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AI-Based Detection of Molar Incisor Hypomineralisation – an External Validation

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Objectives The clinical resemblance of molar incisor hypomineralisation (MIH) to other dental hard tissue defects remains a challenge in diagnostic evaluation. Independent diagnostic methods based on artificial intelligence (AI) could therefore support and verify the visual examination. The aim of this ex vivo diagnostic study was to externally validate an open-access AI-based model for the detection and classification of MIH and related classes (demarcated opacities, enamel breakdowns and atypical restorations) on dental images.

Methods A dataset with web images showing teeth with (N=277) and without MIH (N=178) was evaluated by dentists and served as a reference standard. The dataset was analysed using the AI-based model (http://demo.dental-ai.de) with automated detection and classification of MIH (test method), allowing multiple findings per image. The diagnostic performance of the AI-based model was evaluated in comparison to the workgroup consensus, whereby the influence of the respective image size was also considered. The accuracy (ACC), sensitivity (SE), specificity (SP) and area under the curve (AUC) were statistically determined. The correctness of the localisation and segmentation of the MIH lesions was also subjectively assessed.

Results An overall ACC of 94.3% was achieved for detection of MIH. Cross-classification of the AI-based class prediction and the reference standard resulted in an ACC between 91.4% and 97.8%, with SE and SP values of 81.7% to 92.8% and 91.9% to 98.7%, respectively. The AUC was between 0.894 and 0.945. Considering the image size (12–5,100kB), the diagnostic parameters showed only minor deviations. Moreover, the AI-based model correctly predicted MIH localisation in 97.3% of cases. The segmentation was fully correct in 63.4% of all cases and partially correct in 33.9%.

Conclusions This study documented an encouraging diagnostic performance of the AI-based model by using an external image sample. Future studies are recommended to investigate the diagnostic validity and practicability in different settings.