v. 3, n. 28, 2023

International Journal of Health Science

3D PRINTED ORTHOPEDIC PROSTHESES: APPLICATIONS AND RECOMMENDATIONS IN ORTHOPEDIC TRAUMA

Marcus Vinícius Gomes Martins
PUC Goiás - Pontifícia Universidade Católica de Goiás
Goiânia - Goiás
http://lattes.cnpq.br/2315707599793087

Isabela Henz Tonial
PUC Goiás - Pontifícia Universidade Católica de Goiás
Goiânia - Goiás
http://lattes.cnpq.br/8439745993008643

Isabella Oliveira Freitas Barbosa
PUC Goiás - Pontifícia Universidade Católica de Goiás
Goiânia - Goiás
http://lattes.cnpq.br/2358473788316454

Abner Fonseca de Araújo
PUC Goiás - Pontifícia Universidade Católica de Goiás
Goiânia - Goiás
http://lattes.cnpq.br/5485397901564093

Gabriel Antônio Ferreira Alves
PUC Goiás - Pontifícia Universidade Católica de Goiás
Goiânia - Goiás
http://lattes.cnpq.br/8268315795271176

Frederico Ribeiro Dourado
PUC Goiás - Pontifícia Universidade Católica de Goiás
Goiânia - Goiás
http://lattes.cnpq.br/0824372200427263

Murilo Dionísio Parreira Lira
PUC Goiás - Pontifícia Universidade Católica de Goiás
Goiânia - Goiás
http://lattes.cnpq.br/2320294089787746

Fernando José Ferro Filho
PUC Goiás - Pontifícia Universidade Católica de Goiás
Goiânia - Goiás
http://lattes.cnpq.br/2779208523806568

Beatriz Costa de Oliveira
PUC Goiás - Pontifícia Universidade Católica de Goiás
Goiânia - Goiás
http://lattes.cnpq.br/9583204996200340

Thiago Assis Venâncio
PUC Goiás - Pontifícia Universidade Católica de Goiás
Goiânia - Goiás
http://lattes.cnpq.br/7621674895110296

Jose Nicolas Andraos Filho
UFG - Universidade Federal de Goiás
Goiânia - Goiás
https://orcid.org/0009-0004-3645-1329

Maria Fernanda Borges
Faculdade de Medicina de Rio Verde - Campus Aparecida de Goiânia
Goiânia - Goiás
http://lattes.cnpq.br/0281478931633339

Abstract: Three-dimensional (3D) printing allows the manufacture of personalized and precise orthopedic prostheses based on computed tomography. These prostheses have proven to be important in the treatment of complex fractures, allowing the creation of printed surgical guides, specific anatomical models and simulation practice models. 3D technology has also allowed orthopedic surgeons to better understand fracture patterns, prepare detailed preoperative plans and promote individual postoperative therapy for each case. The 3D printing technique has shown the best results in terms of reducing surgery time, loss of blood volume, less exposure to fluoroscopic agents during the procedure, lower frequency of post-surgical complications, better evaluation of clinical parameters and better radiographic evaluation. The systematic review conducted on the PubMed platform evaluated the factors associated with 3D printed prostheses, analyzing the precision in different orthopedic operations, the effectiveness in the surgical treatment of patients, the clinical parameters used, the customization and individualization of these prostheses. The most frequent indications are acetabular and joint fractures and poor alignment. However, 3D printing still faces some limitations, such as high cost, production time, exposure to radiation, and low investment by hospitals in these 3D models. In summary, 3D technology demonstrates the potential to become a powerful tool in personalized and effective treatments in orthopedics, providing better results for rehabilitation processes. 3D orthopedic prostheses have great potential to further optimize orthopedic medicine in Brazil, but for that to happen, it is necessary to overcome the obstacles that hinder the advancement of this surgical method, such as the high financial cost and the time to prepare individual parts, through technological

investments and training in its production base.

Keywords: Prosthesis, 3d, trauma, orthopedics, printing.

INTRODUCTION

Three-dimensional (3D) printing allows the manufacture of physical products from computed tomography. Under this bias, some manufactured objects contribute to a more appropriate surgical approach in fractures that are difficult to treat, based on the greater precision of a surgical plan, that is, preoperative planning, reduction of morbidity during the procedure, in addition to improving treatment. avoiding possible intercurrences that eventually, with conventional treatment, could occur. Thus, given the new technology that is still being implemented, surgical time tends to decrease, improving both preoperative and intraoperative decisions and a better postoperative period based on recent modern techniques based on high-tech computerized planning and printing. 3D.

METHODOLOGY

The present study is a systematic review conducted on the PubMed platform, using the descriptors "3d printing" and "Orthopedic trauma", with the following inclusion criteria: articles published in English and Portuguese, with publication time frame from 2019 to 2022, excluding duplicate studies that do not fit the purpose of the study.

