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Short Commentary

Artificial Intelligence in Early Detection of Oral Cancer

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INTRODUCTION

Oral cancer is among the most prevalent cancers worldwide, particularly in regions with high tobacco and alcohol use. According to the World Health Organization, oral cancer contributes significantly to cancer-related mortality, with survival rates largely dependent on the stage of diagnosis. Unfortunately, a considerable proportion of patients are diagnosed at advanced stages, leading to limited treatment options and poor prognosis.

Traditional diagnostic methods rely heavily on visual examination, histopathology, and adjunctive imaging techniques. However, these methods are often time-consuming, operator-dependent, and influenced by variability in clinical expertise. This gap has prompted the exploration of artificial intelligence (AI) as a promising adjunct in oral cancer detection.

AI technologies, especially machine learning and deep learning models, can analyze large, complex datasets with speed and precision. In the context of oral oncology, AI offers the potential to identify early neoplastic changes that may otherwise go unnoticed, thus shifting the paradigm from late diagnosis to proactive, early detection.

DESCRIPTION

AI in Oral Cancer Detection

The application of AI in oral cancer detection has grown substantially over the past decade. Machine learning algorithms, trained on vast repositories of clinical images, have shown accuracy levels comparable to or exceeding those of experienced clinicians. Convolutional Neural Networks (CNNs), a subset of deep learning, are particularly effective in analyzing image-based data. They can differentiate between normal mucosa, precancerous lesions such as leukoplakia or erythroplakia, and malignant tumors like oral squamous cell carcinoma with high sensitivity and specificity [1,2].

Integration of Multimodal Data

Beyond image analysis, AI models incorporate multimodal data to enhance diagnostic reliability. Patient history, genetic predisposition, environmental risk factors (such as betel nut chewing or tobacco use), and lifestyle habits are integrated into predictive models. This holistic approach allows for risk stratification, where individuals with higher risk profiles can be prioritized for regular monitoring and early intervention [3].

AI at the Chairside

The translation of AI into chairside diagnostic tools represents a breakthrough in accessible healthcare. Mobile-based applications and intraoral scanners equipped with AI capabilities enable general dentists and primary healthcare providers to perform preliminary screening. This democratizes cancer detection, particularly in rural or underserved regions where access to oral oncology specialists is limited. AI-assisted tools thus bridge the gap between advanced diagnostic technology and real-world clinical practice.

Reducing Diagnostic Variability

One of the persistent challenges in oral cancer detection is inter-observer variability. Clinical interpretation of lesions may differ significantly between practitioners. AI systems, trained on large datasets, offer standardized and reproducible analyses, thereby reducing human error. Studies have shown that AI-assisted diagnosis minimizes false negatives, improving patient safety and outcomes [1,4].

Future Prospects and Challenges

Despite the promise of AI, several challenges remain. These include the need for large-scale, multicenter validation studies to ensure generalizability across diverse populations. Ethical considerations—such as data privacy, informed consent, and algorithmic bias—also require careful navigation. Furthermore, the integration of AI into clinical workflows necessitates training for practitioners, regulatory frameworks, and interdisciplinary collaboration.

CONCLUSION

Artificial intelligence is poised to transform the landscape of oral cancer detection. By enabling early diagnosis, AI can significantly reduce the burden of advanced disease, improve survival rates, and lower healthcare costs associated with late-

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stage treatment. As technology advances, its integration into routine dental practice is not a question of if, but when.

The next decade should focus on developing robust validation frameworks, addressing ethical concerns, and fostering collaboration between dentists, oncologists, data scientists, and policymakers. With these efforts, AI will not replace human expertise but will serve as a powerful adjunct that enhances diagnostic accuracy, accessibility, and patient care in dental oncology.

REFERENCES

1. Ferro A, Kotecha S, Fan K. Artificial Intelligence in oral cancer diagnosis: A systematic review and meta-analysis. Br J Oral Maxillofac Surg. 2022;60(10):e22.
2. Patel S, Kumar D. Predictive identification of oral cancer using AI and machine learning. Oral Oncol Rep. 2025;13:100697.
3. Umapathy VR, Natarajan PM, Swamikannu B, Jaganathan S, Rajinikanth S, et al. Role of artificial intelligence in oral cancer. Adv Public Health. 2024;2024(1):3664408.
4. Schwendicke FA, Samek W, Krois J. Artificial intelligence in dentistry: chances and challenges. J Dent Res. 2020 Jul;99(7):769-74.