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Clinical Integration of Digital Dentistry Applications: Transforming Dental Care, Education, and Global Oral Health

Extended reality (XR), encompassing virtual, augmented, and mixed reality, is emerging as a unifying interface that enhances and expands the clinical and educational potential of digital dentistry technologies. When integrated with intraoral scanning, facial scanning, cone-beam computed tomography, computer-aided design and manufacturing (CAD/CAM), and artificial intelligence–driven workflows, XR enables immersive visualization and interaction with comprehensive patient-specific datasets. In dental education, this integration supports advanced simulation and training environments that improve spatial perception, procedural understanding, and skill acquisition through interactive, risk-free learning experiences.

From a clinical perspective, XR enhances surgical planning by allowing three-dimensional assessment and manipulation of digitally acquired anatomical data, facilitating improved accuracy, interdisciplinary communication, and treatment predictability. During surgical procedures, XR-based navigation systems can overlay preoperative planning data onto the operative field in real time, supporting precise execution of digitally planned treatments and contributing to improved clinical outcomes and patient safety. By bridging digital data acquisition, planning, and clinical execution, XR plays a pivotal role in advancing the precision, efficiency, and translational impact of digital dentistry workflows.

Keywords: Digital Dentistry- CAD/CAM – Extended Reality(XR) – Intraoral scanning – Global Oral health- Dental education- Dental Simulation- Face scanning

Biography

Hamed Marmarshahi is a dental researcher and international speaker with a focus on digital dentistry and emerging technologies. His interests include intraoral scanning, CAD/CAM systems, photogrammetry, artificial intelligence, and extended reality (XR), with emphasis on clinical integration, surgical planning, dental education, sustainability, and global oral health. His work explores how digital workflows can enhance treatment precision, improve educational outcomes, reduce costs, and support environmentally responsible dental care across diverse healthcare settings.

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