MedicalXpress

3D surface topographic scans yield reliable spine range of motion measurements in adolescents

March 8 2023

Cameras that can scan an entire body in a fraction of a second can give spinal surgeons an accurate assessment of how much range of motion youth with scoliosis have in their torso—a critical piece of information for guiding management of people with the condition, researchers at Hospital for Special Surgery (HSS) in New York City have found.

Spine specialists at HSS have been using a 30-camera array, called 3dMD, in the lab for several years, but the new study shows that the system produces clinically meaningful information. Because 3dMD does not rely on ionizing radiation, the technology may help adolescents with scoliosis avoid many of the repeated and potentially harmful X-rays that conventional care requires.

"Determining spinal range of motion is a lot more difficult than it sounds," said Roger Widmann, MD, chief of the Pediatric Orthopedic Surgery Service at HSS and co-principal investigator on the new study. The conventional gold standard has been the use of X-ray imaging; however, X-ray tests are expensive, and long-term exposure to radiation from the scans has been linked to cancers.

The new technology provides a "safe, repeatable, inexpensive measurement of spinal range of motion that can be used in both a research and clinical setting," Dr. Widmann said.

Information from the 3dMD scans can help spine surgeons determine the optimal approach to operative treatments and allow them to better track the progress of scoliosis patients following surgery. "The technology gives you objective measures of range of motion so you can improve your surgical decision-making," Dr. Widmann said.

The HSS team presented their findings today at the 2023 Annual Meeting of the American Academy of Orthopaedic Surgeons (AAOS) in a poster titled "3D Surface Topographic Optical Scans Yield Highly Reliable Spine Range of Motion Measurements in Adolescents."

The 30-camera array can generate a whole-body image of a standing person in under 2 milliseconds—fast enough to eliminate any blurring from even the slightest movement in any direction.

In previous studies, the HSS team and their colleagues have shown that images generated with the ultrafast cameras match the anatomy beneath the skin. That alignment is critical for 3dMD to be useful in the clinic as a way to guide treatment for scoliosis, which affects between 2% and 3% of youth in the United States, or 6 to 9 million people.

Treatment for scoliosis frequently involves physical therapy or the use of braces to correct the curvature of the spine—a measurement called the "Cobb angle"—but in the most severe cases, surgery may be necessary.

For the new study, Dr. Widmann's group used 3dMD to image 254 boys and girls with scoliosis and 53 without the spinal deformity as they underwent several exercises designed to work the torso in various directions.

"This is teaching us which parameters are more useful and which are not," says Howard Hillstrom, Ph.D., a biomechanical engineer at HSS, senior director of the Leon Root, MD Motion Analysis Laboratory and

co-principal investigator on this project.

The new study found two movements that were reliably able to differentiate youth with scoliosis from those with normal spines: bending as far to the left and right as possible while standing, and bending toward the floor as if to touch the toes.

In the first case, patients with scoliosis show significant asymmetry between one side and the other in terms of how far to each side they can bend. Meanwhile, scoliosis patients are not able to bend as far toward the floor—as measured from a point on their collarbone—as those with unaffected spines, Dr. Hillstrom said. "That's good enough to distinguish healthy kids from those with scoliosis because most kids are so flexible they can get to the floor and those with scoliosis probably can't."

Although the assessments make sense both intuitively and clinically, the latest study shows that they are also an objective measure of scoliosis. The entire process, from the start of the scan to the generation of results, takes under 10 minutes, Dr. Hillstrom added.

"And now we have this system that acquires these variables and doesn't require ionizing radiation to do so," he said, noting that this is critically important because scoliosis patients have a significantly greater incidence of cancer, breast cancer, and cancer mortality than those without the condition—an increase many experts attribute to the radiation they receive from X-rays and CT scans.

The process of diagnosing scoliosis starts early. "The first time someone notices that a child may have scoliosis is usually when the school nurse sees it during a routine examination," Dr. Hillstrom said. "The nurse tells the parent to take the child to a doctor, and the first thing a physician will do is order an X-ray."

The HSS team now has imaging studies of more than 300 adolescent patients with scoliosis in its 3dMD database. "Of those, approximately 50 are a year out from surgery and 30 are two years out, providing the ability to look at the long-term benefits of the technology on range of motion and other parameters [such as angle of trunk rotation, back surface rotation, and asymmetry in lateral bending and twisting", Dr. Widmann said.

Provided by Hospital for Special Surgery

Citation: 3D surface topographic scans yield reliable spine range of motion measurements in adolescents (2023, March 8) retrieved 13 May 2024 from https://medicalxpress.com/news/2023-03-3d-surface-topographic-scans-yield.html