

# 3D PRINTING CONFERENCE INNOVATION, MODELLING, APPLICATION & IMPLEMENTATION

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## Neurosurgical simulations using 3D models with soft blood vessels

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Three-dimensional (3D) printing has been a widespread technique across various fields of the business world. For medical use, 3D printed products are mainly used for surgical simulations. For example, prior to a plastic surgery for craniofacial deformity, surgeons create a skull model, dissect it, and try to collate the parts into their appropriate positions. In the present session, I will describe my experience of surgical simulations using 3D models in neurosurgery.

Several types of 3D models have been produced. I will predominantly focus on one of these models, a silicone model of cerebral aneurysm. Because of the propensity of cerebral aneurysm to rupture, it is a critical disease causing Subarachnoid Hemorrhage. We treat this disease by clipping surgery or by coiling intervention of the aneurysm. However, this surgery is challenging because the anatomical structure around these aneurysms is complicated and patient-specific.

Therefore, pre-surgical simulations are important. We decided that 3D printers might be useful for such simulations and developed 3D hollow elastic aneurysm models. A 3D printer, "UP Plus" (Beijing Tiertime Technology, China), with acrylonitrile-butadiene-styrene (ABS) as a modelling

material, was used to produce a vessel model. The prototype was then coated with liquid silicone. After the silicone was hardened, the ABS was melted using solvent and removed, leaving the outer layer as a hollow elastic model.

Simulations using this hollow elastic model were performed in over 50 patients. In most patients, the clipping proceeded as scheduled. The postoperative assessment performed by surgeons showed favourable outcomes in most cases. This method allows simple fabrication at a low cost.

We also fabricate soft brain models using 3D printing and casting techniques. In these cases, direct products of the 3D printer, such as hollow elastic blood vessel and soft brain models are combined. These models are also useful; however, we had to spend time and effort on fabrication. I wish that 3D printers would automatically fabricate such types of models.

### Speaker Biography

Toshihiro Mashiko PhD is Associate Professor in Department of Neurosurgery, Jichi Medical University, Japan. He is a member of many reputed Neuroscience Societies and published good number of research papers in Peer review Journals.

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