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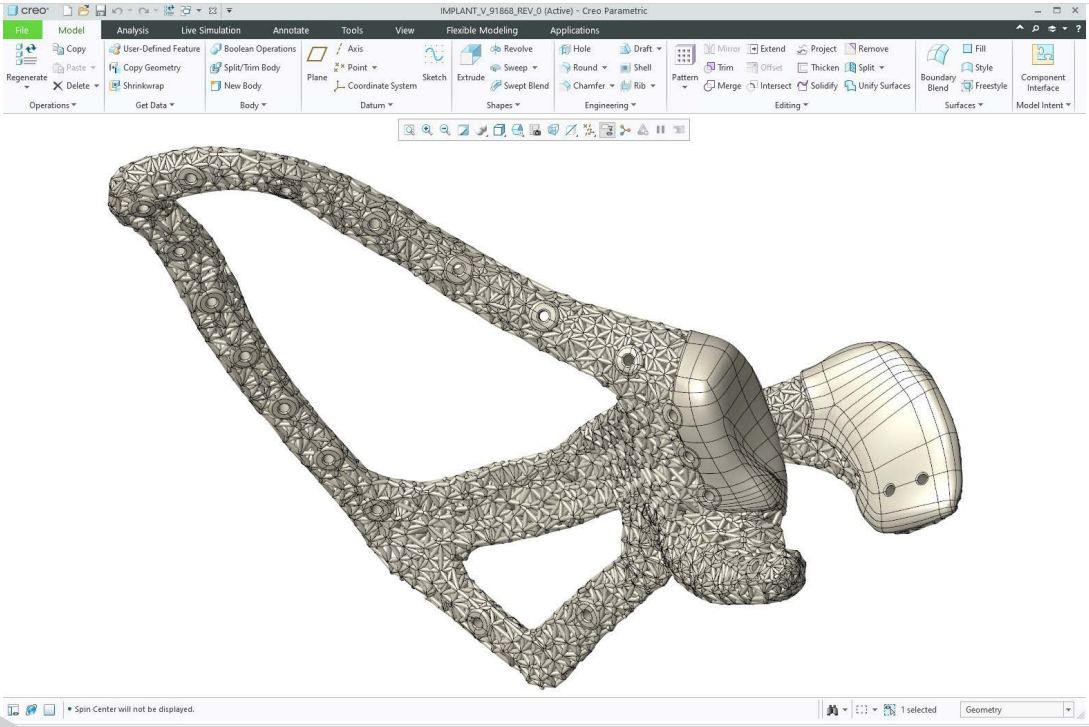
A Breakthrough in Custom Medical Implants: A Collaborative Success Story

Leveraging Creo's Advanced 3D Modeling for Personalized Medical Solutions



Challenges:

The team at Tel Aviv Medical Center, PTC, and Hexagon needed to find a way to create a custom shoulder blade implant for a young patient with cancer. This project required immense precision to address the complexity of the problem, and the team needed to figure out a way to achieve an ideal balance between anatomical, medical, engineering, manufacturing and certification constraints.

Results:

Utilizing the power of Creo's tools for design for additive manufacturing and high-fidelity simulations, the team successfully created, under supervision of Tel Aviv Medical Center experts, the fully personalized scapula implant that was successfully manufactured and certified using technology from Hexagon – contributing to the patient's swift recovery and restored mobility.

Products and Technologies Used:

PTC Creo; Hexagon's Simufact Additive and VGSTUDIO MAX

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Introduction

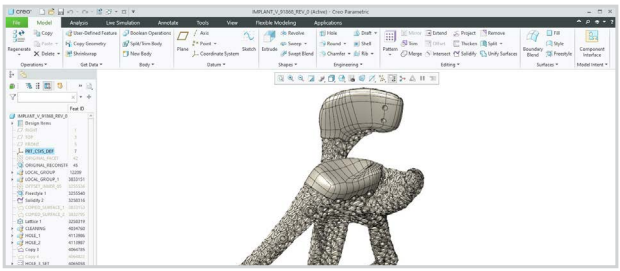
In a groundbreaking convergence of medicine, engineering, and technology, a world-class team from Tel Aviv Medical Center, PTC, and Hexagon has achieved a medical breakthrough: a fully personalized scapula implant designed and manufactured specifically for a young cancer patient. Together, they set a new standard for personalized healthcare, pushing the boundaries of what's possible in digital engineering for medical implants.

