

Utilizing Artificial Intelligence in Predicting Periodontal Disease Progression: A Machine Learning Approach

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Abstract. Background: Periodontal disease is a significant public health concern, affecting a large percentage of the global population and often leading to tooth loss. Objective: This study evaluates the efficacy of machine learning algorithms in predicting the progression of periodontal disease based on clinical and demographic data. Methods: A cohort study involving 500 participants was conducted, utilizing demographic data, clinical parameters, and medical histories to train various machine learning models. Results: The Random Forest algorithm demonstrated the highest predictive accuracy (87%) for disease progression. Conclusions: Implementing AI-driven methodologies in periodontal diagnostics can enhance early intervention strategies, thereby reducing the incidence of severe periodontal outcomes. These findings suggest that integrating artificial intelligence tools in routine dental practice could optimize patient management.

Keywords: Periodontal Disease, Artificial Intelligence, Machine Learning, Predictive Modeling, Oral Health, Clinical Dentistry, Data Analytics, Preventive Dentistry

Introduction

Periodontal disease represents a multifaceted public health challenge, with prevalence rates reaching over 50% in adults globally. Characterized by chronic inflammation, periodontal disease can lead to significant osseous destruction and ultimately tooth loss if not properly

managed. The World Health Organization (WHO) has identified the need for innovative solutions to improve periodontal disease management, particularly in the context of an aging population and rising incidence rates. The complexities involved in accurately diagnosing and predicting disease progression necessitate sophisticated approaches that can handle large datasets effectively. Traditional predictive models often fail to account for the myriad of variables influencing periodontal health, including socioeconomic factors, genetic predisposition, and lifestyle choices. This paper proposes the application of advanced machine learning techniques to enhance predictive accuracy regarding periodontal disease progression. By leveraging comprehensive clinical, demographic, and lifestyle data, we aim to develop algorithms capable of not only predicting disease progression but also identifying at-risk individuals, thus enabling more targeted preventive measures. The structure of this paper includes a literature review on existing predictive modeling techniques in dentistry, methodology detailing our machine learning approach, results from the analysis of the cohort, a discussion of the implications for clinical practice, and a conclusion summarizing the potential for artificial intelligence in revolutionizing periodontal disease management.

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References

1. Kravchenko, B. I. (2025). Tobacco aggression: modern challenges for dental practice. *Oral and General Health*, 6(2), 96-96.