

Use of a Deep Learning Based Online Platform to Diagnose Periodontitis

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Objectives: The goal was to validate a deep learning convolutional neural network-based online platform aiding clinicians in diagnosing periodontitis based on periapical radiographs.

Experimental Methods: An online platform with the built-in computer-aided diagnosis (CAD) model can process uploaded full-mouth series intraoral radiographs (FMS) and generate a comprehensive clinical report that includes radiographic bone loss (RBL) percentage, RBL distance, and assigned RBL stages for each image. The usability of this online platform was assessed by dental care providers (students, residents, dentists) through a survey with the System Usability Scale (SUS) questions. The final scores of SUS (0-100) represent different attitudes to the tested tool: >68: Acceptable; 68-80.3: Good; >80.3: Excellent. The time required to generate the clinical report by care providers was estimated and care providers' knowledge in periodontal diagnosis was assessed based on FMS of 5 standard cases. Comparisons between groups were analyzed by one-way analysis of variance.

Results: In total, 1147 periapical radiographs were used to build the CAD model. Thirty-six care providers were included to evaluate the platform. The periodontal stage accuracy of the 5 standard cases for the CAD (n=1), students (n=16), residents (n=6), and dentists (n=14) was 80%, 65.00±18.62%, 70.00±16.73%, and 65.71±24.09% respectively (p=0.86). The mean SUS scores for students, residents, and dentists were 75.16±16.87, 72.08±14.11, and 87.86±11.43 respectively (p=0.03), demonstrating their positive attitude to this platform. The estimated time required to generate a clinical report for each FMS by students, residents, and dentists was 72.81±82.13, 14.50±5.61, and 31.50±25.81 minutes respectively, and this was significantly longer than the online platform (2.16 ± 0.05 minutes, p<0.01).

Conclusion: This online platform showed high satisfaction from dental care providers with different levels of experience. This deep learning based CAD online platform with a high accuracy of periodontal diagnosis can be used as an adjunct tool in the clinic.