

Enabling Mass-Customization in the Medical Sector:



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Adaptability in the medical sector

Why has additive manufacturing become a real alternative to traditional manufacturing in the medical sector?

The growing use of additive manufacturing in the medical sector derives from the significant benefits offered by this cutting-edge technology. Among the various advantages of 3D printing, the adaptability brought by this technology is really making a difference for the medical sector. Indeed, additive manufacturing is providing a high level of reactivity and flexibility, both regarding the manufacturing process and the product itself.

3D printing is bringing innovation to the medical industry as well as new ways of thinking of the manufacturing process.

Surgeons, for example, are now able to get specialized tools or devices adapted to their daily tasks whenever they need them, and patients have access to perfectly adapted prosthetics or medical supports.

3D printing is a reliable manufacturing method, allowing to produce cost-effective products with a

level of quality meeting the requirements of demanding sectors such as the medical industry.

Particularly interesting for this sector, additive manufacturing is making mass customization a reality. More than just possible, **mass customization is becoming efficient and affordable with 3D printing.** In this ebook, we will focus on this strength and see how it's starting to revolutionize the medical world. Even more important, we will explain how to benefit from mass customization and optimize your manufacturing process for medical purposes.

Understanding the potential of mass customization and additive manufacturing, combined with a clear identification of your opportunities will help you bring your projects the next level.

The Added Value of Mass Customization

Mass customization is the process of delivering services and products that are modified to meet a specific customer's requirements at scale. In the medical sector, this is becoming an efficient method to meet the patient's needs in a more cost effective way.

Mass customization combines flexibility and personalization with mass production. **Creating bespoke parts at scale presents a real challenge to traditional manufacturing and drives costs to unsustainable levels.** While injection molding is poorly adapted to personalization, CNC machining or hand craftsmanship are poorly adapted to scaling. Enabling highly customized parts at scale requires new manufacturing technologies and new ways of thinking.

Additive manufacturing appears to be a real game-changer for mass customization, allowing to **create made-to-measure products without driving up production delays or costs.** 3D printing is the perfect solution to unlock new customizable possibilities as it doesn't require

expensive tooling changes based on individual specifications.

Without the need for molds, the part is created directly according to your 3D file. Any personalizations or adaptations are done to this 3D file without affecting the production process. **3D printing allows you to produce as many variations of the part as are required without additional costs or time.**

Mass customization in the medical sector opens new possibilities for a variety of applications. To get made-to-measure devices, the process can be tricky. Professional designers, 3D scans, software allowing to change some parts or some functionalities: we will go through an in-depth explanation to help you find the best solution to get your adapted designs.

The Tools That Enable Mass Customization

Although mass customization is an added value for customers and patients, it can be a difficult process to put in place requiring both engineering and design skills on the software side and large investments in industrial 3D printing technologies.

Mass customization requires two key elements: the ability to design many variants of the same design adapted to unique constraints and the ability to produce these many variations in a cost and time effective manner. This implies the need for adaptable software and production methods. In this section you'll discover a software solution adapted to medical applications and the power of industrial 3D printing to make it real.

TwikFit

Twikit developed a cloud-based software solution covering the entire process from creation to production. The software allows users to design and interact with products according to their requirements bringing mass-customization to the factory floor.

TwikFit is a modular extension of the TwikBot platform (the software core) for orthotics, prosthetics, and protective gear. It is a web-based

design and customization software solution that allows medical professionals to **create made-to-fit products in a more efficient and less labor-intensive manner.**

The process is an end-to-end optimization that enables mass-customization of products based on 3D scans.

Professionals can utilize TwikFit to automate the production of made-to-fit products. It provides **easy-to-use interfaces to adapt the product's geometry to 3D scan data and other customization parameters.** Its direct scan-to-print capability enables working with the most advanced materials and achieves a precise fit through an efficient digital workflow. Incorporating 3D printing is the digital production technology that enables mass customization.

