



Growing the Capability of Medical Simulation With 3D Printing



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Medical Director of Center for Medical Simulation and Innovative Education at a Florida Pediatric Hospital

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With 3D Printing

Being a pioneer in any endeavor takes courage and determination, but it also requires leadership and vision. It's a path a Florida children's hospital is forging with its 3D printing capability, which is becoming an integral part of its medical simulation program. 3D printing for medical purposes isn't new, but point-of-care use of this technology is still in its nascent stage, and this children's hospital sees this as a vital instrument for providing better patient outcomes.

Elevating the Realism of Simulation

The medical director of the Center for Medical Simulation and Innovative Education at the hospital is an avowed proponent of 3D printing and sees this technology as essential for helping support the program's goals of research and education for the sake of improved care. "When I came here, this was part of my goal, to be able to utilize 3D printing as exactly that; a tool to help improve outcomes for patients and improve the education for clinicians."

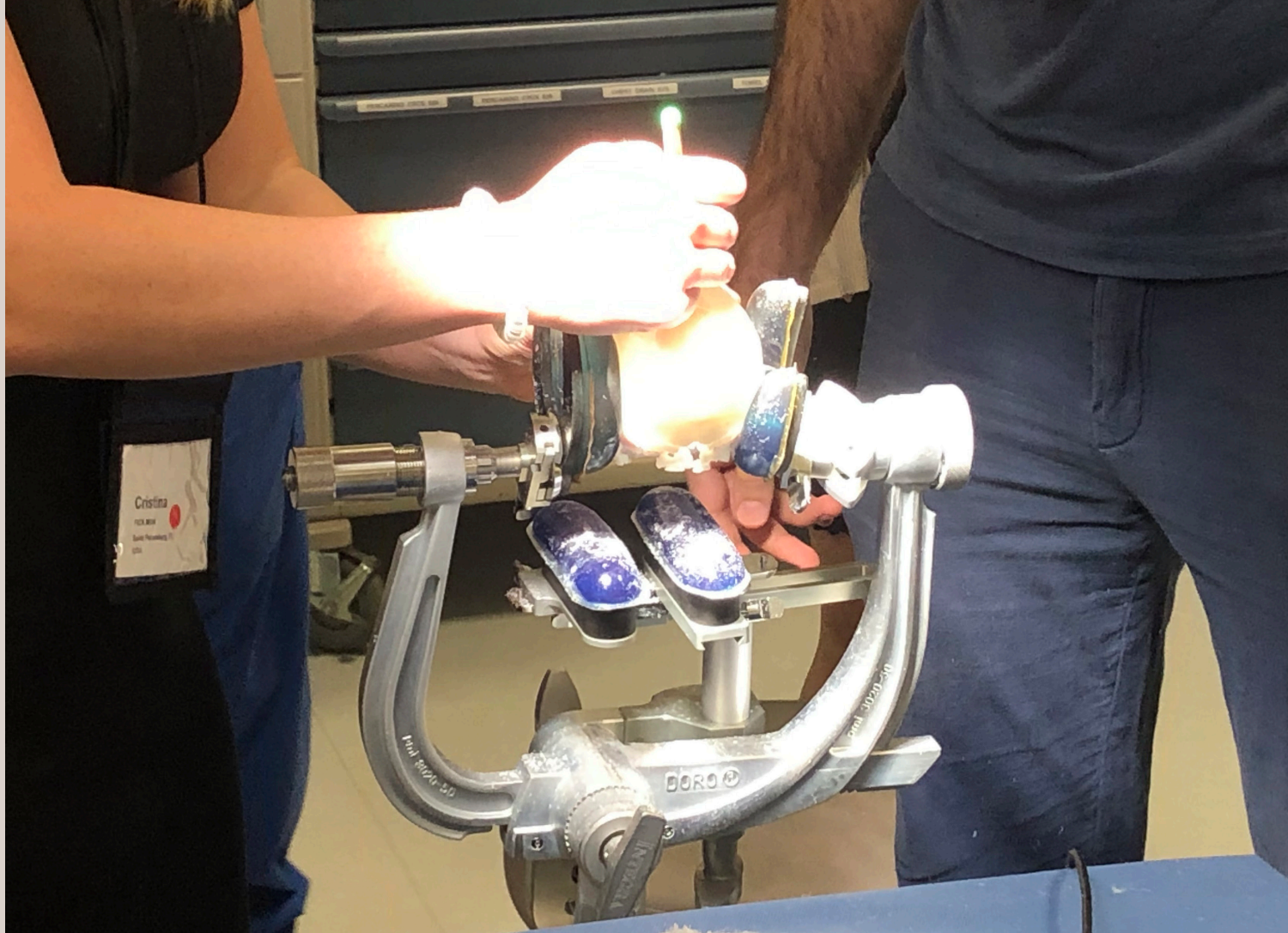
To achieve that goal the hospital acquired a Stratasys J750™ Digital Anatomy™ 3D printer to augment its simulation center. The printer, combined with the Digital Anatomy software, is able to create incredibly realistic anatomical models. To achieve this level of realism, the Digital Anatomy printer makes use of several special materials designed to mimic human bone and tissue: BoneMatrix™, GelMatrix™ and TissueMatrix™. The software leverages these materials to enable over 100 sophisticated anatomical presets to produce models that demonstrate clinically validated realism in both feel and biomechanical performance.



