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Exploring the applications of artificial intelligence in various commercial dental professional software

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Human teeth were classified into incisors, lateral incisors, canines, premolars, and molars, each possessing unique characteristics. Since teeth lacked the ability for self-repair or regeneration, the preservation of natural teeth was the primary goal of clinical dental treatment. For each patient, a comprehensive assessment that incorporated the diagnosis, medical imaging, and individual preferences was required. Consequently, a significant amount of involvement from dental professionals was necessary to formulate tailored treatment plans. Artificial intelligence (AI) technology demonstrated its ability to analyze vast amounts of data and provide optimal feedback. AI adapted to different scenarios and generated context-specific outcomes, making it highly valuable in fields requiring individualized treatment planning.[1]

In dentistry, the scope of AI applications evolved from traditional diagnostic tasks to the design and fabrication of dental prostheses. As AI technology matured, it became an integral feature of most commercially available dental software. Therefore, this study focused on the application of dental commercial software in the fabrication of dental prostheses, exploring the advancements in AI-driven developments in restorative dentistry. The transition of dental prosthesis fabrication from traditional manufacturing to digital workflows was a critical factor in enabling the integration of AI technology. Common applications in dental prosthesis fabrication included oral scanning, dental prostheses, and corrective and surgical guides (Table 1).

Oral scanning software primarily utilized AI technology to identify tooth positions and optimize scanned digital files. During the scanning process, AI removed interference from non-oral tissues, ensuring accurate and clean imaging. In practice, the optimization of models using AI considered variations in equipment, as different devices yielded differing outcomes.[2] Dental prostheses software, compared to other categories, offered a broader range of manufacturers. It employed AI technology to replicate the morphology of adjacent or contralateral teeth for crown restoration design. Another approach involved using tooth morphology from a database to refine and complete crown designs based on the condition of the abutment tooth.[3] The software adjusted occlusion and interproximal spaces according to the spatial configuration of the abutment model. Corrective software calculated the movement rate and sequence based on the treatment plan proposed by the dentist.[4] It generated digital models for different stages of tooth movement, facilitating the fabrication of orthodontic aligners.[5] Additionally, it enabled modifications to dental models for specific requirements, such as creating undercuts or excavation. Surgical guide software incorporated cone-beam computed tomography images to accurately capture hard tissue structures, providing essential support

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Table 1 Overview of commercial software employing artificial intelligence (AI) technology in restorative dentistry. The table lists manufacturers, their software products, associated features, specific AI functionalities, and software versions.

Manufacturer	Software	Features	Artificial intelligence (AI) technology	Version
3Shape (Copenhagen, Denmark)	Unite	Oral scanning software	1. AI mouth scan detection 2. AI port scanning post-processing	Unite III
	Dental system	Designing dental prostheses	1. AI detects suitable tooth database 2. AI automatically designs crowns 3. AI automatic detection of tooth position	Dental system 2024
	Ortho system	Corrective treatment plan	1. AI automatic tooth separation 2. Filling model undercuts 3. Model digging holes	Ortho system 2023
	Implant studio	Designing surgical guides	1. AI automatically generates guides	1.7.82
Printin (Taoyuan, Taiwan)	DentDesign	Designing dental prostheses	1. Automatically grab crown margin 2. Automatic crown design 3. Automatic design adjusts crown occlusion and contact space.	v2.1.60102.0
Zirkonzahn (South Tyrol, Italy)	Modellier	Designing dental prostheses	1. Automatically copy tooth shape (Mirror or copy function).	Version 9532
Dentsply Sirona (Charlotte, NC, USA)	inLab	Designing dental prostheses	1. Automatically copy the mock-up was or the tooth shape of the previous complete tooth (BioCopy function).	22.2.0
Medit (Seoul, South Korea)	Medit ClinicCAD	Designing dental prostheses	1. Automatically generate coping	0.9.6

for implant planning. Additionally, the software utilized AI to automatically define guide areas and optimize thickness and occlusal distance, ensuring precision in surgical procedures. While AI technology significantly enhanced the efficiency and accuracy of dental prosthesis fabrication, the final outcomes still required rigorous oversight by dentists or dental technicians to ensure the correctness and success of the treatment.

In summary, the integration of AI into the design and manufacturing processes of dental prostheses appeared highly promising. Under the supervision of dentists and dental technicians, AI technology provided substantial support and efficiency. Many dental software developers had established robust AI capabilities, indicating a bright future for the application of AI in dental healthcare.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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