The TwikFit software solution enables a digital workflow and mass-customization by incorporating 3D scanning and 3D printing in the process. Ensuring an efficient manufacturing process that is beneficial for OEMs/application providers, clinicians, and practice owners as well as for patients.





A manufacturing solution for mass customization

As we have seen, traditional manufacturing methods present a significant barrier for mass customization. The ability to produce a high volume of unique parts requires new technologies and production management systems.

The solution is 3D printing. Not the familiar desktop 3D printer, but **industrial scale, professional 3D printing. Industrial technologies and materials break down the last barrier to mass customization**, by allowing hundreds or even thousands of unique parts to be produced in the same batch.

With powder bed fusion technologies such as Selective Laser Sintering (SLS) or HP's Jet Fusion technology, a bed of powder is fused layer by layer to allow hundreds of parts to be printed simultaneously. As the parts are suspended in unfused powder, there's no need for supports and minimal post-processing.

Powder bed fusion technologies use high-performance materials with interesting properties for any application. The variety of **professional grade materials now available can offer high rigidity, flexibility, flame resistance, chemical resistance, and impact resistance** depending on the project requirements.

While these technologies and materials are a great solution for mass customization, they are certainly cost-prohibitive and labor intensive for many businesses to run internally.

A trusted manufacturing partner with the knowledge and experience of industrial manufacturing is what makes mass customization a reality. An established service bureau will not only provide access to these technologies but also traceability, quality assurance, support on choosing the right material, and high-quality finishing to ensure professional parts.

Applications of Mass Customization for Medical

Many medical projects could benefit from the use of mass customization. Let's take a closer look at the possibilities offered by mass customization in the medical sector.

Manufacturing made-to-measure devices

From Medtech devices to medical tools or prosthetics, mass customization can be relevant for plenty of medical applications. The medical industry is driven by complex challenges, to improve the health and quality of life of many individuals all around the world. In this sector, the importance of adaptability and customization is growing to become a real necessity.

From the development of electronic cases for Medtech devices or the creation of orthopedic insoles, mass customization can show its potential in various applications.

The most apparent application for mass customization in the medical sector is creating adapted devices according to the individual patient's

morphology and particular needs. **These supports require a great deal of time to custom fit and the expertise of highly trained professionals** to ensure a perfect alignment.

Today these professionals have access to **3D scans and advanced software that reduce the time intensive aspects of creating custom devices** and also greatly reduce the cost, ensuring that more people have access to the medical supports they need to live full lives.

We will focus on the advantages of mass customization for the development of orthopedics, including orthotics and prostheses. With 3D printing these adapted devices are produced to **match exactly to the individual patient's needs and thanks to the freedom of design offered by 3D printing, they can also be stronger, lighter, and more visually interesting.**

Here are a few examples of medical products which can benefit from mass customization:

