Editorial

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ARTIFICIAL INTELLIGENCE IN ORAL PATHOLOGY: REVOLUTIONIZING DIAGNOSIS WHILE PRESERVING HUMAN EXPERTISE

Artificial intelligence has progressed from a speculative concept to a practical clinical tool, and oral pathology is at a notably crucial juncture. The field of oral pathology relies on microscopic analysis of tissue specimen, the exact task that machine learning has shown exceptional skill in automating. The issue isn't whether AI will replace the oral pathologist, but rather how the field can leverage it while maintaining the discernment that characterizes accurate diagnosis.

Diagnosing oral epithelial dysplasia, grading oral squamous cell carcinoma, and differentiating reactive from neoplastic lesions all involve subjective interpretation, and interobserver variability remains a known challenge even with standardized criteria. Whole-slide imaging has made it possible to digitize glass slides with high reliability, and deep learning algorithms trained on these images have shown encouraging results in detecting dysplasia, identifying malignant features, and classifying oral squamous cell carcinoma — facilitating rapid screening of extensive case volumes and highlighting specimens requiring further examination.

Oral squamous cell carcinoma is a major world-wide health challenge, but its impact is heavily concentrated in South Asia. Timely diagnosis continues to be the strongest indicator of survival; however, delays in reporting continue, and there is a shortage of trained oral pathologists in Pakistan. AI-powered systems, combined with telepathology, could bridge that access gap and bring specialist-level evaluations even into disadvantaged regions — as long as the necessary infrastructure, data protection, and faculty training are established to facilitate it.

None of this positions AI as a complete answer. Model performance depends on the data it was trained on, and many published systems rely on small, single-institution datasets that may not generalize across populations, scanners, or staining protocols. Algorithms built on data from developed countries should not be implemented locally without independent validation. The ethical questions are just as unsettled: most deep learning systems remain "black boxes," and in a field where diagnosis directly shapes patient outcomes, that lack of explainability is a real barrier to trust, not a minor inconvenience.

In addition, fundamentally, histopathological diagnosis is not solely pattern identification. It requires recording accurate clinical history, radiographic findings, and molecular data, and clear communication with clinicians and patients — skills no algorithm currently replicates.

The future of oral pathology will be defined by collaboration with AI rather than competition. Pathologists who understand AI, contribute to its development, and critically assess evolving tools will shape how it is used — and will keep it accountable to patient welfare rather than convenience. The task now is not simply to adopt these tools, but to guide their implementation through research, training, and sound validation. The microscope is becoming a digital platform; the judgment behind it still has to be human.

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