



3D Printing Improves Treatment for Thoracic Wall Tumors

New Tools Promote Better Patient Care

Biodonostia Health Research Institute, founded in 2008, is the first institute for medical research in the Basque region of Spain. Daily, the institute and the co-located Donostia University Hospital, face challenging surgical cases. These all require precise, complex and often difficult surgeries during which surgeons need to make the most of every tool in their arsenal to ensure a safe clinical outcome.

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Dr. Jon Zabaleta

Thoracic Surgeon, Biodonostia Health Research Institute



This patient-specific model of a thoracic wall tumor was 3D printed using the Stratasy Fortus 450mc.





3D printed models of the thoracic wall enable surgeons to plan, perform and perfect the resection on the 3D model ahead of the actual surgery.

A new and vital tool is 3D printing. The hospital recently entered into a partnership with Tknika, a Research and Applied Innovation Center for Vocation Education and Training in the Basque region, and Tecnun, a specialist division of Universidad de Navarra. This partnership gives the surgical team access to more advanced 3D printing technology.

“3D printing is an essential surgical tool for us,” explains Dr. Jon Zabaleta, Thoracic Surgeon at Biodonostia. “Previously, no 3D printed model we created in-house could meet the level of detail and accuracy we needed. However, thanks to our partnership with these local institutions, we now have access to advanced 3D printing technology from Stratasys that enables us to meet the demands required to create highly-accurate, patient-specific 3D models.”

Stratasys FDM 3D printing has proved particularly important when treating complex, and often life-threatening thoracic wall tumors. Located on the chest wall, thoracic tumors can cause excessive and painful swelling, or lead to trouble breathing for the patient.

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Surgical Time Reduced by Two Hours

In a recent case, a 64-year-old man came to Dr. Zabaleta with an extremely complicated tumor on his thoracic wall. Over the course of two years, the tumor had slowly spread across multiple ribs. The man was in intense pain, concerning surgeons about his respiratory function.

“Ordinarily, in a case like this, we would remove the affected ribs and correct the defect by covering the area with a titanium plate,” said Dr. Zabaleta. “These plates are a standard size, designed for men of 100 kg or women of 50 kg, and need to be altered and rotated during surgery to suit each patient’s specification. In a complicated surgery, this can add hours to the operating time.”

As Dr. Zabaleta explained, this case presented a complex challenge for the surgical team, since removing the tumor would require removal of more than one rib, an unusual method of treatment that increased the surgical risks. As a result, the surgeons needed to find the best way to correct the defect with the strength to protect the lungs, while maintaining flexibility and movement in the chest.

In order to explore and plan the surgery, the surgeons turned to their partnership with Tknika and Tecnum to produce an advanced, patient-specific 3D model of the patient’s thoracic wall. Together, the hospital’s partners converted a conventional CT scan of the patient into a 3D printed model using the Stratasys Fortus 450mc™ 3D printer and returned it to the surgical team within 24 hours.

“By creating a precise, anatomically-accurate 3D model of the thoracic wall, we were able to plan and perform the resection on the 3D model ahead of the surgery,” explains Dr. Zabaleta. “This allowed us to measure the screws and pre-bend the titanium plates in advance and helped reduce the overall operating time by 2 hours. For the

patient, this meant a significant reduction in time under anesthesia, and for our hospital, freeing up time in operating rooms saves costs.”

For this condition, the surgeons required a model strong enough to replicate human bone, so the teams at Tknika and Tecnum selected FDM® technology for its ability to print with engineering-grade thermoplastics.

“Our partnership afforded us access to the necessary technology to produce a large and complex model that was incredibly strong, close to the real bones we would face during surgery. Without the strength of this model, we could not have prepared for the surgery in the same way,” Dr. Zabaleta explained.

In addition, Dr. Zabaleta credits the 3D models with an improvement in patient-doctor communication. He used the models to explain how they would protect the lungs, which helped alleviate the patient’s anxiety ahead of a complicated operation and achieved informed consent more quickly and easily. Additionally, this process makes the surgical consult faster and more efficient, offering the surgeon time to see more patients.



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Extending the Use of 3D Printing to Other Disciplines

Dr. Zabaleta believes that the next natural step will be for all surgical disciplines at Biodonostia to use 3D printing to prepare and plan for surgeries, as it offers the hospital the opportunity to innovate their treatment procedures and improve patient care.

“The use of the 3D printed model was so essential to this case, and we are working to apply this to many other surgical disciplines across the hospital, from pancreatic tumors to airway stenosis, and these 3D printed models are already being used to help train our future surgeons,” said Dr. Zabaleta.



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