25TH NATIONAL & 11TH INTERNATIONAL ANNUAL CONGRESS
ON RESEARCH AND TECHNOLOGY OF IRANIAN MEDICAL SCIENCES STUDENTS
URMIA UNIVERSITY OF MEDICAL SCIENCES, URMIA, IRAN

Using Artificial Intelligence and Machine Learning to Predict the Success of Dental Implant Treatment: A Systematic Review

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Citation:
Nikbakht MH, Amani Beni P, Shirban F. Using Artificial Intelligence and Machine Learning to Predict the Success of Dental Implant Treatment: A Systematic Review. *Iranian biomedical journal*. Supplementary (12-2024): 363.

ABSTRACT

Introduction: Nowadays, dental implants are widely used to replace missing teeth. However, complications, failures, and diseases are not uncommon. Accurate prediction of implant success is influenced by many factors, making it a challenging subject for dentists. One of the contributions of machine learning (ML) to the medical field is the prediction of treatment outcomes. We aimed to review studies using ML and artificial intelligence (AI) to predict dental implant treatment success.

Search Strategy: Our systematic review focused on the literature regarding methods for predicting the success of AI-assisted implant treatments. A search was conducted in five databases: MEDLINE/PubMed, EMBASE, Web of Science, Cochrane, and Scopus, using Keywords “artificial intelligence”, “machine learning”, “dental implants”, “prognosis”, and “prediction”. A manual search was conducted, as well. Studies that investigated the clinical applications of AI to predict implant success using patient risk factors were included. Review articles, letters to the editors, and posters were excluded. Relevant articles published up to October 2022 were identified and assessed for quality, and data was extracted by two reviewers.

Results: A duplication check was conducted, and 74 articles were identified. After screening and applying inclusion and exclusion criteria, seven studies were reviewed that investigated the success of implant treatment using AI methods. Different ML models and input data were used in the studies. Among the included studies, the accuracy, sensitivity, and specificity of these methods in all eligible studies ranged from 62.40% (for LR) to 99.25% (for NN), 48.08% (for K-NN) to 97.63% (for NN), and 61.11% (for DT) to 100% (for SVM), respectively.

Conclusion and Discussion: According to the findings, the NN method showed the highest accuracy and sensitivity, and the highest specificity belonged to SVM. They also reported that dental implant prognosis mostly depends on factors such as the mesiodistal position of the inserted implant, fixture width, and implant system.

Keywords: Artificial intelligence, Dentistry, Machine learning

[DOI: 10.61186/ibj.25th-11th-IACRTIMSS]