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Editorial

Prosthodontic Research in the Digital Era: Current Trends and Future Prospects

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Digital transformation has become a buzzword across many industries, and the dental field is no exception. Based on electronic health data, digital transformation is acknowledged as one of the biggest game-changers of the twenty-first century, tackling both current and future challenges in dental and oral healthcare. A novel method for addressing today's major healthcare issues, such as an ageing population with a higher incidence of chronic diseases and higher lifetime treatment costs, is offered by the utilization of digital tools and apps. Health care providers may improve patient satisfaction, develop loyalty and trust, and streamline operations with the aid of digitalization. The trend of digitalization has also been influenced and nurtured by the social and cultural habits of civilised society in industrialised nations. These behaviours include urbanism, centralization, mobility, and constant accessibility through the use of smartphones, tablets, and the internet of things (IoT). In order to ensure transparency for all parties involved—including patients, healthcare providers, universities and research institutions, the medtech industry, insurance, the public media, and state policy—digital dentistry necessitates managing expectations in a more pragmatic and realistic manner. It is not to be construed that digital smart data technology will eventually take the place of people who can provide dental competence and patient empathy. The dental team in charge of digital applications is still crucial to patient care and will always be so. Many difficulties arise in the process of gathering, storing, and analysing digital biological patient data. Safeguarding patient data for optimal safety requires not just technical considerations for managing massive volumes of data, but also adherence to globally established norms and ethical guidelines.[1]

There are four main categories that best describe the advantages of digital dental technologies in Prosthodontics. The first and foremost is improved communication. Dental laboratory staff, patients, dentists, and other stakeholders may all communicate clearly with the help of computerized patient records. Furthermore, digital radiographs and pictures depicting intraoral conditions improve the information exchange between medical professionals and patients. One of the main benefits of integrated electronic patient records is error-free, real-time communication. Enhanced record keeping, data fidelity, workflow efficiency, and therapeutic outcomes are among the benefits of increased quality. Real-time clinical improvement is made possible by intraoral scanning of tooth preparations that are examined in highly contrasted, magnified fields on a computer screen while the patient is in direct view. Data archiving for specific patients is the third benefit. The following are some benefits of using 3-D archived diagnostic casts: a) long-lasting images without causing damage or loss to the original casts; b) allowing the images to be interfaced with other images for analysis using cutting-edge analytical and design tools; c) removing human error; and d) reduced costs for storage. The fourth and most significant advantage of digital technology in Prosthodontics is its favourable effect on patient satisfaction. More advanced treatment plans are driven by the enhanced diagnostic data. Several factors, such as time constraints, IT support costs, a lack of basic computer skills, disruptions to workflow, privacy and security concerns, interprofessional and intersystem connections, and technical and expert support, are impeding the adoption of digital technology in Prosthodontics.[2,3]

Several digital processes for production processing in Prosthodontics have already been incorporated into treatment procedures, particularly in the quickly expanding fields of rapid prototyping (RP) and computer-aided design/computer-aided manufacture (CAD/CAM). Artificial intelligence (AI) and machine learning (ML) have created new opportunities for automated processing in radiological imaging. Furthermore, the technology underlying the superimposition of various imaging files to create virtual dentistry patients and

non-invasive simulations comparing various outcomes before any clinical intervention is known as augmented and virtual reality, or AR/VR. These exciting new technologies—whose potential applications are still up in the air—have been made conceivable by increased IT capability.[1,2,3]

The process of rapidly and autonomously creating three-dimensional (3D) models of a finished product or a component of a whole using 3D printers is known as rapid prototyping. Complex 3D geometries can be produced at a reasonable cost with minimal material waste, thanks to the additive manufacturing technique. The workpiece is virtually sliced into multiple two-dimensional layers. The tool-path is then generated by the AM machine in both the x and y dimensions. A three-dimensional component is formed by sequentially depositing each material layer on top of the other. The foundation of this novel approach is the slicing of a three-dimensional CAD model into numerous thin layers, which are then built one after the other by manufacturing machinery using the geometric data. Dental technology can benefit greatly from RP's mass manufacture of dental models and its ability to fabricate implant surgical guides. Large-scale, simultaneous production in a repeatable, standardized manner is highly advantageous from an economic perspective.4

Augmented reality, or AR, is an interactive technology that uses computer-animated perceptual data to enhance a real-world experience. Stated differently, augmented reality is the addition of virtual content to the physical world. Usually, it involves superimposing extra digital data on real-time pictures or movies. In contrast, virtual reality relies solely on artificial, non-reality-connected computerized settings. Every imaginable form of sensation, primarily visual, aural, and haptic, can be employed alone or in any combination, depending on the technique. In addition to several fascinating advancements for patients and healthcare professionals, AR/VR technologies are currently finding a growing number of applications in the field of Prosthodontics as a whole.[5,6]

Artificial Intelligence has come a long way in the last ten years. The field of Prosthodontics is about to benefit from the most intriguing AI applications that are just around the corner. Though AI is developing quickly, it will never be able to fully replace human intelligence, skill, or capacity to make decisions. Artificial Intelligence (AI) in prosthodontics is growing exponentially. The implementation's results are on par with, and sometimes even better than, those of humans. AI can be seen as a potential tool in every area, including the identification of marginal lines, the classification of denture fixtures and maxillofacial prosthesis, and the reduction of human error in implant cementation. Furthermore, AI cannot take the role of human knowledge, skill, or treatment planning; it can only support clinicians in carrying out their responsibilities in a professional manner. AI is generally recognized as a great tool for Prosthodontists, despite the fact that there are still obstacles to be addressed, including data collection, interpretation, computing power, and ethical issues. With careful design and long-term clinical validation, AI can be transparent, unbiased, repeatable, and user-friendly.[7,8]

Future research should emphasize the connection between oral and general health in order to concentrate on patient-centered outcomes and personalized therapy. Research in Prosthodontics ought to be useful to society in this context. It shouldn't only produce papers for scientific journals; instead, it should aim to improve clinical protocols. Research and development in material science and related technical applications aim to preserve tooth structures with early diagnosis, repair of dental conditions to attain aesthetics, function with high degree of predictability, along with fewer appointments. Digital technology has a significant impact on patient motivation, clinical aspects, laboratory procedures, student training, practice management, and research.

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Dr Vivek V. Nair
Editor, IPS Kerala