The Patient's Journey and the Need for Custom Solutions

The journey began when a young patient, plagued by months of pain and restricted movement, was diagnosed with a rare cancer. MRI imaging revealed extensive damage to the scapula, the shoulder blade, along with an aggressive tumor infiltrating surrounding muscles. A challenging path lay ahead, with the immediate goal of removing the affected bone while retaining as much shoulder function as possible.

Innovative Planning Through Advanced Engineering

The patient was initially treated with chemotherapy to shrink the tumor, but a full scapula removal, or scapulectomy, remained necessary. Faced with a surgery that could have left the patient without shoulder function, the team chose a different route: they would design and implant a custom 3D-printed titanium scapula, crafted to mirror the patient's unique anatomy. This approach would not only restore the mobility but also contribute to redefining future treatment protocols for complex skeletal surgeries.



Innovative Implant Design

• Essential requirements and challenges for the implant design included:

• Preservation of the patient's original anatomical volume, shape, and kinematics.

• Optimization of the implant's mechanical properties while minimizing weight.

• Provision of an optimal set of anchoring points for muscle attachment.

• Implementation of an advanced lattice structure to facilitate the ingrowth of connective tissue and muscles, leveraging Creo Design for Metal Additive Manufacturing to minimize supports and distortion.

• Introduction of minimal surfaces to ensure smooth joint kinematics.

• Utilization of advanced mechanical simulations to verify the load-bearing capacity of the implant for shoulder and arm movements.

• Ensuring the manufacturability and reducing print trials of the implant, harnessing Simufact Additive to simulate and compensate the thermo-mechanical processes that distort parts as they are printed.

• Verifying successful print quality for certification, leveraging VGSTUDIO MAX to process the CT scan data and verify the quality of the complex structure and the printed metal's properties.

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The Milestone Surgery and Patient Recovery

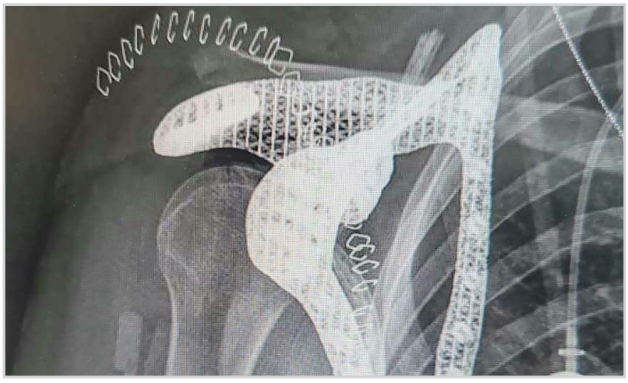
The surgery proceeded as planned, with the personalized implant fitting seamlessly into the patient's anatomy. The precisely customized part, achieved through Creo design, and Hexagon certification tools played a pivotal role in the patient's swift recovery, allowing her to begin regaining mobility within days—a testament to the engineering excellence embedded in the implant. Today, the patient is progressing through rehabilitation, with restored function and an improved quality of life.

A New Era in Personalized Medicine

This collaboration has contributed to redefining personalized medicine, integrating digital thread technologies to create personalized solutions that support efficient soft tissue ingrowth. For patients facing complex skeletal cancers, this marks a new dawn—one where innovative technology meets compassionate healthcare. Dr. Solomon Dadia, Head of the Surgical Innovation and 3D Printing Unit at Tel Aviv Sourasky Medical Center, emphasized the significance of these advancements:

> "Bioactive printed implants are the future of implants! The development of complex implantable printed materials, together with powerful additive manufacturing and simulation software, enables us to introduce smart implants to the surgical world. These implants interact with tissues to optimize their survival in the body, ensuring a perfect fit and promoting tissue growth. These advancements mark a new era in personalized medicine."

Dr. Solomon Dadia,
Head of the Surgical Innovation and 3D Printing Unit at Tel Aviv Sourasky Medical Center



About the Collaborators

Tel Aviv Medical Center: Leading in patient-centered care, setting the bar for pioneering surgical techniques.

PTC: Leading digital transformation, enabling breakthroughs in personalized medical solutions.

Hexagon: Ensuring safe, certified medical advancements, driving the rapid delivery of high-quality components using a digital twin to predict and improve manufacturing processes.

Conclusion

This story captures a remarkable convergence of technology and humanity, where the patient's rapid recovery highlights the profound impact of personalized medical solutions. From diagnosis to the patient's renewed mobility, this project underscores how Creo and cross-disciplinary collaboration are reshaping healthcare's next frontier with solutions tailored to each patient.

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