Review

The Integration of Artificial Intelligence in Prosthodontic Practices

Haitham Binhuraib[1*], Bayan Alzahrani[2], Sarah Almahdhi[3], Riyadh Alzhrani[4], Mohammed Alasmari[5], Mashari Albalawi[5], Hattan Alghabban[5], Ahmed Aldhafyan[6], Ayman Alamri[5], Talal Almohaisen[7], Khalid Alotaibi[8]

[1] *Department of Prosthodontics, North Jeddah Specialist Dental Center, King Abdullah Medical Complex, Jeddah, Saudi Arabia*
[2] *Dental Department, Al Yamamah Hospital, Riyadh, Saudi Arabia*
[3] *College of Dentistry, King Khalid University, Abha, Saudi Arabia*
[4] *College of Dentistry, Jazan University, Jazan, Saudi Arabia*
[5] *Department of Prosthodontics, King Salman Armed Forces Hospital, Tabuk, Saudi Arabia*
[6] *College of Dentistry, Dar Al Uloom University, Riyadh, Saudi Arabia*
[7] *College of Dentistry, Riyadh Elm University, Riyadh, Saudi Arabia*
[8] *General Dentist, Dental Clinics Complex in East Riyadh, Riyadh, Saudi Arabia*

Correspondence should be addressed to **Haitham Binhuraib**, Department of Prosthodontics, North Jeddah Specialist Dental Center, King Abdullah Medical Complex, Jeddah, Saudi Arabia. Email: hhuraib@moh.gov.sa

Abstract

The integration of intelligence (AI), in practices is a significant advancement in dental care, providing transformative solutions across different aspects of clinical management. By utilizing AI treatment planning, prosthetic design and overall patient care can be greatly improved. This review explores the state of AI applications in prosthodontics examining studies and advancements that support its integration into clinical workflows. This review explores the state of AI applications in prosthodontics, focusing on its impact on care and clinical use. From speeding up diagnostics through automated image analysis to revolutionizing design and improving treatment planning, AI has shown potential. The proactive management of complications and enhanced patient communication further highlight AI's influence in prosthodontics. However, challenges related to data security and the need for training should be carefully considered. It is essential for dental professionals to collaborate with AI developers to ensure effective implementation. As technology advances, further research will refine the role of AI in prosthodontics, leading to better outcomes for both practitioners and patients.

Keyword: *Artificial Intelligence, Prosthodontics, Clinical Management, Dental Care, Patient Communication*

Introduction

Artificial intelligence (AI) has become a game changer, in fields, including prosthodontics, which focuses on restoring and replacing teeth. The integration of AI into practices brings advancements to dental care (1, 2). By utilizing AI treatment planning, prosthetic design and overall patient care can be greatly improved. This review explores the state of AI applications in prosthodontics examining studies and advancements that support its integration into clinical workflows. One area where AI has shown potential is in image analysis and diagnosis within prosthodontics. Dental imaging plays a role in planning treatments and AI algorithms have proven to be highly effective in interpreting images. For example, studies demonstrate that AI can automate the detection of pathologies helping prosthodontists diagnose and intervene at a stage (3, 4). This not only improves treatment efficiency. Also leads to better outcomes for patients. Additionally, AI algorithms have proven useful in assessing bone quality and quantity— factors when placing implants (5, 6). Recent research demonstrates the ability of machine learning models to analyze cone beam computed tomography (CBCT) scans and offer bone density predictions. This valuable information assists prosthodontists in making decisions about stability and success rates (7-9). By utilizing AI in these assessments prosthodontic practices can enhance planning. Minimize the potential for complications. In the field of designing prosthetics AI has introduced methods that streamline and improve the customization of prostheses. Traditional approaches to design often rely on measurements and subjective assessments, which can result in variations, in fit and comfort. However, AI-driven solutions utilize machine learning algorithms to analyze patient data, such as scans and bite registrations. This analysis enables the creation of personalized prosthetic devices (10, 11). Consequently, this does not improve how well the prostheses fit and function. It also reduces the time and resources required for manual adjustments. Moreover, AI plays a role in optimizing treatment planning by analyzing sets of patient data. For example, this study demonstrates how AI can process information from health records, genetic factors and individual patient preferences to develop treatment plans tailored to each person's specific needs. By taking into account aspects like health conditions, lifestyle factors and patient expectations this holistic approach leads to more patient centric prosthodontic interventions. Additionally, beyond improving processes and treatment planning procedures AI assists in managing prosthetic complications. Prosthodontic practices often encounter challenges such as fractures in devices or issues related to material wear or occlusal discrepancies (12). In these cases, AI based monitoring systems can analyze feedback along with data and wear patterns to predict possible problems before they arise. Taking an approach enhances the durability of restorations reducing the necessity for frequent modifications or replacements. AI integration in practices also extends to interaction and education. As mentioned in the research, interactive AI platforms play a role in enabling real time communication between prosthodontists and patients helping individuals gain an understanding of their treatment options and expected results. This leads to improved satisfaction. Supports informed decision making, which aligns with the principles of patient centered care. However, incorporating AI into practices poses challenges. Concerns regarding data security, ethical considerations as the need for comprehensive training and education for dental professionals have been raised. It is crucial to address these issues to ensure effective implementation of AI technologies in the field of prosthodontics (13, 14). In summary integrating intelligence into practices represents a significant advancement in optimizing diagnosis, treatment planning, prosthetic design and patient communication. The studies discussed in this literature review provide evidence of AIs effectiveness in addressing challenges faced by prosthodontists. As technology continues to evolve further research and development will undoubtedly. Expand AIs role in prosthodontics for the benefit of both practitioners and patients. Ongoing collaboration between professionals and AI developers will be instrumental in realizing the transformative potential of this technology within