Craniosynostosis Prototype Model created using Bone Matrix and Tissue Matrix Material - Side View.



Craniosynostosis Prototype Model created using Bone Matrix and Tissue Matrix Material - Rear/Overhead View.



A simulation engineer with the hospital's Center for Medical Simulation and Innovative Education, who is responsible for working with the printer to create the models and training tools used for research and education, was impressed with the power of the Digital Anatomy printer, highlighting its advanced bone capabilities. He prepared skull and spine models for a physician-training workshop that allowed the doctors to practice cutting and drilling the bone models. The doctors' feedback was that the models provided a very realistic simulation of working with real bone. "They were very impressed with the bone matrix material. They said it was definitely close to the real thing," he says. Standard bone models made from plastic usually don't provide the same hardness and resistance of real bone and are typically easier to cut into. "They were really surprised how difficult it was to drill into, it as it would be with actual bone," he adds.

This kind of training can be a boon for doctors training for complex and delicate procedures

like spinal fusion. The simulation team stresses that looking at pictures or videos doesn't have the same impact as a realistic simulation. "You have to know your site locations, where you can drill and where you cannot. It's the physical landmarks that you're getting used to. That's the benefit of printing these models, so you can really practice your landmarks."

The medical director of the Center for Medical Simulation and Innovative Education reinforces that impact for special cases they see at their children's hospital. "In pediatrics, there's always a higher level of complexity. Kids are born with very rare, unique, individualized diagnoses and complications, and 3D printing is kind of perfect for that," she says. "Now with this printer, because it does soft and hard materials, I can make skin and soft tissue and bones, and I can potentially create a trainer so that our fellows don't have to perform the procedure for the first time on a tiny 500 gram (17 ounce) baby."

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Providing Access to Training for Better Results

For this simulation team, the goal is to positively impact the lives of the young children who need special care. But at a more tactical level, helping the surgical teams with highly effective training and problem-solving capabilities are key objectives, and tools like the Digital Anatomy printer help them achieve that. According to the medical director of the Center for Medical Simulation and Innovative Education, the large manufacturers of simulators, while they're improving, don't have a lot of pediatric models that meet their training needs. 3D printing fills that void.

"Because 3D printing provides a view and a tactile experience, especially with this printer having the soft and hard materials, the opportunities seem endless to me because (doctors) can operate before they operate," she says. "Decreasing complications and identifying a better way is going to have so many trickle-down effects; it's going to decrease surgical time, it's going to decrease morbidity and mortality and

help us decrease anesthesia time, which is better for brain development," she adds.

Promoting the Benefits

The team at this Florida simulation center has been working primarily with individuals within the hospital that are interested and engaged in 3D printing technology. But the objective is to expand the awareness. "Our goal is to start doing more internal PR and reaching out to other groups that may not realize there's a tool here that they could use, and showing them what the potential options are."

The team also points out that because of the simulation center's educational expertise, they've had the opportunity to grow their capability to train staff. Combined with the ability to print out multiple molds and training models for staff to practice with, the program has been easily adopted. "Because we have the combination of educational expertise on how you might use the print in an educational setting, plus now the ability to print out the trainers, I think that's been a big win for us and I think that's what's given us the most value and ROI."

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