

# Press Release

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## Salzburg University Hospital Performs Groundbreaking Surgery Using 3D Systems' Most Advanced Orthopedic Technologies

- 55-year-old male suffering from skull deformity receives 3D-printed PEEK cranial implant successfully manufactured at point of care
- Hospital's in-house clinicians combined unique capabilities of Oqton's D2P® and Geomagic Freeform® software with 3D Systems' Kumovis R1 to produce patient-specific cranial implant
- Application of 3D Systems' technologies addresses rapidly growing cranial implants market — anticipated to reach more than \$2 billion by 2030

**ROCK HILL, South Carolina, April 19, 2023** – Today, [3D Systems](https://www.3dsystems.com) (NYSE:DDD) announced that the University Hospital of Salzburg (Austria) has successfully applied the company's unique portfolio of point-of-care additive manufacturing technologies to design and produce its first 3D-printed PEEK cranial implant as a custom device for an individual patient need. These technologies were brought together by the hospital's in-house clinicians to successfully address the patient's needs, providing a customized solution that best positioned the team for success. The hospital used Oqton's D2P® software to create 3D models from the patient's CT images and Oqton's Geomagic Freeform® to complete the design of the patient-specific occipital prosthesis. The cranial implant was printed using VESTAKEEP® i4 3DF PEEK by Evonik on 3D Systems' Kumovis R1 extrusion platform. PEEK is a very desirable material for the production of medical devices because it is lightweight, resistant to thermal and ionizing radiation, and possesses mechanical properties similar to those of human

bone. The Kumovis printing platform was specifically designed to enable this type of point-of-care application within the hospital.

The adoption of 3D-printed cranial implants is expected to accelerate significantly based on technological advancements. According to a [report](#) released by Acumen Research and Consulting in February 2023, the cranial implants market size in 2021 was roughly \$1.2 billion and is anticipated to approach \$2.1 billion by 2030. Cranial implants can address a breadth of applications including trauma, defects, and reconstruction. Advances in technology — including materials and manufacturing methodologies such as 3D printing — are anticipated to provide new solutions to help drive growth in this market.

In commenting on this groundbreaking surgery, Dr. Jeffrey Graves, president and CEO of 3D Systems commented, “We are thrilled for Mr. Trummer and the relief this procedure has given him, and deeply indebted to the talented surgeons and staff at Salzburg University Hospital who brought together for the first time our unique software, hardware, and materials technologies in a point-of-care hospital setting to address his specific needs. We believe that this success provides a real-life demonstration of the potential for enhancing orthopedic outcomes through the use of comprehensive digital manufacturing technologies in a hospital setting. Our focus on point-of-care implementation of these integrated technologies is a key priority for our company, and one that we believe will bring significant benefits to patients around the world in the years ahead.”

As a pioneer in personalized healthcare solutions, 3D Systems has worked with surgeons for over a decade to plan more than 150,000 patient-specific cases, and additively manufacture more than two million implants and instruments for 100+ CE-marked and FDA-cleared devices from its world-class, FDA-registered, ISO 13485-certified facilities in Littleton, Colorado, and Leuven, Belgium. For more detail on the procedure performed by the University Hospital Salzburg (Austria) team, the translation of the hospital’s press release is below. The full German press release is available [here](#).

March 23, 2023

### **55-year-old received occipital prosthesis from 3D printer**

Spectacular technical and medical premiere at Salzburg University Hospital - Patient Rainer Trummer: "I'm doing great!"

Computer scientist Rainer Trummer (55) from the city of Salzburg has a lifelong history of suffering behind him: he suffers from craniosynostosis. That is, one of the cranial bones ossified too early during childhood, resulting in a deformation of the skull. "Especially as a child, I was often teased. Later, people said less, but you could tell what they were thinking. Of course, that left its mark on me."

For a long time, Trummer searched for a doctor who could help him. An operation already planned abroad was canceled because of the Covid pandemic and could not be rescheduled. Then the Salzburg resident turned to Professor Alexander Gaggl, head of the Department of Oral and Maxillofacial Surgery at the University Hospital of Salzburg, and his team: "I had known Professor Gaggl since another operation in 2012 and had complete trust in him."

### Balloon filled with water stretched the scalp

Professor Gaggl and his team decided on a spectacular treatment that would take months to complete: "From the beginning, we planned to replace the visually missing occiput with a prosthesis. However, we faced the challenge that the scalp is very taut and hardly stretchable." So last year, Rainer Trummer had a plastic balloon implanted under his scalp, which was then filled with saline solution over the course of 6 months until it reached the size of the planned implant. A total of 250 milliliters of saline solution were pumped into the balloon.

Then the most technically spectacular thing: The Salzburg Provincial Clinics set up a laboratory with their own 3D printers at the University Hospital in 2021. Trummer was to become the first patient with an implant from the 3D printer, which was also produced in-house. "This was possible because with the 3D Systems Kumovis R1, we have a 3D printer that can print implants made of PEEK plastic under cleanroom conditions," explains Simon Enzinger, managing senior physician at Department of Oral and Maxillofacial Surgery.