Orthopedics

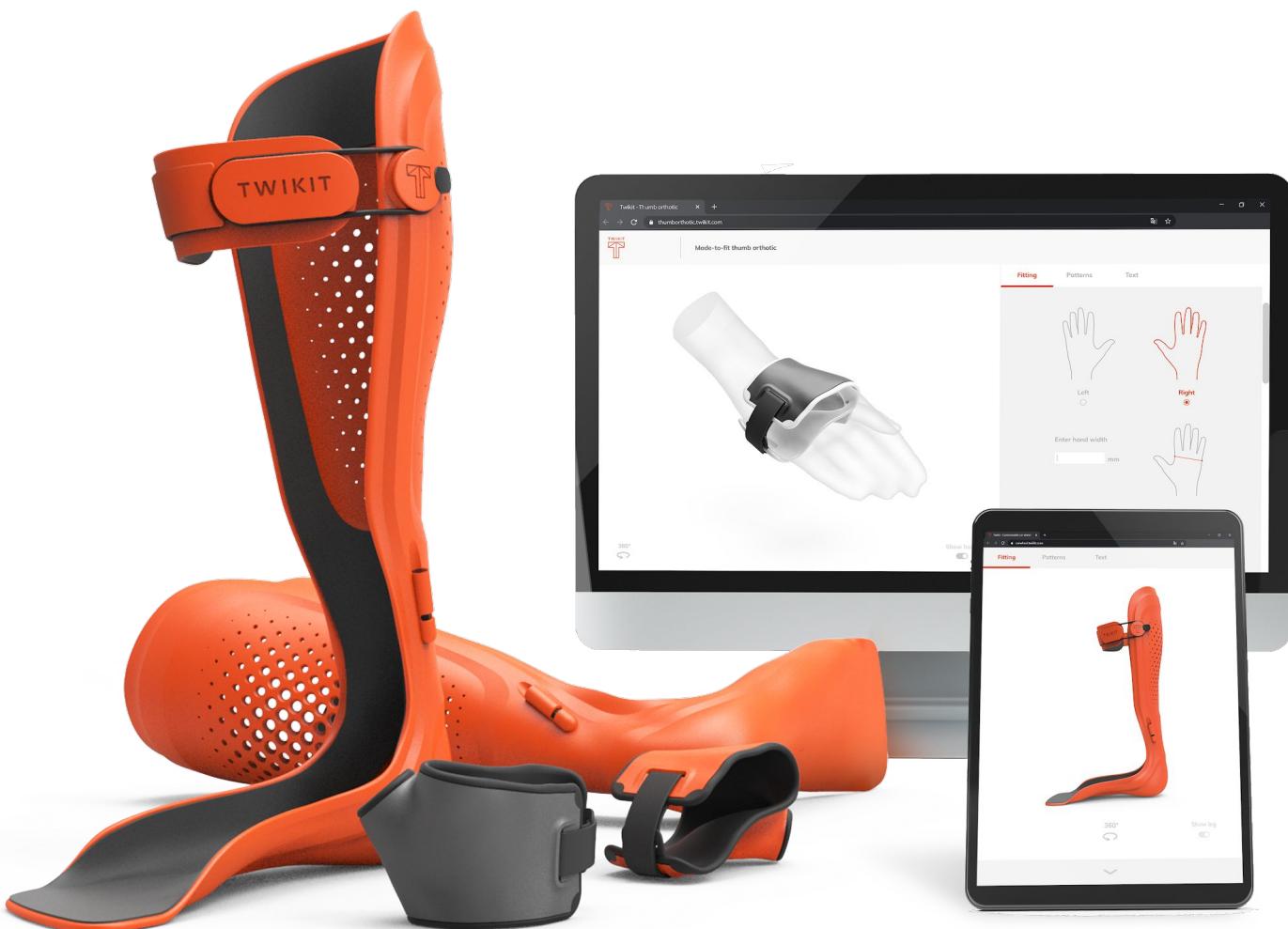
Orthopedic devices, in general, are designed to prevent and manage (treat, support, strengthen) the musculoskeletal system. They include, among other products, orthotics such as insoles, protective helmets, and braces. These orthopedic products can be manufactured with great quality and detail through the digital and automated mass customization workflow.

