



— SABRINA SCHILLING

Strong back thanks to 3D printing: TRUMPF technology speeds up healing

Spinal implants from Tsunami Medical fuse with the bone faster than others thanks to their sophisticated structure, which is created using additive manufacturing on a TruPrint 3000 from TRUMPF.

Stefano Caselli is not short of good ideas. For him, an idea is good if it speeds up the healing process for patients and makes surgeons' work easier. Caselli is the managing director of the Italian medical technology company Tsunami Medical. In Modena and nearby Mirandola, Tsunami manufactures medical instruments for minimally invasive procedures and for taking tissue samples through biopsies. In addition, Tsunami also manufactures spinal cages, implants used as a kind of placeholder between two neighboring vertebral bodies in the back. And there are many small details in Tsunami's products that make them a good idea.

— Complex structure

On the one hand, there is their structure: Tsunami's spinal cages consist of a fine metal mesh with countless wafer-thin connections. "This is where they differ from the products of many other manufacturers," says Stefano Caselli. These usually still have holes. Surgeons use these to screw them to the neighboring bones so that they hold firmly in the spine. For him, this is an outdated approach. "This design dates from the time when the implants were made of PEEK. This high-performance plastic has a smooth surface that the bone cannot grow into. That's why the holes are needed," explains Caselli. Like him, many manufacturers have switched to 3D printing, but have simply adopted the previous design of the parts one-to-one.





<p>Stefano Caselli is never at a loss for a creative idea. Together with his team, he develops 3D-printed implants that make healing easier for patients.</p>



<p>The implants consist of a fine mesh. This fuses more quickly with the bone. Only the laser can print it.</p>



<p>All implants bear the name of an Italian island. In the operating theater, they make it easier for surgeons all over the world to insert them into the spine.</p>

Together with his team, he took a different approach when entering the field of additive manufacturing in 2010, and completely redesigned the parts for 3D printing. "We wanted to make optimal use of the biocompatible and biomechanical properties of titanium," says Caselli. The challenge: titanium is stiff. To achieve elasticity similar to that of human bone, the Tsunami designers worked on the geometry of the spinal cages – and developed them as a mesh structure. This allowed them to achieve a stable base that is also flexible. "The mesh also provides a porous surface that allows the bones to fuse well and quickly," emphasizes the CEO. A study by Cambridge University confirms his statement: after just four to five days, the bone has grown through the mesh. This is significantly faster than with other implants.

— Innovative implants

Stefano Caselli's ambition has been sparked and he has an idea. His new project: expandable implants that can be easily adjusted to the required size. Patients benefit from a customized solution and hospitals only need one standard product instead of countless variants.

But Caselli's creative team is still tinkering with it, and they are launching the third generation of their spinal cases. Inside, they are integrating a mechanism that fixes the implant directly into the bone. Caselli thinks it's an absolutely ingenious idea. After all, it allows surgeons to attach the implants quickly and easily.



<p>The TruPrint 3000 was the best choice for Tsunami to overcome the challenges of manufacturing titanium implants.</p>



<p>The TruPrint 3000 is equipped with the multilaser option. With two 500-watt lasers, Tsunami builds the cages twice as fast using the laser metal fusion process.</p>





<p>Even complex mechanisms can be integrated into the implants using laser-metal fusion.</p>

—— Reliable systems for creative ideas

However, Caselli first had to rethink his manufacturing technology to ensure that the third generation of his implants would not only be a good idea but also a marketable product. The systems previously used for 3D printing reached their limits when faced with this complex task. Caselli explains: "We have to achieve the component including the mechanism in a single setup. This was not possible with the 3D printing systems we used at the time." He looked for alternatives and found them at TRUMPF. His team started initial trials with the TruPrint 2000 [additive manufacturing system](#) and found that it worked wonderfully. However, the capacity was not sufficient for the planned series sizes. So Tsunami switched to a [TruPrint 3000](#) and started production with it. Transferring the products to the TRUMPF systems was easier than expected: "We were able to adopt the geometry directly and hardly had to change any of the parameters."

Another advantage is that the TruPrint 3000 medium-format machine is equipped with the multi-laser option. With two 500-watt lasers, Tsunami can build the cages twice as fast using the laser metal fusion process. As Stefano Caselli emphasizes, "The large build volume also allows us to print six of the implants on top of each other – in a single production step. We have already doubled our production volume and can triple it by stacking the cages even higher." There is one thing he can always rely on: the quality of the parts remains the same across the entire build space and height. This means that the spinal cases meet the high requirements of medical technology.

Stefano Caselli likes it: "The TruPrint 3000 was the best choice for meeting the challenges of manufacturing our titanium implants. It allows us to produce the complex components, including the integrated mechanism, in a single setup. Thanks to the large construction volume, we can also print large series sizes. And all in the high quality required in medical technology. "It's also good that Caselli has TRUMPF as a reliable partner at his side. TRUMPF systems can keep pace with his creative ideas. And he will need that in the future, because the team at Tsunami Medical never runs out of good ideas.



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