OBJECTIVES

Evaluate the factors associated with 3D printed prostheses, analyzing the precision in different orthopedic operations, the effectiveness in the surgical treatment of patients, the clinical parameters used, the customization and individualization of these prostheses.

RESULTS

The use of 3D printing technology in orthopedic surgery has been demonstrating its importance in the treatment of complex fractures such as comminuted, displaced or those involving joint surfaces. The most frequent indications are acetabular and joint fractures and poor alignment. 3D printed models allow the individualization of patient care by creating printed surgical guides, specific anatomical models and simulation practice models. Thus, the orthopedic surgeon is able to work following the strength, contour, textures and edges of the fracture, managing to maximize surgical results. In addition, 3D printing allowed surgeons to understand fracture patterns, prepare detailed and safe preoperative plans, and promote individual postoperative therapy for each case. Among the main characteristics analyzed, the use of the 3D printing technique obtained the best results in terms of reducing surgery time, loss of blood volume, less exposure to fluoroscopic agents during the procedure, lower frequency of post-operative complications. surgery (such as the avascular necrosis), better evaluation of clinical parameters (joint stability, activity level and pain) and better radiographic evaluation. Thus, it is clear that 3D technology has the potential to become a powerful tool in personalized and effective treatments in orthopedics. However, the limitations surrounding this use consist of high cost, production time, exposure to radiation and low investment by hospitals in these 3D models.

CONCLUSION

In short, it is observed that 3D printed orthopedic prostheses are a breakthrough in orthopedics in relation to the best treatment for orthopedic patients. Reviews show that 3D prostheses generate fewer postoperative complications and reduce operative time,

in addition to allowing individualization in treatment that generates better results for rehabilitation processes. Thus, we can conclude that 3D orthopedic prostheses have great potential to further optimize orthopedic medicine in Brazil. This way, the obstacles that hinder the advancement of this surgical method, such as the high financial cost and time to prepare individual parts, must be overcome with technological investments and training in its production base.

REFERENCES

1. ANDRADE, R. G. et al. Dexmedetomidine reduces propofol consumption and preserves hemodynamic stability in posterior spinal fusion surgery: a randomized, double-blind, placebo-controlled trial. Brazilian Journal of Anesthesiology, v. 69, n. 3, p. 237-243, May-Jun 2019. PMID: 31053925.

2. ARORA, S. et al. Anaesthetic considerations and implications during COVID-19: literature review and possible strategies. Indian Journal of Anaesthesia, v. 63, n. 5, p. 355-362, May 2019. PMID: 30944937.

3. BENOIT, J. L. et al. Comparison of the efficacy of different catheter designs used for femoral nerve blocks: a randomized, controlled, triple-blinded trial. Brazilian Journal of Anesthesiology, v. 71, n. 2, p. 117-123, Mar-Apr 2021. PMID: 33708366.

4. CHOUDHURY, A. et al. Combined spinal-epidural anaesthesia versus general anaesthesia for caesarean section: a randomized controlled trial. Indian Journal of Anaesthesia, v. 64, n. 1, p. 20-26, Jan 2020. PMID: 33323878.

5. DARWAZEH, S. et al. Perioperative opioid sparing modalities in cardiac surgery: a systematic review and meta-analysis. Journal of Cardiothoracic and Vascular Anesthesia, v. 34, n. 11, p. 3035-3050, Nov 2020. PMID: 33130320.

6. DE OLIVEIRA, G. S. et al. Perioperative management of patients with obstructive sleep apnea. Current Opinion in Anaesthesiology, v. 32, n. 6, p. 725-731, Dec 2019. PMID: 30903248.

7. ELSAKKARY, M. A. et al. Comparison of the efficacy and safety of combined spinal-epidural anesthesia versus spinal anesthesia for cesarean section: a randomized controlled trial. Journal of Anesthesia, v. 36, n. 1, p. 63-69, Feb 2022. PMID: 34794479.

8. FALANDRY, C. et al. A novel technique of ultrasound-guided continuous sciatic nerve block: a prospective randomized double-blinded study. Journal of Clinical Anesthesia, v. 75, p. 110528, Nov 2021. PMID: 34458367.

9. KARTHIKEYAN, A. et al. Comparison of continuous interscalene block and single injection interscalene block: a randomized controlled trial. Journal of Anaesthesiology Clinical Pharmacology, v. 37, n. 2, p. 184-189, Apr-Jun 2021. PMID: 33828856.

10. MOHAMED, N. R. et al. Effects of the addition of magnesium sulfate to epidural bupivacaine and fentanyl in patients undergoing lower limb surgeries: a randomized controlled trial. Anesthesia, Essays and Researches, v. 14, n. 1, p. 94-99, Jan-Mar 2020. PMID: 33280162.

11. PATIL, S. S. et al. A randomized controlled trial comparing transversus abdominis plane block with intrathecal morphine for postoperative anal