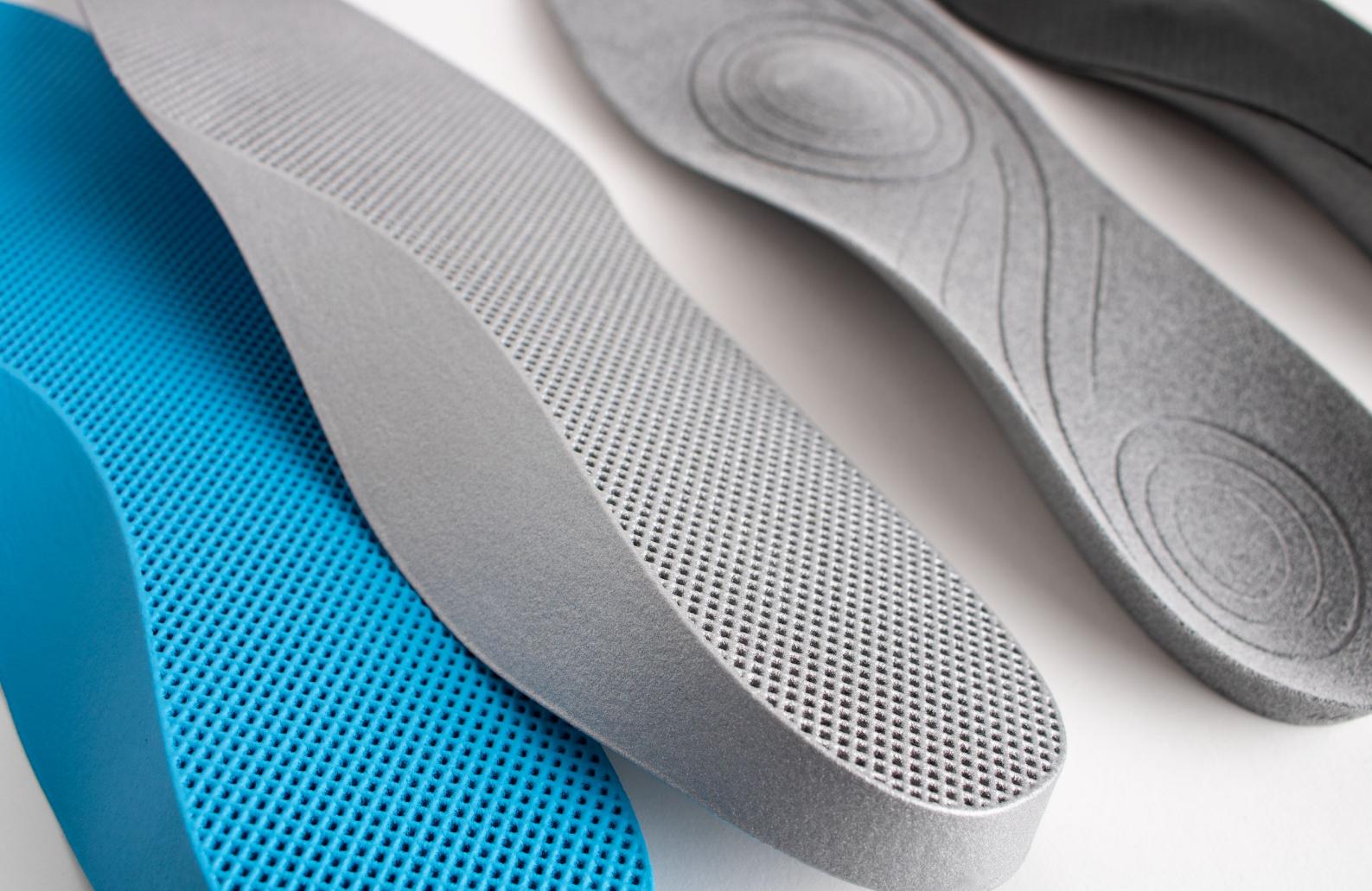
A manufacturer of orthopedic devices who implemented mass customization through 3D printing experienced a reduction in both lead time and cost. Their **semi-automated process was about eight times faster than the conventional polymer process** used for creating orthopedics. Mass customization allows the manufacturer to scale up and extend their range of orthopedics.

Hand braces, wrist braces, knee braces, ankle-foot orthoses, orthotic insoles and protective helmets are examples of orthotics

increasingly being designed and manufactured using digital technologies such as design software, 3D scanners, and 3D printers. By implementing customization, the orthotics promote healing without complications because of their made-to-fit form based on a patient's 3D scan.

