Chapter 2
A Systematic Review of the Impact of Artificial Intelligence (AI) on Dental Diagnosis

Sameer Shukla
https://orcid.org/0000-0002-1610-8417
Independent Researcher, USA

ABSTRACT

This chapter systematically reviews the impact of Artificial Intelligence (AI) on dental diagnosis, focusing on its applications in digital dentistry, particularly in rural areas where access to quality dental care is limited. We conducted a review of the literature examining research articles, medical trials and case reports that explore the use of intelligence tools, like Google Cloud Vision API and Vertex AI in dental diagnosis. The review looked into factors such as accuracy of diagnosis, effectiveness and impact, on patients results. The findings suggests that AI powered diagnostic systems greatly improve the accuracy and efficiency of diagnoses in detecting cavities, gum diseases and other oral health issues. Utilizing cloud based AI services offers options, for clinics in areas, with limited resources encouraging early detection and tailored treatment strategies. Despite the challenges associated with data privacy and the need for model validation

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INTRODUCTION

Artificial Intelligence is finding its applications in essentially all fields; in healthcare, it greatly enhances diagnosis, accessibility, and patient care. In dentistry, AI seems to be an exceptionally assuring solution, especially for areas where access to quality dental healthcare may not be so ideal. According to a study by (Mahdi et al., 2023), AI applications in dental healthcare improve diagnostic services in terms of effectiveness, accuracy, and accessibility. In this chapter, we will explore the transformative potential of AI in dental diagnostics, particularly in underserved rural areas.

Machine learning algorithms are computational models that learn from data patterns, enabling efficient diagnostics, as they process visual data for the identification of patterns often overlooked by the human eye. These tools are particularly valuable in dental diagnostics for conditions such as cavities and gum issues, thus offering early and more accurate detection. By leveraging these technologies, practitioners can reduce human error and streamline diagnostic processes, saving time and improving outcomes.

The use of AI tools such as Google Cloud Vision API and Vertex AI is revolutionary in dental diagnostics. Vision API can process X-ray and intraoral images, and Vertex AI is used for deploying machine learning models that are optimized for dental diagnosis (Shukla, 2023). These technologies help the providers in the rural areas to identify the diseases at the earliest and with great precision so that interventions can be made early and the need for complex treatments is eliminated. These tools help in performing repetitive and time-consuming back-office functions thus enabling the healthcare professionals to spend more time with the patients (Schwendicke & Krois, 2022).

However, AI adoption in dentistry is not devoid of challenges. There are issues related to data privacy, continuous model validation, and ethical considerations regarding the use of patient data that need to be addressed early enough. For example, compliance with data protection laws like HIPAA will be important in gaining the trust of stakeholders. Therefore, TAM and UTAUT provided useful frameworks to understand issues related to accuracy, cost-effectiveness, and ease of use that will affect the uptake of AI in dental practices, with an emphasis on those in rural underserved areas.

The application of AI in dental diagnosis has been systematically reviewed with respect to its potential transformative outcomes on rural healthcare. Individual sections of this review explore benefits, accuracy, and access improvements facilitated by AI, as well as challenges, such as data privacy concerns and infrastructural barriers to complete adoption. By doing this, the chapter also offers practical suggestions