Integrating Digital Technologies in Dentistry to Enhance the Clinical Success

Humagain M,[1] Rokaya D[2]

At present, there has been a massive advancement in digital technologies in dentistry. Digital technologies can be integrated into dentistry and medicine for the diagnosis and treatment of a disease. In dentistry, its applications include data acquisition to prosthesis fabrication. Since the invention of computer-aided design/ computer-aided manufacturing (CAD/CAM) system, milling systems, rapid prototyping, virtual reality simulators, augmented reality, and three-dimensional (3D) printing of dental biomaterials, and these have revolutionized and created a new treatment modality.[1-3] Due to the massive advancement and evolution in the optical scanning and designing technology has led the shift from 2D to three-dimensional (3D) with the use of 3D leading to disruption in the treatment modality.[4-6] The face landmarks can be recorded digitally from the 3D face scanning using the scanner and can be used for facial recognition, facial cosmetic planning, reconstructive surgery, and maxillofacial rehabilitation.[7,8] Hence, 3D face scan and intraoral scan can be superimposed with CBCT scan for the facial analysis, occlusion analysis, 3D smile design, and even digital/ virtual face bow transfer and full mouth rehabilitation.[9-13]

Intraoral scanners (IOS) have become one of the most valuable dental-treatment devices for patients, dentists, and dental technicians. The IOS simplify the procedures in the clinic, eliminates plaster models, provides real-time impression scanning and visualization, allows improved communication between the dentist, patients, and dental technician, reducing errors and clinical time of dentists and dental technicians.[14] Accuracy of IOS can be enhanced by reducing the span of scanning, scanning length, and ensuring the scanned surfaces exhibit minimal irregularities.[15]

Similarly, dental imaging has also advanced over recent years. Most x-ray based diagnostic technology been digitized with the possibility of low dose 3D computed tomography imaging and many optical imaging techniques have been adopted in more therapeutic imaging of the dental patient.

Additive manufacturing (3D printing), a advanced processing technique, can be applied to plastic, metal, ceramic, concrete and other building materials.[16] 3D printing has enormous potential to ameliorate oral health care in research, clinical treatment, and education in dentistry. 3D printing technology can be utilized in different specialties of dentistry, including prosthodontics, oral and maxillofacial surgery, orthodontics, endodontics, and periodontics.[17] Recently, there is recent growth of 3D printing from rapid production prototypic parts and models with readily customizable production of working parts. Various polymeric materials can be 3D designed and printed for various dental applications.[18,19] There is tremendous advantage of in situ photopolymerization as well as the ability to select from a variety of preformed processible polymers.

Furthermore, the use of newer materials such as polyether ether ketone (PEEK) and polyether ketone ketone (PEKK) in dentistry and medicine for various applications using CAD/CAM technology resulted in better treatment outcomes.[11,20] Finite element (FE) modeling has become a useful tool for modeling complex structures and analyzing their mechanical properties.[21,22] It is an ultimate method. A key factor for the success or failure of a dental implant is the way stress is transferred to the surrounding bone.[21] Hence, FE analysis can be used for the calculation of the effects of stress on the implant and surrounding bone in implant dentistry.

In conclusion, there has been a massive advancement in the digital technologies in dentistry and medicine, which includes from chairside scanning to printing technology, and the biomaterials and techniques have been continuous upgrading.

[1]Department of Periodontology and Oral Implantology, Kathmandu University School of Medical Sciences, Dhulikhel, Kavre, Nepal.

[2]Department of Clinical Dentistry, International College of Dentistry, Walailak University Bangkok 10400, Thailand.

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