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Review

Artificial Intelligence in Periodontology: Current Trends and Future Prospects

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Abstract

Artificial intelligence (AI) has made significant strides in healthcare, including dentistry. In periodontology, AI is being applied for diagnostic support, disease classification, treatment planning, and patient education. This article explores the current applications, benefits, challenges, and future directions of AI in periodontology, with references to recent literature.

Keywords: Artificial intelligence, AI, dentistry, periodontology, applications.

INTRODUCTION

Artificial Intelligence (AI) includes the development of systems that are capable of performing tasks that typically require human intelligence, such as learning, reasoning, and problem-solving (Russell & Norvig, 2021). AI has shown improved diagnostic accuracy, increased efficiency, and effective decision-making in the field of dentistry. (Schwendicke et al., 2020).

Applications of AI in Periodontology

Diagnosis and Imaging

To assess periodontal bone loss AI models, particularly Convolutional Neural Networks (CNNs) are being developed. (Lee et al., 2018). Diagnostic variations of dentists can be avoided with the advent of automated analysis.

Disease Classification and Staging

Classification of the stages of periodontitis in accordance with the 2017 World Workshop classification system can be done by AI-based decision systems. (Miki et al., 2020). These tools combine clinical parameters like probing depth, clinical attachment loss, and also the radiographic data.

Predictive Analytics and Risk Assessment

AI tools can predict disease progression and treatment outcomes based on factors such as age, smoking, oral hygiene, and systemic conditions like diabetes (Schwendicke et al., 2020).

Treatment Planning and Guidance

AI can also suggest personalized treatment strategies and recall intervals using patient data and historical trends (Wang et al., 2021). Integration with robotic technologies is emerging in periodontal surgeries for precision and reduced human error.

Education and Simulation

AI-driven educational platforms can simulate periodontal scenarios for students and help them in visual diagnosis and critical thinking. (Joda, T., et al. 2019)

Benefits of AI in Periodontology

- Improved diagnostic accuracy and early detection of periodontal diseases.
- Enhanced efficiency and consistency in treatment planning.
- Enables personalized care using predictive models.
- Supports evidence-based practice through large-scale data analysis.

Challenges and Limitations

- AI depends on enormous, high-quality datasets for model training.
- Ethical considerations regarding data privacy of the patients and transparency of decision making.
- Limitations in clinical validation and regulatory frameworks. (Muller et al., 2022).

Future Perspectives

- Early detection of the disease can be done by integrating salivary biomarkers and genetic data.
- Mobile applications based on AI can be developed for patient's self-assessment and also for monitoring the patients remotely.
- Use of multi-modal AI combining clinical, radiographic, and wearable sensor data.
- Real-time decision support systems in clinical periodontal surgery.

CONCLUSION

AI in periodontology is rapidly evolving, offering opportunities to enhance diagnostic accuracy, optimize treatment plans, and personalize patient care. With further research, ethical considerations, and clinician training, AI could become a standard tool in periodontal practice.

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