### Salzburg University Hospital is a pioneer in 3D printing throughout Europe

In-house clinical engineers created a model of the occipital prosthesis having a diameter of 12 and a thickness of up to 3 centimeters on the computer using the patient's CT images and then printed the implant on a 3D Systems' Kumovis R1. The manufacturing process took about 10 hours.

### The result is "a miracle" for the patient

On February 10, a few days before Rainer Trummer's 55th birthday, Professor Gaggl and Senior Physician Enzinger performed the procedure, which took 6 hours - a comparatively "short" time. Enzinger said, "We fixed the implant to the top of the skull with 4 plates and 8 screws." And with a grin, he adds, "It holds bombproof!"

A good 6 weeks later, the surgical wounds have largely healed. "I'm doing great, I'm totally happy!" beams Rainer Trummer. "I don't feel like I have an implant in my head, but now I have a completely 'normal' head. It's like a miracle for me."

### Type B expertise center and digitization strategy

The Department of Oral and Maxillofacial Surgery is one of three so-called type B expertise centers at the University Hospital Salzburg - specifically for cleft lip, jaw and palate and

craniofacial anomalies. Professor Gaggl said, "Normally, we perform operations on children for cranial malformations - we are all the more pleased that we have now been able to give a long-standing patient a new lease on life."

The establishment of the 3D printing lab is part of a digitization strategy that the University Hospital of Salzburg has consistently pursued since the onset of the Covid pandemic: "We wanted to take with us the positive momentum that the pandemic triggered in this area," explains lecturer Paul Sungler, Managing Director of the University Hospital Salzburg and an experienced surgeon. "We stand for digitization in the interest of patients, and 3D printing and its many clinical application possibilities are a central building block here."

#### Patient-specific plastic implants printed on Kumovis R1

Founded in 2017 as a spin-off of the Technical University of Munich, startup Kumovis GmbH was acquired by global additive manufacturing solutions leader, 3D Systems (NYSE:DDD) in 2022. 3D Systems offers personalized healthcare solutions that include the Kumovis R1 printer and implantable high-performance plastics such as the VESTAKEEP® i4 3DF (PEEK filament from Evonik Industries AG) used here.

Additionally, 3D Systems' team provides support in application development, qualification of the printers, and regulatory implementation of holistic process chains for manufacturing patient-specific medical devices.

Stefan Leonhardt, director, medical devices, 3D Systems adds, "Since patient safety is our top priority, we have invested a lot of resources in biological and mechanical testing of printed implants over the last few years, from which innovative clinics and their patients are now benefiting. The entire team is extremely proud that our technology has now made its way into patient care."

#### **Forward-Looking Statements**

Certain statements made in this release that are not statements of historical or current facts are forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. Forward-looking statements involve known and unknown risks, uncertainties and other factors that may cause the actual results, performance or achievements of the company to be materially different from historical results or from any future results or projections expressed or implied by such forward-looking statements. In many cases, forward-looking statements can be identified by terms such as "believes," "belief," "expects," "may," "will," "estimates," "intends," "anticipates" or "plans" or the negative of these terms or other comparable terminology.

Forward-looking statements are based upon management's beliefs, assumptions, and current expectations and may include comments as to the company's beliefs and expectations as to future events and trends affecting its business and are necessarily subject to uncertainties, many of which are outside the control of the company. The factors described under the headings "Forward-Looking Statements" and "Risk Factors" in the company's periodic filings with the

Securities and Exchange Commission, as well as other factors, could cause actual results to differ materially from those reflected or predicted in forward-looking statements. Although management believes that the expectations reflected in the forward-looking statements are reasonable, forward-looking statements are not, and should not be relied upon as a guarantee of future performance or results, nor will they necessarily prove to be accurate indications of the times at which such performance or results will be achieved. The forward-looking statements included are made only as of the date of the statement. 3D Systems undertakes no obligation to update or revise any forward-looking statements made by management or on its behalf, whether as a result of future developments, subsequent events or circumstances or otherwise, except as required by law.

**About 3D Systems**

More than 35 years ago, 3D Systems brought the innovation of 3D printing to the manufacturing industry. Today, as the leading additive manufacturing solutions partner, we bring innovation, performance, and reliability to every interaction - empowering our customers to create products and business models never before possible. Thanks to our unique offering of hardware, software, materials, and services, each application-specific solution is powered by the expertise of our application engineers who collaborate with customers to transform how they deliver their products and services. 3D Systems' solutions address a variety of advanced applications in healthcare and industrial markets such as medical and dental, aerospace & defense, automotive, and durable goods. More information on the company is available at [www.3dsystems.com](http://www.3dsystems.com).

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