

Artificial intelligence in dentistry: bridging knowledge and practice

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In recent years, the field of dentistry has witnessed significant advancements through the integration of artificial intelligence (AI). The book *Artificial Intelligence in Dentistry*, edited by Kaan Orhan and Rohan Jagtap, serves as a comprehensive guide that explores the vast potential of AI in enhancing dental practice. This article summarises key insights from the book, highlighting the transformative impact of AI on dental diagnostics, treatment and education.

AI-supported pathways in dental diagnostics

The integration of AI in dental diagnostics is a significant advancement in the efficacy and accuracy of disease detection and management. The book explores a variety of AI-supported pathways that are transforming the way dental professionals diagnose and evaluate oral health conditions.

The analysis of dental radiographs is one of the primary implementations of AI in diagnostics. Traditional methods of interpreting X-rays may be subjective and susceptible to human error. AI algorithms, particularly those that are based on deep learning, have been trained on extensive datasets of radiographic images, which has allowed them to accurately identify patterns and anomalies. These algorithms have the ability to detect dental caries in its early stages, identify periodontal bone loss and evaluate the severity of periapical lesions, frequently prior to the clinical manifestation of these issues.

AI is also instrumental in the diagnosis of obstructed teeth and the planning of their surgical extraction. AI systems can foresee the complexity of impaction and recommend the most suitable surgical approach by analysing radiographic data, thereby reducing complications and enhancing patient outcomes.

An additional substantial application is the evaluation of crown and root fractures. AI tools can improve the visualisation of fractures that may be challenging to identify using traditional methods, thereby enabling clinicians to make more informed decisions about treatment options. This is especially crucial in the prevention of superfluous extractions and the preservation of tooth structure.

AI-supported diagnostics are of assistance in the identification of root and canal morphology and the determination of working length in endodontics. The success of root canal procedures is contingent on the precise determination of the working length, and AI systems offer improved precision in measuring these critical parameters. Furthermore, AI assists in the identification of intricate root canal systems that can be difficult to navigate without the use of sophisticated imaging and analysis.

AI is capable of diagnosing temporomandibular joint (TMJ) disorders and detecting conditions such as obstructive sleep





apnoea (OSA). AI can analyse joint sounds and movements in TMJ diagnostics, providing non-invasive methods for evaluating joint health. AI systems can identify patients at risk for OSA by evaluating cephalometric radiographs and other data, thereby facilitating opportune interventions.

Additionally, AI is demonstrating its invaluable worth in the early detection of buccal mucosal lesions, including potentially malignant disorders. The prognosis of oral malignancies is significantly enhanced by early diagnosis, and AI systems can help in the screening of large populations, ensuring that high-risk individuals receive the requisite follow-up and treatment.

The book also delves into the role of AI in predictive analytics, including the estimation of the necessity for retreatments and the prediction of the eruption patterns of third molars. These predictive tasks are instrumental in the planning of future dental interventions and the counselling of patients regarding prospective oral health issues.

In general, the field of dental diagnostics is being revolutionised by AI-supported pathways, which provide unprecedented levels of precision, efficiency and predictive power. Dental professionals can enhance patient care by developing more precise diagnoses and implementing more effective treatment plans through the utilisation of these technologies.

Enhancing treatment planning and execution

AI's function is not limited to diagnostics; it also includes the facilitation of treatment planning and execution. AI technologies assist in the identification of optimal treatment pathways in specialities including Orthodontics, Endodontics, Prosthodontics and Oral and Maxillofacial Radiology. For instance, AI algorithms can evaluate the complexity of root canal systems, thereby facilitating the planning of procedures more efficiently for endodontists.

AI assists in the design of prosthetics with high precision, thereby guaranteeing a better fit and function, in the fields of restorative dentistry and implants. The efficacy of dental practices is not the only benefit of AI integration in these areas; it also improves clinical outcomes.

Innovations in dental education and research

The book also explores the transformative potential of AI in dental education. The integration of AI-driven tools into dental curricula is intended to provide students with the necessary skills for diagnostics and treatment planning. In a simulated environment, these tools enable students to practise and refine their abilities, thereby providing interactive learning experiences.

Furthermore, the book presents state-of-the-art research on the applications of AI in 3D and bioprinting, which are on the brink of revolutionising tissue engineering and dental prosthetics. These technologies have the potential to develop personalised dental solutions that are customised to the specific requirements of each patient.

ETHICAL AND LEGAL CONSIDERATIONS

As with any technological advancement, the incorporation of AI in dentistry is subject to ethical and legal considerations. The book offers a comprehensive examination of these aspects, providing practitioners with guidance on the responsible application of AI. The exploration of issues such as data privacy, informed consent and the medico-legal implications of AI-driven decisions ensures that dentists navigate this new landscape with caution and professionalism.

Future perspectives

Artificial Intelligence in Dentistry concludes by exploring the future potential of AI in the dental field. The book envisions a future where AI technologies are seamlessly integrated into every aspect of dental care, from routine check-ups to complex surgical procedures. As these technologies continue to evolve, they are expected to further improve the quality of care, increase accessibility and reduce costs.

Conclusion

Artificial Intelligence in Dentistry offers a comprehensive perspective on the transformative influence of AI on the dental field. AI technologies are poised to transform dental diagnostics, treatment and education by bridging the divide between knowledge and practical application. Dentists and specialists must remain informed about these advancements as the field continues to evolve, thereby ensuring that they fully leverage the potential of AI to improve patient outcomes and enhance patient care.