and lateral excursion. The development involved correlation of anatomic specimens with in vivo ultrasonography, which enabled quantification and comparison of fiber bundle length, muscle thickness, and aponeurotic height.

Discussion: A novel ultrasonography protocol that will facilitate better understanding of normal MM morphology during mandibular protrusion and lateral excursion was developed. In the future, this protocol could be used as a basis to study MM changes in TMDs.

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BLOCKCHAIN: A NEW DATA STANDARD IN ORAL AND MAXILLOFACIAL RADIOLOGY?

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Background: Despite the Health Insurance Portability and Accountability Act (HIPAA) efforts, protected health information (PHI) and patient's privacy and safety are still under risk. With exposure of greater than 200 million patients' records for the period 2009−2019, the U.S. government is wondering if enough is being done to keep data safe. Blockchain is becoming a gold standard in health care data management because of its trusted, autonomous, immutable, and secured distributed ledger properties.

Objective: The goals of this retrospective, randomized, double-blind study were to assess (1) the effectiveness of Blockchain patient data conversion, (2) backup storage requirements, and (3) HIPAA compliance, compared with the current data storing and sharing methods and the feasibility of the use of Blockchain in Oral and Maxillofacial Radiology (OMR).

Materials and Methods: Head and neck computed tomography (CT) scans (n = 92,903 files) from the Cancer Imaging Archive (Blockchain folder n = 46,465 and Monitoring folder n = 46,438) and deidentified PHI were randomly assigned by 1 operator. Data were then converted into cryptographic Blockchain hashes via syncing the CBCT scans database folder with the DDSBlockchain (Charlotte, NC, 28,277) folder into the Hyperledger private Blockchain platform by a second operator. Data conversion percentage was assessed, and an F-test Two-Samples for Variances was conducted to quantify data upload speed ($P < .05$). Storing sizes of the original data and the Blockchain data were compared, and sharing privacy and safety were corroborated through the HIPAA compliance checklist by a third operator within the private Blockchain platform.

Results: One hundred percent of data uploaded were converted into Blockchain. Blockchain conversion had an average speed of 0.617 files per second. No statistical difference ($P = .562$) was found when comparing the 2 folders upload speed (average 26 hours, 11 minutes, and 5 seconds). The Blockchain data report storage size was 1.22 MB, whereas the original data folder storage size was 5.36 GB. No HIPAA breach was found during the data upload, conversion, sharing, and storage processes.

Discussion: The Blockchain private platform promises to become a gold standard in OMR PHI data backup because of its data conversion effectiveness, low storage requirements, and trusted, autonomous, immutable, and secured distributed ledger capabilities for keeping data private and safe. Preliminary study results indicated the feasibility of adopting Blockchain in OMR as a new data backup management method.

Conflict of interest: D. Uzbelger Feldman is co-founder and HIPAA compliance officer at DDSBlockchain (Charlotte, NC, 28277).

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DIAGNOSTIC ACCURACY OF APPROXIMAL CARIES IN DIGITAL RADIOGRAPH BY CHINESE AND AMERICAN DENTISTS: AN IN VIVO STUDY

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Background: Because dental education system is not the same in both the United States and China, there may be differences between Chinese and American dentists in the radiographic diagnosis of dental lesions.

Objective: The aim of this study was to assess whether there were any differences in the accuracy of diagnosis of approximal caries between Chinese and American dentists.

Materials and Methods: The study was approved by the local ethical committee. Thirty-nine noncavitated teeth were collected from 11 patients who had parts of the upper or lower jaws excised to remove a cyst or neoplasm. Before surgery, radiographs of the involved teeth were taken by using the digital imaging system Digora Optime (Soredex, Helsinki, Finland). The teeth were then sectioned for histologic validation of the lesions. Four Chinese and 4 American dentists and 5 American senior dental students evaluated all of the radiographs according to a 5-category scale. Receiver operating characteristic (ROC) analysis was performed. Repeated-measure analysis of variance (ANOVA) was employed for statistical analysis.

Results: There were no significant differences among the Chinese and American dentists and the American senior dental students ($P = .472$). Interobserver ($P = .67$) and intraobserver ($P = .24$) variances were not significant.

Discussion: Dental education background is not an influencing factor on the accuracy of diagnosis of approximal caries based on digital radiographs.

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HUMAN MANDIBULAR BONE DENSITY DISTRIBUTION: IMAGE ANALYSIS AND BONE REMODELING SIMULATION

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Background: Bone density distribution affects the short-term and long-term success of dental treatments. Currently, there is no quantitative method to analyze bone density distribution in alveolar bone.

Objective: In this study, the bone density distribution in human mandibles was obtained from quantitative analysis on medical images and was also modeled by using biomechanics simulations.

Materials and Methods: Cone beam computed tomography (CBCT) images from 33 patients were obtained from dental clinics. The CBCT scanner was calibrated by using our self-made phantoms to convert gray-scale to mineral density. The CBCT images of multiple human mandibles were analyzed. Finite element models were used to simulate the effects of normal chewing and bite force on bone density distribution. A strain energy density−based bone remodeling algorithm was used in the simulations.

Results: For the same materials in phantoms, there was no significant difference in gray scale in different locations inside the regions of interest, despite the known drawbacks of CBCT. At the chosen effective energy level, the gray scale in CBCT images had high linearity with attenuation coefficients for all materials in the phantoms. The averaged trend in mandibular bone density distribution was obtained. It was higher near the root of the tooth and lower away from the tooth, especially near the lingual arc of the jaw. The numerical simulation results showed a similar trend in bone density distribution under chewing force.

Discussion: The gray scale in CBCT images from the 1 CBCT scanner used in this study had linearity and spatial consistency inside certain regions of interest. The bone density distribution obtained from image analysis had good agreement with that obtained from bone remodeling simulations based on biomechanics analysis. The results may provide detailed information on dental anatomy and can also build the foundation for future improvements in dental treatments using image-based biomechanics analysis.

OSTEOPOROSIS PRESCREENING USING DENTAL PANORAMIC RADIOGRAPHY WITH DEEP LEARNING

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Background: Known as the most common bone pathosis, osteoporosis affects millions of people every year. Clinical diagnostic methods for osteoporosis are expensive and, therefore, have limited availability in population prescreening. Recently, studies have shown that dental panoramic radiography (DPR) can provide information of bone density changes and have potential to be used in trabecular bone structure analysis.

Objective: The aim of this study was to investigate the potential of using deep neural networks on DPR images for osteoporosis prescreening.

Materials and Methods: We collected 108 DPR images from 108 patients (52 patients with osteoporosis and 56 normal individuals). We designed a deep learning algorithm for osteoporosis prescreening. The algorithm uses a multitask scheme to transfer the network pretrained on ImageNet to our data set and improves accuracy in osteoporosis prescreening.

Results: The leave-one-out cross-validation showed that the highest overall accuracy of osteoporosis prescreening to be 92%, demonstrating its significant advantage over previous methods.

Discussion: The study findings showed that using deep neural networks can significantly improve the accuracy of prescreening for osteoporosis, based on 108 DPR images.