

# Chapter 10

## The Use of 3D Additive Technology in the Conception of Upper Extremity Orthotics: Advances, Applications, and Perspectives

**Nadia Hachoumi**

*ISPITS-Higher Institute of Nursing Professions and Health Techniques, Morocco*

**Rquia Laabidi**

*Cadi Ayyad University, Morocco & FMP Marrakech, Morocco*

**Mohamed Eddabbah**

*Higher School of Technology, Cadi Ayyad University, Morocco*

### ABSTRACT

*3D additive technology is revolutionizing the field of upper limb orthotic manufacturing, offering customized, efficient and cost-effective solutions. This article examines the evolution of the use of 3D printing in the design and manufacture of orthotics for the upper limb, highlighting its advantages over traditional methods. We explore the various applications of this technology, such as the creation of custom orthotics for patients with orthopedic, neurological or musculoskeletal disorders. In addition, we discuss current challenges and future opportunities in this field, particularly with regard to the accuracy, durability and accessibility of orthotics made by 3D printing. In conclusion, this article highlights the potential of 3D additive technology to improve the quality of life of patients requiring upper limb orthotics, while paving*

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*the way for new advances in rehabilitation and personalized treatment.*

## **INTRODUCTION**

The emergence of 3D additive technology has created a revolution in a variety of sectors, with healthcare and medicine undergoing profound transformations (Alzoubi and al., 2023). One area where this innovation is having a particular impact is the manufacturing of orthotics for upper limbs (Demeco and al., 2023a). This revolutionary technology has transformed the design and manufacture of orthotics, enabling new levels of precision and personalization. Recent advances in materials science have enabled the introduction of lightweight, durable and flexible materials such as thermoplastic elastomers and high-strength polymers, greatly enhancing the comfort and functionality of these devices (Iftekar and al., 2023). Furthermore, new 3D scanning technology makes it possible to build extremely accurate digital models of a patient's limb, ensuring that orthotics fit perfectly and offer ideal support (Farhan and al., 2021). Modern 3D printing software makes it easier to create sophisticated and patient-specific designs, with the ability to change rigidity, thickness, and ventilation to match individual demands. 3D printing's quick prototype capabilities also help to hasten the development process, allowing for incremental improvements and timely manufacturing of final orthotic devices (Sala and al., 2022). Clinically, 3D-printed wrist orthoses offer superior support and stabilization for disorders such as carpal tunnel syndrome, wrist fractures, and tendonitis, with a better fit and comfort than traditional solutions. Custom elbow braces treat disorders such as tennis elbow and post-surgical recovery, whereas shoulder braces help with the rehabilitation of ailments like rotator cuff tears and dislocations. Custom hand and finger splints are also useful for patients with arthritis, tendon injuries, or fractures, as they provide focused support while preserving dexterity and functionality (Demeco and al., 2023b). 3D printing in upper limb orthotics holds immense potential for smart, personalized devices. It can integrate sensors, IoT, bioprinting, artificial intelligence, and eco-friendly materials. As 3D printing becomes more widespread and affordable, the cost of producing custom orthotic devices will decrease, making high-quality care more accessible to a broader population, including underserved areas (Rodrigues and al., 2021).

In this paper, we look at the growing role of 3D printing in the creation of upper limb orthotics. We'll look at recent advances, clinical applications and future prospects for this promising technology. Thanks to its ability to produce customized orthotic solutions tailored to individual patient needs, 3D printing has been a game-changer in orthopedic rehabilitation.

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