Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 6 Issue 1 January 2023

Short Communication

Three-Dimensional (3D) Printing Technology in Traumatology: is it the Present or the Future?

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DOI: 10.31080/ASOR.2022.06.0662

Received: November 24, 2022

Published: December 13, 2022

Three-dimensional printing (3D) is an additive manufacturing technique, which through digital models of a patient, obtained through different techniques such as computed tomography (CT), allows the manufacture of custom made and specific structures for each patient, in real size, by using plastic materials [1,2].

This is a growing technology, used nowadays in the field of engineering, architecture, entertainment, education, in addition to its use in a variety of health areas, which has had an explosive increase in the number of publications per year since 2013 that are found through electronic medical databases such as PUBMED and SCOPUS [3]. In this field, for example, we find the dental area, where the use of small and custommade implants is required [4]. Within the field of medicine, there is currently a great interest in various areas, such as regenerative medicine and tissue engineering with the bioprinting of organs, (heart, liver, kidney, etc) [5,6].

Undoubtedly, a specialty of medicine in which it is generating great interest is Traumatology and Orthopaedcis, through the printing of orthoses/prostheses, surgical instruments and anatomical models [7,8]. It has also shown benefits in the planning of surgeries, facilitating the understanding of fracture patterns and more personalized planning of surgeries, allowing the surgeon to visualize the anatomy of each patient [9]. Within this area, this technology has shown benefits, for example, in shoulder replacement surgeries, where 3D printing is used as a guide for inserting the glenoid component [10] which is considered the most complex part of the surgery, since a small deformity can lead to excessive retroversión, tilt or even a perforation of the glenoid vault [11]; Iannotti., *et al,* using bone models, compared the position of the pins by using 3D printing vs the standard method, showing an increase in accuracy of 3.7° ± 0.9° in version, 8.1 ± 1.2° in inclination and 1.2 ± 0.2 mm in location [12]. Similarly, the study by Berhouet., *et al,* analyzed the position of the glenoid component of 10 patients who underwent total shoulder arthroplasty surgery in which this technology was used as a means of preoperative planning, achieving changes in the version, inclination and rotation of the glenoid [13].

This technology is also being used in hand surgeries, which are complex surgeries and require great precision, giving crucial information in the preoperative planning, allowing understanding of complex fractures, unions/malunions, to practice reduction and/or fixations and even to measure the size of the bone grafts [14]. Studies, such as that of Chen C., *et al.* [15], have shown that by using this technology in the preoperative setting, operating time, blood loss and the use of x-rays are significantly reduced.

On the other hand, 3D printing has generated an intraoperative aid, through the printing of cutting guides and for the positioning of plates, which have been used for the cutting of both diaphyses and metaphysis [16,17], and even epiphysis when the joint has been compromised [18].

Finally, in the knee area, in which our team has more experience, this technology has shown great benefits, as shown in the study by Ozturk., *et al,* who compared different surgical outcomes when performing surgeries of complex fractures of the tibial plateau by planning with 3D printing vs CT, and evidenced shorter surgical times (89 ± 5.9 mins vs 127 ± 14.5 mins respectively), lower blood loss (160.5 ± 15.1 ml vs 276 ± 44.8 ml), shorter tourniquet times (74.5 ± 6 mins vs 104.5 ± 5.5 mins) and reduced the use of intraoperative x-rays (10.7 ± 1.76 times vs 18.5 ± 2.17 times) [19]. Shen., *et al.* also analyzed the quality of reduction in tibial plateau fractures using 3D models vs conventional CT, demonstrating an "excellent" result in 75% vs 45% of cases, according to Rasmussen's score [20].

In our experience, 3D printing has been very useful especially in the preoperative setting by changing the surgical plan, especially for the number of plates to use and in the surgical approach (work still under development). We believe that, undoubtedly, 3D printing is presented as a useful tool in various areas of health, but especially in Traumatology and Orthopaedics, being a great contribution in the pre, intra and postoperative setting, therefore it is very likely that we will continue to see an increase in its use and a greater interest in generating publications in the coming years.

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