During the design and fitting process, patients can choose from various materials, colors, and textures to create a personalized composition that supports healing. Form scraping and shaping ensure **a reduction in friction and pressure combined with increased comfort.**





Orthotics

Orthotics focus on mobilization or immobilization support as a treatment using the latest advancements in technology.

Custom orthotics ensure a precise and time-efficient creation process for the medical expert and an overall better patient experience.

Foot orthotics, for example, demand a lot of design freedom. They require different zones (e.g., medial/lateral arch, metatarsal, heel, etc.) with variable thicknesses, cutouts, and characteristics (incl. flexibility and rigidity). The combination of parameters is different per use-case—sex, condition, activity, etc.

Protective helmets are also orthotics that are suitable for mass customization. The software can

modify and adapt a digital file of a helmet to previously made 3D-scan measurements. The level of energy absorption is optimized based on the patient's needs, keeping the weight and the safety of the product in mind.

The functional, along with other aesthetic/finishing, features of an orthotic are not only achievable by hand in the traditional way but also with 3D printing. On top of that, the order and clinician-prescription form can be digitized and generated into a digital file to be 3D printed. More design freedom and less administrative burden due to the online mass customization software. Therefore, these - important for quality of life - products are suitable for mass customization.

Prosthetics

Prostheses are suitable for mass customization because of the **importance of both fit and aesthetic design**. The design software allows for complete customization of the prosthetic's appearance to fit the patient's body and visual preference.

The prosthetic leg socket and prosthetic cover are parts that can be created in a time-effective manner using customization technologies.

The socket's scan-to-fit production leads to an advantage for the patient, a premium fit for maximum comfort. The cover which decides the prosthetic's visual appearance can be adjusted to blend with different prosthetic devices. It can be **completely personalized to fit the patient's body and lifestyle**. The materials, color, shape, and texture can reflect the patient's needs and tastes—and is affordable due to the digital production process, which includes 3D printing technology.

What are the parameters to create made-to-fit products?

The Twikfit platform requires **3D scan data or physical measurements as input parameters**. This data is key to create a product with the perfect body fit, ensuring a comfortable and optimized healing process.

By inputting the unique data within the TwikFit platform, a product template is adjusted to fit the 3D scan or physical measurements accordingly. It can be completely customized by adding configuration parameters that make the product conform to patients' specific needs and uniqueness.

Finally this 3D file is sent to a 3D printer to produce the unique part. **The device can also be adapted to environmental conditions (moisture, heat, chemicals, etc) it will encounter with the right material and finishing options.**



Putting it all together: Sculpteo x Twikit

It might be time for you to combine the benefits of Twikit and Sculpteo to improve and optimize the manufacturing process of your medical devices:

As we have seen, using the best tools will allow you to achieve the most innovative and ambitious medical projects. Combining the freedom to generate completely customized designs of TwikFit with a flexible manufacturing partner using additive manufacturing gives you the perfect solution for mass customization in the medical sector.

The TwikFit software and Sculpteo are both specialized in mass customization and can support your project from beginning to end. Their goal? To simplify your whole manufacturing process. Getting perfectly adapted designs using your 3D scan has never been more straightforward.

You can generate adapted parts and print them all at once by uploading your 3D file on Sculpteo's website.

Using a service bureau such as Sculpteo offers you the possibility to **choose the materials adapted to your device** From flexible TPU to Nylon PA11 or PA12, your medical project can benefit from great material properties. A team of 3D printing experts will help you make the most relevant choices for your medical projects.





Digital manufacturing leader since 2009, Sculpteo works with innovative companies to integrate 3D printing in their manufacturing processes.

Sculpteo offers 3D printing on-demand with experienced digital manufacturing specialists and professional technologies.

Learn more about integrating 3D printing to your business:



Twikit integrates digital manufacturing and mass customization into any business model and digital production flow.

The software solution covers the entire process from order to production to capture the value of on-demand digitally manufactured, personalized products.

Step into customization with a seamless end-to-end solution.



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