Computerized table lets students do virtual dissection

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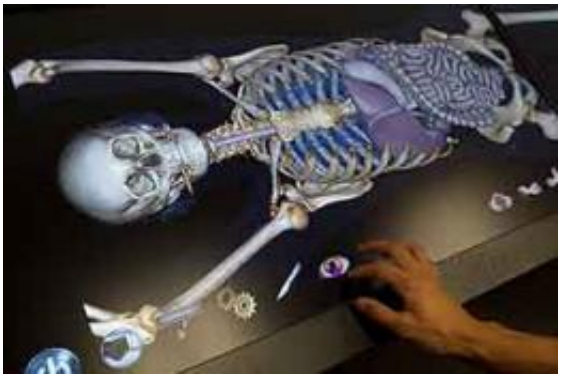

A new tool for teaching anatomy is getting a trial run in a bioengineering class. The table features a 7-foot by 2.5-foot screen that presents 3-D images of a human body that students could “dissect” with some simple finger motions. Credit:

“You make the diagnosis,” said the anatomy instructor, looking up expectantly at his students.

The handful of undergraduates gathered in close around the newest anatomy teaching aid, a life-sized, iPad-like dissection table with a 3-D image of a CT scan of a young woman’s injured shoulder.

Peering intently at the screen, the students couldn’t resist touching it.

With a swipe of the forefinger, they zoomed in on the image. Then

zoomed out. One touch, and the virtual shoulder rotated. Another touch, and the muscles disappeared leaving just the bones. One more touch and the bones dissolved, leaving the circulatory system behind.

“I’ve never seen anything like it,” said Meghan Bowler, 21, a junior bioengineering student from Boston.

Only an hour or so before the students huddled around the high-tech table, the professor, Sakti Srivastava, MD, associate professor of surgery and division chief of clinical anatomy, had presented a lecture on the anatomy of the upper limb in a nearby classroom using visual aids — illustrations and diagrams — and then led the group next door to some further hands-on education with the help of a cadaver, some 3-D dissection photos and the new technology called a “virtual dissection table.”

In the ongoing search for how best to explore and learn about the anatomy of the human body, Silicon Valley engineers have now joined a long list of doctors, artists, photographers and other technology innovators by adding a new method of anatomical exploration.

The new virtual dissection table takes advantage of 20th-century technological advancements in imaging, such as X-rays, ultrasound and MRIs, and combines them for use in a 7-foot by 2.5-foot screen. At Stanford, the table is being tested as a way to further enhance that age-old teaching method — the dissection of human cadavers.

“The virtual isn’t the same as the real,” said David Gaba, MD, associate dean for immersive and simulation-based learning. “What we want to do is leverage the best of both. It’s not really, ‘Is one better than the other?’ Rather it’s, ‘What can we do with the two combined?’”

Sakti Srivastava (center), anatomy division chief, uses the high-tech table to show students a dislocated shoulder. Credit: Norbert von der Groeben

The table, which made its debut on campus in April, is on loan from Anatomage, a San Jose-based medical technology firm, to the anatomy division at the medical school. Faculty are experimenting with its use as a possible teaching aid for everyone from undergraduate anatomy students to medical students, residents and even patients.

“We want to see what the educational value of this resource, this tool, might be,” Srivastava said. “Does it complement the cadaveric work of our students?”

The table is designed as a complement to other anatomical educational devices, with the added benefit of allowing users to easily explore hard-to-reach parts of the human body. Its creators refer to it as something of a reusable cadaver.

The $60,000 device is part of a new wave of technology that makes possible interactive displays of the body using real-life images. The touch screen — created by placing two LCD screens together horizontally — allows users to investigate a realistic visualization of 3-D human anatomy and to delve inside the human body. CT scan images are

augmented with 3-D modeling and annotation explaining what the viewers are viewing.

The images morph magically from soft tissue to hard tissue. The tissue can be sliced much like actual tissue on cadavers in the dissection lab next door, but no knife is needed — just a single slide of a finger will do. Then, with the press of a button, the entire body is restored instantly.

“The idea is you can build the body part by part,” said Paul Brown, DDS, consulting associate professor of anatomy.

Four faculty in radiology and anatomy are building a searchable library of digital anatomical images based on CT scans, MRI and ultrasounds of the human body that could be used with the table.

With access to such a library, the table would be able to include a wide selection of anatomical variations and pathologies in the human body — from tumors to fractures to cystic fibrosis. Anatomy professors at Stanford and at other schools could use the library of images to develop an extensive variety of lesson plans.

The first students to work with the table were in the new undergraduate bioengineering anatomy course taught by Srivastava. The day’s instruction began with a traditional lecture focused on the anatomy of the shoulder and the arm: the veins, arteries, nerves, bones, muscles. Then students walked over to the lab.

In one room was the traditional dissection lab. It was filled with rows of the medical students’ cadavers, each covered by a blue tarp. Two of the dissection tables were uncovered with a human arm on display for this day’s session.

In the dissection room, teaching assistants poked and prodded through

the blood vessels and muscles of the already-dissected human arm. The ulnar artery, the brachioradialis muscle — each anatomical piece described and illustrated previously in the lecture hall — was picked up and pointed out with a gloved hand for the class to see.

“What artery is this?” asked a teaching assistant, separating one vessel from the other.

“The ulnar,” the group said.

“And this?”

“The radial.”

When they were finished, the students rotated to the room next door to view 3-D images of the shoulder and chest from the world-renowned Bassett photographic collection of human dissection. And then on to the a third lab room where the virtual dissection table was open for class.

At the virtual dissection table, the professor asked the students for a diagnosis of the shoulder problem.

“The humerus is out of the socket,” Bowler answered.

“Right, it’s a complete dislocation,” Srivastava said. “Now, rotate the image a little bit. You can see there are smaller, fractured sections. You can predict the direction of the force that caused the dislocation. This is a rare variety. The patient comes in like this,” he said, holding his arm straight up in the air.

Then, once more, he reiterates the anatomy that he described in lecture hall:

“This is the brachial artery. It divides into two.

“I want you to see this little piece of bone, the medial epicondyle” — part of the elbow joint. “See that groove there? The ulnar nerve, that’s the funny bone. That’s where that sits.

“See the ulnar artery?”

Retired lab manager John Dolph, a 40-plus-year veteran of the anatomy division, was fascinated by the new table. But he was also quite sure that it would never completely replace the role of the cadaver in teaching anatomy.

“I think it has great potential,” Dolph said. “I’m from the old school. I still love the dissection of the human body. It’s still important and will always be. But the modern student has grown up with technology. Some will find this technology very easy to learn from.”

Srivastava said early use of the table is encouraging, but it will take some time to determine how widely it will be used on campus, if at all.

“The virtual dissecting table affords new ways to see and interact with the same anatomy, as well as providing access to a collection of normal variations and abnormal pathologies,” Srivastava said. “It allows you to see relationships between, say, bones and organs that are difficult to see with a real cadaver.”

Provided by Stanford University Medical Center