



Technology Frontier

News Bite on PolyU's Innovation

Scolioscan Air: Portable 3D Ultrasound Imaging System Makes scoliosis assessment more accessible

Scoliosis is one of the most common spinal diseases among adolescents. In their rapid developmental phase, teens tend to experience quick progression of curvature and frequent monitoring is advisable. As X-ray poses radiation hazards, researchers from the Department of Biomedical Engineering developed a clinic-based 3D ultrasound imaging system a few years ago, which has been commercialized and installed in many healthcare centres for clinical use around the world. This year, they came up with a downsized version known as Scolioscan Air, which weighs 5 kg and fits easily into a suitcase. The team expect the new system would make mass screening and routine scoliosis assessment more accessible, thus facilitating early diagnosis and timely treatment.



Ir Prof. Yong-ping Zheng (3rd from left) and his research team

Scoliosis, a medical condition of sideways-curved spine, either in C or S shape, is one of the most common spinal diseases among adolescents. Most patients observe an onset from age 10 to 17, and females are eight times more likely than males to progress to a curvature that needs treatment¹. So far, X-ray imaging is the clinical gold standard for scoliosis assessment, but it also exposes the recipients to radiation hazard. To provide a safe radiation-free way to monitor and screen scoliosis with added portability, Ir Prof. Yong-ping Zheng, Henry G. Leong Professor in Biomedical Engineering and Head of Department of Biomedical Engineering, led a research team to develop Scolioscan Air – a palm-sized 3D ultrasound scanner

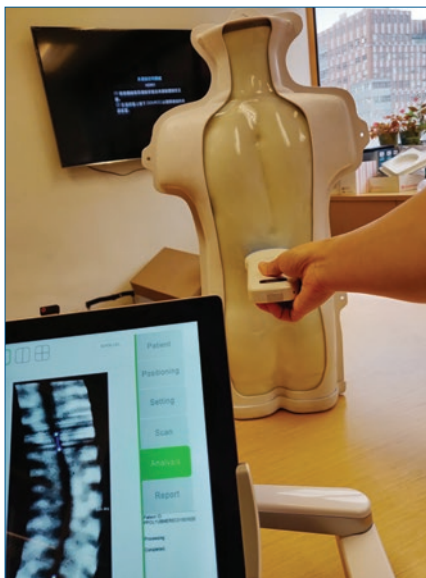
and imaging system. The team expect more teens can benefit from accurate radiation-free assessment of scoliosis in the future.

Safe scanning with no radiation hazard

In Hong Kong, about 3 to 5% of teens are estimated to suffer from scoliosis.² Among them, about 15% tend to suffer from deteriorating condition and would have to wear braces or undergo surgery as the curvature progresses. As teenagers grow and develop rapidly, regular and continual check-ups with X-ray imaging are essential. But research shows that scoliosis patients receiving an average of 16 radiographs during the treatment period have an overall cancer rate that is five times higher than the



Scolioscan Air, a portable 3D ultrasound imaging system for scoliosis assessment



Application of the palm-sized ultrasound probe



Scolioscan Air won a Grand Award, a Gold Medal with the Congratulations of Jury and a special merit award in the 47th International Exhibition of Inventions of Geneva.

control group 25 years after treatment, with endometrial and breast cancer being the most common.³ Thus, scoliosis patients cannot be exposed to X-rays too frequently and their conditions cannot be monitored as closely as they should be. In light of this, Prof. Zheng and his research team developed Scolioscan, a clinic-based 3D ultrasound imaging system, so that all teens can be screened for scoliosis without radiation hazard. The system has been registered by an industry collaborator in the European Union, Australia, and the registration in China is being processed. Scolioscan has been installed in medical and healthcare centres in Hong Kong, Macau and Beijing, Guangzhou, Shenzhen in China, as well as the Netherlands, Italy, and Australia for clinical or research applications. The team then kept working on a portable version, in Prof. Zheng's words, "to bring the service to patients anytime, anywhere, instead of asking them to come to a clinic or hospital."

3D ultrasound scan anytime, anywhere

The result is Scolioscan Air, a portable version of Scolioscan with a palm-sized scanning probe that weighs only 5 kg. All three components, including an ultrasound probe with optical marker, a depth camera and a tablet computer can fit easily in a suitcase. A typical scan only takes 30 seconds, with accuracy comparable to Scolioscan. When asked about the advantages of Scolioscan Air, Prof. Zheng said, "First and foremost, there is no radiation hazard. In fact, a person is normally suggested not to receive

X-ray examinations more frequently than once every six to twelve months. But six months are a long period of time for rapidly developing teens with progressing scoliosis. Thus, we need other means to monitor their conditions safely. Ultrasound is the answer and a patient may receive ultrasound scans as frequently as needed without any radiation hazard. Secondly, X-ray can only take a 2D image of the spine, while most spinal deformities are of a 3D nature. With ultrasound, we can capture 3D images in real time and build 3D models that can be viewed from different angles. That would help healthcare professionals to understand their conditions better. Finally, Scolioscan Air is ultra-portable, so that it can be brought to a school or a community healthcare centre for mass screening easily, saving time and effort. All in all, it makes the scoliosis assessment a lot more accessible to teenagers in different areas, so that early diagnosis and timely treatment become possible."

In April 2019, Scolioscan Air won a Grand Award, a Gold Medal with the Congratulations of Jury and a special merit award in the 47th International Exhibition of Inventions of Geneva, Switzerland.

1 "Scoliosis" American Association of Neurological Surgeons. Retrieved from <https://www.aans.org/patients/neurosurgical-conditions-and-treatments/scoliosis>

2 Fong, et al. "A population-based cohort study of 94401 children followed for 10 years exhibits sustained effectiveness of scoliosis screening." *Spine Journal*. January 2015. Retrieved from http://www.curvyspine.com/uploads/1/3/9/3/13939979/screening_for_scoliosis.pdf

3 Simony, et al. "Incidence of cancer in adolescent idiopathic scoliosis patients treated 25 years previously." *US National Library of Medicine*. October 2016. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27592106>