

Design and manufacturing of shoulder orthoses

MAUSA Precision Mould



Email: mausa@matriceriamausa.com | Telf.: +34 943 492 775 | Web: www.matriceriamausa.com

Sector: Biomedical

Challenge: Additive manufacturing vs. traditional manufacturing of an orthotic device.

Solution: Scanning, design and manufacturing of the device using Multi Jet Fusion technology.

CHALLENGE

The traditional way of making an orthosis can be a long and complex process. At a first appointment, the limb or torso must be wrapped in plaster, which is an unpleasant and complicated procedure. After this, the cast must be cut and sent for fabrication, where the orthotic device is fabricated by hand from the plaster cast. Due to the handmade nature of the products and the relatively small number of medical specialists available to make them, the norm is to wait several months for the final orthotic, and even then there is no guarantee of a good fit. An ill-fitting orthosis results in all kinds of negative scenarios:

The patient therefore has to attend more appointments for device revisions, incurring travel and time costs. But how would it be possible to produce orthopaedic devices that fit from the start and spare users the actual procedure? Looking for a method to improve the process of creating and fitting orthoses, the answer was found in 3D printing which, when combined with simulation technologies, can help create orthoses in a fraction of the time that provides a more comfortable fit.

The challenge arose in accurately representing the highly complex interaction of the human body and the device, along with the user's movements, and the multiple contacts between the orthosis and the body along with

the behaviour of the orthosis material made of polymers. Therefore, we at Mause have developed a unique orthosis whose function is to alleviate the problems created by wear and tear of the supraspinatus tendon. This tendon located in the shoulder is responsible for all adduction, abduction, retropulsion and antepulsion movements of the arm.



SOLUTION

As soon as the idea was born and the goal was set, PRIM Rehabilitación turned to Mause, who immediately understood their problem and helped set up a process that incorporated the latest design and manufacturing technologies.

In a first step, the patient's limb and torso were digitally scanned to provide a high-precision 3D model of the body, but without any of the discomfort caused by the casting procedure. Due to recent advancements in technology, Mause was able to implement a 3D scanning solution that enables more accurate measurement without the challenges of traditional molds.

Subsequently, the Mause design and engineering team collaborated together with PRIM in optimizing the design for its manufacture and that it was adapted much more precisely to the needs.

3D scanning is less invasive and more accurate than the traditional method, and it only takes a few minutes. The new process using 3D body data helped us make custom-made orthotics that would fit the first time, saving the patient repeat visits.

Finally, they needed a 3D printing solution that would meet their needs for strength and durability, while being economically viable. Mause, experts in HP's Multi Jet Fusion technology, discovered that the materials used and the quality of the product that it could produce were superior to other methods, in this case the material used for the manufacture of this orthosis was PA12, which is It is a mechanically strong and biocompatible material.

ADVANTAGES

3D printing of custom orthoses has advantages over traditional orthosis fabrication as it can produce custom shapes and geometries that are not possible using traditional fabrication techniques. Devices can be manufactured faster and are easier to modify and reproduce, and a permanent digital record is generated for all orthoses and any changes, allowing for quick reprints and cost-saving design changes.

Additionally, 3D printing can replace the uncomfortable and itchy casts used to heal broken bones. Made from scans, these orthoses are lightweight, custom-made and comfortable, and can be worn in the shower for optimal hygiene.

Another central feature is that 3D printing allows the designer to make custom and durable 3D printed medical molds for the individual's arm, and due to the properties of the material the final products are thinner, lighter and more environmentally friendly.

3D printing of orthoses is a way to get devices fully adapted to the morphology of the patient and really adapted to their needs. This is precisely why additive manufacturing is increasingly used in the medical sector.

For a total and correct functionality, together with the printed part, different components such as metallic inserts, a hydraulic cylinder, straps, or neoprene foam were assembled for greater comfort for the patient. In addition, to obtain a better finish of the orthosis, several post-processing treatments were applied. In the first place, a superficial cleaning was applied to the piece. Subsequently, the orthosis was tinted black; and finally, a surface finish was applied for a better touch and a more polished finish. Finally, the assembly of all the components was carried out.



Using a 3D scan of the patient's leg, it is possible to create a perfectly tailored medical device.

It is also a way to work on the appearance of the orthosis and achieve a finish that pleases the patient. In this specific case, a black tint has been applied to the product.

- The pieces have great resistance and rigidity.
- Offers good chemical resistance.
- Biocompatible - Meets US FDA and ISO 10993 guidelines for intact skin surface devices.
- Various finishing possibilities.
- Faster additive manufacturing process for printing functional, durable, prototype, or end-user parts.
- It allows to reduce costs.
- Increases the effectiveness of orthoses.
- It allows to reinvent the industry with innovative designs.