

# Improving Clinical Outcomes

## 3D Printing Improves Liver Transplant Pre-Surgical Planning for Dokuz Eylül University

Turkey's Dokuz Eylül University Hospital specializes in translational medicine, a discipline in biomedical research which aims to improve human health by using a collaborative approach to explore new diagnostic tools and treatments. Liver transplant surgeries in particular brought the challenge of an increasing number of donor deaths.

“Currently, liver transplantation is the only treatment option for both acute and chronic liver failure, with grafts for transplants supplied from cadavers via organ donation or from volunteer living donors,” explained Dr. Tufan Egeli, Staff Surgeon at Dokuz Eylül University Hospital. “However, cadaver grafts are inadequate to meet the increasing worldwide need for liver transplantation, which is why living donor operations have increased steadily. For these procedures, donor safety is of the utmost importance, so the ability to accurately evaluate liver anatomy and volume measurements of preoperative donor candidates is critical.”

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Dr. Tufan Egeli

**Staff Surgeon, Dokuz Eylül University**



The university was using 2D CT (computed tomography) data to visualize the anatomical and vascular structure of the liver during the preoperative planning for complex liver transplantations. However, this presented shortcomings in that the data can only be viewed on a computer screen, limiting the practicality of pre-surgery planning. To improve patient safety and the success rate for liver transplants, the hospital sought a way to produce clinically relevant liver models that precisely replicate the patient's liver. This would allow for pre-surgery planning that helps surgeons see and understand the exact anatomy in model form.

### 3D Models Improve Visualization

Rather than limit surgeons to diagrams on a screen, having a 3D printed model in their hands lets them more precisely plan surgeries and analyze the impact on critical areas of the body. The hospital found the solution by supporting the surgical process with the Stratasys J750™, the world's only full-color, multi-material 3D printer. Its advanced capabilities enable medical teams to view an actual model of the anatomy they'll be dealing with, helping them visualize the surgeries and anticipate problems.

"The 3D model can be used to better conceptualize the operation, and thus prepare for complications such as hepatic hydatidiform arthritis," said Dr. Egeli. "This information is valuable to medical teams and particularly surgeons." The Stratasys J750 can achieve a layer thickness of 14 microns, so the donor's liver can be replicated as a 3D printed model with the vascular structures presented clearly and in the right volume. This offers invaluable support to surgeons during operations and can help reduce the eventuality of complications.

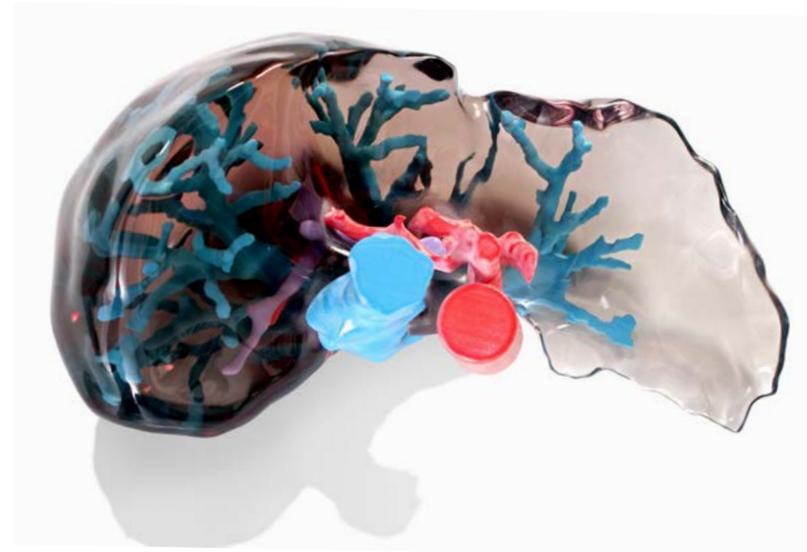
As Dr. Egeli put it, "The J750 directly meets our objectives to enhance hospital operations and improve clinical outcomes. It provides a unique opportunity to further train and develop the skills of medical professionals, strengthening our surgical training, thus positively impacting individual patients. Using 3D printing increases lab and operating room efficiency and saves the hospital vital expenditure."



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Dokuz Eylül University Hospital uses liver models with transparent tissue produced on the Stratasys J750 3D printer to enhance pre-surgical planning and improve clinical outcomes.



### A Life-Saving Future

Dokuz Eylül University Hospital predicts that the improved surgical outcomes achievable by pre-surgical planning using 3D printed models will lead to an increase in the number of willing donors. As an example, the surgical team\* recently used the CT data of a living donor candidate to obtain a 3D printed liver medical model with transparent tissue. Not only could the team use the model to evaluate liver vascular structures (hepatic artery, portal vein, hepatic vein) to ensure that the donor was viable, but they were also able to present the donor with the visual representation to explain the procedure and achieve informed consent from the patient.

“The J750 directly meets our objectives to enhance the way in which surgeons perform their role and improve clinical outcomes. Furthermore, from an instructional perspective, the 3D printed models enhance our ability to more accurately convey surgical procedures to students. This opportunity to further train and expand the horizons of medical professionals means that our surgical training will continue to strengthen, thus positively impacting individual patients,” Dr. Egeli said.

Additionally, Dr. Egeli believes that clinical training and education using 3D printing will increase lab and operating room efficiency and save the hospital vital expenditure.

\*The individuals involved in bringing about this project as part of the hospital's multi-disciplinary surgical team include: Phd. Belma NALBANT; Prof Dr. Tarkan UNEK; Prof Dr. Ibrahim ASTARCIOGLU; Assoc. Prof. Dr. Canan ALTAY; Assoc. Prof. Dr. Mustafa Alper SELVER; Phd. Ali Emre KAVUR; Assoc. Prof. Dr. Mücahit OZBILGIN; Staff Surgeon Dr. Cihan AGALAR; Prof. Dr. Funda OBUZ, and Staff Surgeon Dr. Tufan EGELI.

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