



# Practice before the operation: medical models from the 3D printer

## Patient-specific reproductions from Magdeburg help doctors to prepare

A few years ago 3D printing still sounded like science fiction. Today, “additive manufacturing” is a leading growth market – and the technology is also gaining ground in Saxony-Anhalt. Researchers and developers are continuously developing new possibilities for the use of products which originate from the 3D printer. The paths they take lead them into every area of life. One such path has been taken by the Magdeburg company M3DP Medical Devices and Prototypes, which largely specialises on the patient-specific reproduction of organ and bone structures. The reproductions enable doctors to better prepare for sophisticated operations.

3D printing is believed to have a great future in the world of medicine. Bone implants for the human body are already available and entire skullcaps from the 3D printer have even been used on patients. Research is currently taking place into the reconstruction of organs. “In a few years’ time, I’m certain that a lot of things will be possible that seem beyond belief today,” explains Dr Fabian Klink. Dr Klink, who hails from Magdeburg, is the director of M3DP, a company which is increasingly committed to combining 3D printing technology with modern medicine. For the start-up, which came into being one year ago on the initiative of three doctors of mechanical engineering, another possible use has emerged for this combination. Increasing numbers of customized organ models are coming into being in the manufacturing hall, which M3DP is using in its experimental factory – a research and transfer centre for application-oriented research. “On this basis, doctors can prepare far better for operations,” explains Klink. “The surgeon can plan and simulate every step, rehears it with their colleagues, and enter the operating theatre better prepared.”

Dr Fabian Klink took the first step in this direction on starting his doctorate. He starts to combine mechanical engineering with medical technology whenever medical doctors at Magdeburg University Clinic for ENT approach the Otto-von-Guericke University and ask for medical models. The topic interests him and two of his colleagues, who are now his business partners. With their specialist technical knowledge they immerse themselves in the world of medicine, focusing on anatomy, observing operations and joining in with training courses for doctors. They “translate” professional vocabulary and link it with 3D manufacturing with which they “experiment”. Five years later, the research topic for the doctorate is a line of business. In addition to other products, M3DP manufactures models of temporal bones for the planning of operations to the inner ear.

In order to insert an internal ear implant into the cochlear for a deaf or hearing-impaired patient, the ENT surgeon has to precisely mill an access point through the hard bone tissue - without injuring any nerves or hearing and equilibrium organs. “If a cochlear implant has to be used on a deaf patient, until recently it was frequently the case that the physician was only able to simulate the use and complete their training on adult human specimens,” he explains. “This operation is carried out particularly frequently on children, though.”

Using the computer the team which later establishes the company M3DP develops models for the ENT clinic which are based on patient data. Through a special high-precision 3D printing process, authentic surgical models are created that can be used by budding and established physicians for their training, learning and planning. Together with the Magdeburg research and development team of the University ENT Clinic and the company Dornheim Medical Images GmbH, in 2014, the Professorship for Design Engineering at Otto von Guericke University is awarded the “Hugo Junkers Prize for Research and Development Saxony-Anhalt” in the category of “Innovative Alliances”.

This recognition, the shared research and development and the opportunities were what provided the incentive for Fabian Klink to enter this field. “When we began our work in the area of medicine we quickly realised its possibilities,” explains Klink. The subsequent emergence of his company was a logical next step for Klink.

M3DP now produces an increasing amount of patient-specific models in addition to “training models” with 3D printing. To this end, physicians make CT and MRT images available with the agreement of the patient and the clinic. By Fabian Klink and his team, the images are converted into a data record which can be read by the printer.

At the Magdeburg manufacturing facility 3D models are also created that can be used together with liquids. “We print arterial patterns with genuine clinical pictures,” explains Klink. Genuine CT images also provide the basis in this case. Scientists use the models from Magdeburg, for example, in tests with blood-like fluids to determine how a stent or a catheter affects the flow behaviour in the diseased area. With the printed arterial patterns, it is also possible for stents and medical tools to be developed further.

“We are thinking big,” says Fabian Klink. He plans to continue developing his company, to go in-depth in the specialist field of medicine and to expand the complete portfolio.

Word is getting around on the products that M3DP is able to make. One advantage is its proximity to the university. Klink, who is also a research assistant, attributes importance to maintaining the links between teaching and research. “Scientific input is always important. “We combine it with business,” he explains. Klink attends trade shows such as the Medica and RapidTech where he makes important contacts – with potential customers and networks. “We’re excited about what’s coming next,” he highlights. He has recently sent some of his models of the inner ear to the famous Charité hospital in Berlin. And he also has more ideas for 3D prints in mind: models of houseboats that a company could show to its customers before the “real one” is built, individual prototypes, parts for cars or – returning to the specialist medical field – images of brains, arteries, skulls and tumours in dummy skulls. It certainly seems a long time since 3D printing sounded like science fiction in Magdeburg.

Image caption:

Dr Fabian Klink during the manufacturing process of a 3D print in the experimental factory in Magdeburg.

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Chemists at Martin Luther University Halle-Wittenberg (MLU) have developed a way to integrate liquids directly into materials during the 3D printing process. This allows, for example, active medical agents to be incorporated into pharmaceutical products or luminous liquids to be integrated into materials, which allow monitoring of damage. The study was published in “Advanced Materials Technologies”.

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