Letter to Editor

Artificial Intelligence Augmenting Pediatric Dentistry in the Diagnosis and Management of Oral Potentially Malignant Disorders

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Dear Editor

Oral malignant and premalignant lesions are extremely uncommon in children compared to adults. However, their diagnosis and management remain challenging since their clinical characteristics often resemble benign oral conditions in children. The overall prevalence of oral mucosal lesions is reported to be 5.2%, mainly showing up as mucoceles and aphthous ulcers [1]. However, recent studies have shown that oral potentially malignant disorders (OPMDs), such as leukoplakia, erythroplakia, oral lichen planus, and oral submucous fibrosis, can also occur in children, which subsequently necessitates careful surveillance during pedodontic practice [2-3].

While the rarity of OPMDs is reassuring at the general population level, it limits clinician experience, delays diagnosis, and restricts the development of robust evidence-based guidelines [4].

Pedodontists who are often the first to assess OPMDs must therefore follow established pediatric oral pathology protocols, including systematic history taking, comprehensive intra- and extraoral examination, documentation, differential diagnosis, and follow-up for lesions deemed self-limiting. Lesions that persist, fail to respond to empiric management, or exhibit concerning clinical features warrant biopsy or referral for definitive diagnosis. However, early OPMDs frequently present with subtle, nonspecific findings, and existing adjunctive diagnostic methods, such as autofluorescence, vital staining, and cytologic techniques, lack sufficient accuracy for routine clinical decision-making, underscoring the need for improved diagnostic support [1, 5-6].

Artificial intelligence (AI) holds promise as an adjunctive tool by enabling the analysis of complex, multimodal clinical data beyond traditional linear reasoning, thereby providing a comprehensive decision-making system aimed at enhancing timely and early detection [7-9].

AI may support pedodontists in several areas, including screening and triage, risk stratification (e.g., comparing biopsy versus conservative monitoring), and decision-support systems that integrate clinical findings, intraoral photographs, and patient-related data, thereby assisting in personalized follow-up planning and monitoring of suspicious lesions. AI may further contribute to the development of evidence-based guidelines for the diagnosis and management of pediatric OPMDs by integrating clinical data from diverse populations, with iterative refinement of risk estimates based on longitudinal follow-up data, which may help address limitations related to data scarcity [10]. Moreover, image-based deep learning models trained on clinical photographs of OPMDs have demonstrated promising diagnostic performance in retrospective studies conducted predominantly in adult populations, with pooled sensitivity and specificity estimates of 91% and 94%, respectively [11-12]. While these findings suggest a potential role for AI-assisted diagnosis of pediatric oral mucosal lesions, their applicability to this age group remains uncertain because of the scarcity of pediatric-specific datasets. Therefore, coordinated efforts toward standardized reporting and systematic documentation of pediatric OPMD cases by frontline clinicians (e.g., pedodontists, oral pathologists, and other relevant healthcare providers) are recommended as a worthwhile direction for future research, in order to establish sufficiently large, well-characterized datasets for AI model training and validation. Furthermore, transfer-learning approaches may help address the scarcity of pediatric OPMD data by enabling models trained on larger adult oral lesion datasets to be subsequently fine-tuned using pediatric cases [13]. In addition, multicenter collaborations, international registries, and federated learning frameworks may facilitate the development of sufficiently large and diverse pediatric datasets while preserving patient privacy and addressing data-sharing constraints.

While pediatric-specific AI models have recently been developed for dental pathologies, an equivalent model for oral mucosal lesions remains unavailable, which motivated this letter [14]. Overall, several barriers to clinical implementation remain. Challenges related to model explainability and interpretability, medicolegal accountability, and the need for robust external validation across independent pediatric populations must be addressed before AI systems can be routinely integrated into pediatric dental practice [7-8, 15]. It is worth mentioning that AI use does not replace consultation with the pedodontist [15-16].

In conclusion, AI might have the potential to support the diagnosis and management of pediatric OPMDs; however, its clinical utility requires robust validation using pediatric-specific datasets. It could also assist practitioners in navigating the complexities of these uncommon yet important lesions through improved detection, risk assessment, patient-specific follow-up care, and evolving clinical guidance.

Conflict of Interest

The authors declare no conflict of interest.

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