COMPUTER-AIDED AND 3D PRINTING TECHNOLOGIES; NEW FRONTIERS IN RECONSTRUCTIVE SURGERY

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Computer-aided and 3D printing technologies have recently become accepted standard of care protocol for preoperative surgical planning and in the design prosthesis. With the recent advancements in software developments 3D modeling and simulation allows virtual reconstruction of the any anatomical part including craniofacial structures. This enables simulation of the surgical procedure, while ensuring accurate intra-operative execution of surgery with a predictable optimal postoperative result. Rapid prototyping on the other hand involves creating a physical 3D model from a computer model. The technology has been used by industry to create intended consumer products, including automobiles, toys, and computers where Models can be analyzed and modified before production is planned (1). There are five major types of rapid prototyping: Stereolithography(STL), selective laser sintering(SLS), fused deposition modeling, multijet modeling, and 3D printing. In STL, a laser emitting ultraviolet light causes local polymerization of a pool of photosensitive resin in shapes corresponding to each CT slice while in selective laser sintering, a laser is used to fuse small plastic, metal, or ceramic particles into a 3D object. In fused deposition modeling, a plastic is melted and extruded through a nozzle that can move horizontally and vertically to lay down plastic according to CT slice information. In the multijet model process, layers of powder are selectively bonded by a water-based ink that is released in the shape corresponding to the CT slice information. In 3D printing, a photopolymer-based resin is jetted via high-resolution inkjet and cured using ultraviolet light. 3D printing has found application in maxillofacial surgery, neurosurgery, cardiovascular surgery and orthopaedics. (2). In the field of osseointegrated implantology modeling and simulation software provides surgeons the ability to work interactively with patient-specific virtual models to simulate surgical procedures and improve the planning process. This is followed by the fabrication of the custom-fitting surgical guide which serves as the link between virtual implant planning and surgery(3).

As would be expected, any technical process could produce errors, which must be minimized using quality assurance processes of regular calibration and validation. Currently in the market, commercial low cost 3D printers are increasingly becoming available and although concerns have been raised about their validity and reliability some authors have concluded that Plastic models generated using the low-cost 3D printers provide dimensional accuracies comparable to other well -established rapid prototyping technologies. Validated low-cost 3D printers could, therefore represent a step toward the better accessibility of rapid prototyping technologies in the medical field (4).

In the current issue of African Journal of Oral health sciences Nguyai et al (5) have highlighted the recent introduction of 3D printing technology in Kenya with the use of low-cost printers. This is a welcome and an overdue development in our profession and will go a long way in providing an extra planning tool in maxillofacial surgery in the region.

Reference

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