



Editorial

Digital transformation in dentistry: The expanding role of intraoral scanners and CAD-CAM technology

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Received: 05-05-2026 Accepted: 14-05-2026 Available Online: 23-05-2026

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The field of dentistry is undergoing a profound transformation driven by rapid advancements in digital technology. Among the most significant innovations are intraoral scanners (IOS) and computer-aided design/computer-aided manufacturing (CAD-CAM) systems, which are redefining clinical workflows, enhancing precision, and improving patient experiences. As we move toward a fully digital era, these technologies are no longer adjuncts but essential components of modern dental practice.

1. Evolution of Digital Dentistry

Traditional dental workflows have long relied on elastomeric impressions, gypsum casts, and manual laboratory procedures. These methods, although reliable, are associated with limitations such as patient discomfort, dimensional inaccuracies, and increased procedural time. The advent of intraoral scanners and CAD-CAM systems has enabled direct digital data acquisition and streamlined prosthetic fabrication, significantly improving efficiency and precision.^{1,2}

Recent literature highlights that digital scanning technologies have revolutionized diagnostic capabilities and treatment planning, allowing clinicians to capture detailed three-dimensional representations of oral structures with high accuracy.³

2. Clinical Applications and Advantages

The clinical applications of IOS and CAD-CAM systems have expanded across multiple domains, including prosthodontics, implantology, orthodontics, and maxillofacial rehabilitation.² Digital impressions demonstrate improved patient comfort, reduced chairside time, and enhanced communication with dental laboratories.

Contemporary studies (2024–2025) have shown that intraoral scanners provide high trueness and precision, even in complex clinical scenarios such as subgingival margin capture and full-arch implant rehabilitation.^{4–5}

CAD-CAM systems further enhance restorative outcomes by enabling standardized fabrication of prostheses, reducing operator variability, and ensuring consistent marginal adaptation. The ability to fabricate restorations using both subtractive (milling) and additive (3D printing) methods has significantly improved clinical outcomes.⁶

3. Technological Advancements and Integration

Recent innovations in digital dentistry (2023–2025) have focused on cloud-based workflows, artificial intelligence (AI), and enhanced scanner technologies. The evolution of intraoral scanners now includes features such as real-time data processing, photogrammetry, and improved soft tissue capture, contributing to greater clinical accuracy and efficiency.⁷

Furthermore, integration with CBCT imaging enables guided implant surgery, facilitating prosthetically driven implant placement with higher predictability.⁸ The emergence of AI-based models for analyzing intraoral scan data has opened new avenues for automated diagnosis and treatment planning, further enhancing clinical decision-making.⁹

4. Challenges and Limitations

Despite significant advancements, certain limitations persist. The high initial cost of equipment, need for technical expertise, and variability in accuracy for full-arch scans remain challenges for widespread adoption.^{5,10} Additionally, data management and standardization across different software platforms require further refinement.

5. Future Perspectives

The future of digital dentistry is strongly aligned with AI integration, machine learning, and fully automated workflows. Emerging technologies are expected to enable real-time diagnostics, predictive treatment planning, and personalized dental care. Continuous improvements in

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<https://doi.org/10.18231/j.jaoh.12877.1779526023>

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scanner accuracy, software algorithms, and biomaterials will further enhance the scope of CAD-CAM dentistry.⁹

6. Conclusion

Intraoral scanners and CAD-CAM technology represent a paradigm shift in modern dentistry, offering enhanced precision, efficiency, and patient-centered care. With continuous technological evolution and increasing accessibility, digital dentistry is poised to become the standard of care, transforming both clinical practice and dental education.

7. Conflict of Interest

None.

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Cite this article: Paul R. Digital transformation in dentistry: The expanding role of intraoral scanners and CAD-CAM technology. *JAOH.* 2026;3(1):1-2.