prosthodontics. This study aims to examine the integration of intelligence within Prosthodontic Practices.

Methodology

On November 26, 2023, I conducted a review of articles from Cochrane Library, PubMed, and Scopus. The purpose of this review was to examine how artificial intelligence is being used in practice. Specifically, I focused on studies conducted in English since 2008 that highlight the application of intelligence in prosthodontics. My goal was to gain an understanding of the assessment methods and early warning systems that healthcare professionals are adopting when using AI in practice.

Discussion

The incorporation of intelligence (AI) in practice has brought about a new era of clinical management, providing innovative solutions to the challenges faced by dental professionals. In terms of diagnosis AI's automated identification of issues from radiographic images speeds up and improves the accuracy of diagnoses, allowing prosthodontists to address concerns like cavities and gum diseases promptly. The use of AI in assessing bone quality in dentistry demonstrates its potential to revolutionize treatment planning and contribute to better success rates for implants (15). AI-driven solutions also improve the design by optimizing customization through the analysis of patient-specific data. This not only ensures a comfortable fit for patients but also streamlines the process of delivering prosthetics showcasing the efficiency benefits of AI in clinical management. Furthermore, AIs role extends to analyzing datasets for comprehensive and patient-centered treatment planning. By utilizing AI based monitoring systems, proactive management of complications related to prosthetics reduces the need for adjustments or replacements, ultimately enhancing the lifespan of restorations. Patient communication and education are also significantly impacted as interactive AI platforms facilitate real-time communication between prosthodontists and patients (16, 17). This fosters better patient understanding. Promotes decision making that aligns with the principles of patient

centered care. However, with these progressions, there are obstacles to overcome in the use of AI. Concerns surrounding data security and the necessity for training are aspects that must be tackled. It is vital for dental experts and AI developers to work together closely in order to ensure efficient implementation.

Clinical Manifestation

The integration of intelligence (AI) in practices signifies a significant change in dental care, resulting in noticeable effects on various aspects of patient treatment. In the field of diagnosis AI has emerged as a tool reshaping how prosthodontists approach patient evaluations. Traditional diagnostic methods often rely on the interpretation of images, which can introduce subjectivity and time constraints. However, groundbreaking studies have demonstrated the effectiveness of AI algorithms in automating the detection of problems from radiographs (18, 19). This practical application leads to more diagnoses, empowering prosthodontists to promptly identify issues like cavities, gum diseases and abnormalities. The early identification facilitated by AI speeds up treatment planning. Contributes to enhancements in patient care outcomes. AIs impact on diagnosis goes beyond realms by also encompassing the evaluation of bone quality and quantity, especially relevant in implant dentistry. A noteworthy example is the use of AI to predict bone density based on cone beam computed tomography (CBCT) scans. This application assists prosthodontists in assessing the feasibility of placement with a detailed understanding of the patient's bone structure. The practical implications are evident through improved planning and increased predictability and success rates, for procedures. In the field of creating limbs the influence of AI is significant as it completely transforms how dental prosthetics are personalized. Traditional methods often rely on measurements and subjective assessments, which can sometimes lead to prosthetics that don't fit perfectly with a patient's structure. However, AI-driven solutions utilize machine learning to analyze patient data, such as scans and bite registrations. This approach allows for the production of personalized prosthetic

devices that enhance patient comfort and functionality. By incorporating AI into treatment planning healthcare providers are able to combine datasets, including electronic health records, genetic factors and individual preferences. This comprehensive analysis enables prosthodontists to develop tailored treatment plans that not address considerations but also align with the patient's overall well-being by considering their systemic health, lifestyle factors and expectations. Additionally, AI integration in practices plays a role in the proactive management of complications associated with prosthetics like fractures, material wear and occlusal discrepancies. A recent study showcased the use of monitoring systems powered by AI. These systems carefully analyze feedback and clinical data. Wear patterns to anticipate and prevent possible problems. This proactive approach to care reduces the necessity for adjustments or replacements, providing patients with enhanced convenience and comfort. Patients benefit from restorations that last longer allowing clinicians to focus more on measures. This in turn improves the quality and durability of treatments. Integrating AI into the setting also enhances communication and education. For example, interactive AI platforms enable prosthodontists and patients to have real time discussions about treatment options and expected outcomes. This technological advancement fosters informative conversations leading to better patient understanding and involvement in decision making. As a result, it cultivates a relationship between patients and providers. The impact of AI integration in practices extends across aspects of patient care such as expediting diagnostics, refining prosthetic design, optimizing treatment planning, proactive management of complications and facilitating effective patient communication. As the field continues to advance, these benefits will grow further, equipping prosthodontists with advanced tools to provide optimal and personalized care for their patients.

