OT4 produces flexible, customized orthotic devices, leading to improved patient outcomes

By implementing HP Multi Jet Fusion technology and HP's flexible materials, OT4 prints orthotic devices that move with patients

Data courtesy of OT4 Orthopädietechnik GmbH

Introduction

OT4 Orthopädietechnik GmbH develops, designs, and produces patient-specific orthoses using 3D printing technology. As a partner of orthopedic workshops, clinics, and medical professionals, the Munich-based company offers innovative and state-of-the-art manufacturing processes, combining individuality with uncompromising quality.

OT4's mission is to build completely new solutions for existing medical conditions and to implement new ideas into each of its products to foster trust and reliability in the orthotics industry.

• Industry

Healthcare

• Sector

Prosthetics and orthotics

• Objective

In order to cut costs and improve patient outcomes, OT4 sought to 3D scan, design, and print three orthotic devices: a safety helmet, a hand brace, and a Dynamic Ankle Foot Orthosis (DAFO).

• Approach

OT4 adopted HP Multi Jet Fusion (MJF) technology and HP 3D High Reusability (HR)[1] PA 11 to produce more flexible orthotic devices that move with patients' bodies and meet individual medical needs.

• Technology | Solution

HP Multi Jet Fusion technology, HP Jet Fusion 3D Printing Solutions

• Material

HP 3D HR PA 11

Challenge

OT4 has used various 3D printing technologies (e.g., SLS) for years, but the German company has faced challenges in choosing the technology that best fits its needs and in finding the most appropriate CAD software.

Previously used 3D printing technologies involved expensive materials and processes, and former materials produced powdery parts that were prone to breakage, depending on the printing alignment. Additionally, the cosmetics and aesthetics of the end products were not suitable or ideal for end users. As such, OT4 was looking for a new way to 3D print three of their devices.

- OT4's **safety helmet** is used after surgeries in which cranial bones (or parts of cranial bones) have been removed (i.e., a craniectomy) and the brain has lost some of its protective barrier. It is important for the patient to have a light, ventilated, and optimally fitted cover to protect the head.
- **Finger/hand braces** can help protect and support joints, as well as keep the finger joint properly aligned. The splint can be used to immobilize a joint in a certain position or to increase the mobility of a joint that is fixed in a particular position. These conditions typically cannot be treated with orthoses, but OT4 decided to test technologies that would produce more flexible products.
- A **Dynamic Ankle Foot Orthosis (DAFO)** is a brand name for a lower extremity brace that provides thin, flexible, and external support to the foot, ankle, and/or lower leg. These devices fit firmly to the ankle and correct foot deformities at specific pressure points. They also help improve mobility and stability of the ankle joint. Designed to help a patient maintain a functional position, a DAFO can improve stability for successful standing and walking. In order for patients to correctly use and benefit from the DAFO, it must be produced with a flexible material that allows the device to move with the patient's body.

Solution

OT4 switched from SLS to HP MJF technology thanks to the higher part quality and robustness made possible with HP 3D HR PA 11 material.[1]

"HP 3D HR PA 11 is a fantastic new material for us because it is more dynamic," says Ian Spring, Head of Design and Development at OT4. ***"This is one of the big priorities for us. We are producing products that go on peoples' bodies. They are moving all the time, and the material has to move, too."***

Orthotics ***"must continuously withstand strong elongating forces and must be flexible,"*** says Andreas Flamm, CEO, OT4 Orthopädietechnik GmbH. ***"Thin-wall printing using HP PA 11 has produced good results. We can also make products thinner, lighter, easier to clean, and softer on the skin."***

To produce their protective helmet for patients to wear following craniectomies or surgical procedures where a portion of the brain is removed, orthotists around the world previously used plaster to mold the helmet around a patient's head, using the patient's open skull to fit and form the device. But with HP MJF, OT4 uses a hands-off 3D scanning process. HP MJF and OT4's software help create lighter products with thinner walls and an improved flow of air, which also provides more comfort for the patient.

"One of the big benefits of HP and HP PA 11 is that we can create different layers," Spring says. ***"We can create a suspension zone that offers extra comfort and extra suspension from the outside."***

Thanks to HP 3D HR PA 11's flexible properties and enhanced elongation at break[2], orthotists can fit devices, such as the hand brace and DAFO, to a patient's specific needs, achieving both flexibility and durability.

Result

With HP MJF technology, OT4 is now able to manufacture products without the need to apply expensive post-processing. Parts produced with HP MJF have the same properties in x, y, and z directions, which means the build chamber space can be maximized for each production job and with optimal nesting; this, in turn, can help drive down costs.

"Using HP Multi Jet Fusion can save us 30% in costs compared to other techniques," Spring says.

Aesthetically, HP MJF resulted in stronger, more robust surfaces and more technically appealing devices. The process also saves times for the orthotist: *"Thanks to HP Multi Jet Fusion, we at OT4 can save an orthotist up to 10 hours of work compared to using common techniques, depending on the part,"* Flamm says.

"3D constructing using HP Multi Jet Fusion makes it possible to produce completely new products with a functionality that wasn't possible up until now," says Flamm. *"Before HP came onto the market with this new technology, we couldn't deliver a product with the same durability, the same quality, and in the same time."*

Spring adds: *"We can bring in new features and new functions and increase the quality of life for our patients even more."*

Learn more about HP Multi Jet Fusion technology at
hp.com/go/3DPrint

Connect with an HP 3D Printing expert or sign up for the latest news about HP Jet Fusion 3D Printing
hp.com/go/3Dcontactus

1. Based on using recommended packing densities and compared to selective laser sintering (SLS) technology, offers excellent reusability without sacrificing mechanical performance. Tested according to ASTM D638, ASTM D256, ASTM D790, and ASTM D648 and using a 3D scanner for dimensional accuracy. Testing monitored using statistical process controls. HP Jet Fusion 3D Printing Solutions using HP 3D High Reusability PA 11 provide up to 70% post-production surplus powder reusability, producing functional parts batch after batch. For testing, material is aged in real printing conditions and powder is tracked by generations (worst case for reusability). Parts are then made from each generation and tested for mechanical properties and accuracy.
2. Testing according to ASTM D638, ASTM D256, and ASTM D648 using HDT at different loads with a 3D scanner for dimensional stability. Testing monitored using statistical process controls.

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