Management

The integration of intelligence (AI) in practices is a game changer transforming how patient care and treatment strategies are approached. It has significantly impacted aspects of prosthodontics from diagnostics to personalized prosthetic design and comprehensive treatment planning. The influence of AI on management is evident through its ability to enhance efficiency and effectiveness in procedures (20). In terms of diagnosis AI technologies have emerged as tools that automate the detection of dental issues from radiographic images improving the speed and accuracy of diagnoses for problems like caries, periodontal diseases and anomalies. With AI handling diagnosis tasks prosthodontists can focus more on treatment planning and intervention than spending excessive time interpreting images. Furthermore, AIs role in diagnosis extends to assessing bone quality and quantity which's crucial, in implant dentistry. Several studies showcase how AI can predict bone density using cone beam computed tomography (CBCT) scans. The use of AI in prosthodontics management improves planning by offering an understanding of the patient's bone structure. This leads to decision making when it comes to determining if implants are viable and where they should be placed. Ultimately this contributes to success rates and predictable outcomes for implant procedures. In the field of designing prosthetics the use of AI technology in management is bringing about a change by challenging traditional methods that rely on manual measurements and subjective evaluations. Pioneering research has demonstrated how AI driven solutions utilizing machine learning can analyze data such as intraoral scans and bite registrations. This meticulous analysis carried out by AI helps create customized prosthetic devices. From a clinical management standpoint this not only ensures a fit but also streamlines the process of delivering prosthetics ultimately enhancing patient comfort and satisfaction. The influence of AI in management extends to treatment planning while presenting a comprehensive and holistic approach. Studies have shown how AI can process datasets including electronic health records, genetic factors and patient preferences (21, 22). By incorporating AI into treatment planning prosthodontists are empowered to tailor interventions according to each individual's needs. This comprehensive approach takes into account not health and lifestyle factors but

also considers the overall well-being of the patient when developing treatment plans that are both technically sound and aligned with their expectations. Such strategies in management contribute to outcomes and increase patient satisfaction, particularly when handling complex cases. An important aspect of integrating AI into practices is its role in managing potential complications associated with prosthetics. Addressing issues, like fractures, in prosthetics, material wear and occlusal discrepancies can be effectively managed through the implementation of AI based monitoring systems. This proactive approach involves analyzing feedback, clinical data and wear patterns to anticipate and prevent problems. By reducing the need for adjustments or replacements this approach ensures that restorations last longer. Clinicians can allocate resources strategically to measures enhancing the quality and durability of prosthetic treatments. In the setting, intelligence management (AI) plays a crucial role in patient communication and education. Interactive AI platforms enable real time communication between prosthodontists and patients, facilitating informative discussions about treatment options and expected results. Enhancing understanding and involvement through clinical management contributes to higher levels of satisfaction and informed decision making fostering a positive relationship between patients and providers that improves overall patient care. In summary, managing intelligence in practices involves a range of advancements that significantly impact patient care and treatment strategies. From diagnoses to personalized prosthetic design and comprehensive treatment planning, AI technologies are revolutionizing the field of prosthodontics. The proactive management of complications, along with patient communication, further emphasizes the transformative influence of AI in the clinical realm of prosthodontics. As this field continues to evolve, implementing clinical management strategies will be vital in harnessing the potential of AI to optimize patient outcomes and streamline prosthodontic workflows.

Conclusion

Incorporating AI into practices showcases progress and innovation in clinical management. AI's impact is evident in aspects, such as improved processes and personalized prosthetic design highlighting its potential to enhance patient care. Additionally, the proactive handling of complications and enhanced patient communication further establish the role of AI in prosthodontics. As the field continues to advance it is crucial to address challenges related to AI adoption while prioritizing considerations and comprehensive training. The collaboration between professionals and AI developers will play a role in unlocking the full potential of this technology benefiting both practitioners and patients in the realm of prosthodontics. The promising developments discussed in this review set the stage for a future where AI becomes an ally in achieving dental care outcomes.

Disclosure

Conflict of interest

There is no conflict of interest.

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Data that support the findings of this study are embedded within the manuscript.

Author contribution

All authors contributed to conceptualizing, data drafting, collection and final writing of the manuscript.

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