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SCOLIOSCAN: ASSESSMENT OF 3D SPINAL DEFORMITY USING ULTRASOUND IMAGING

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Summary: Scoliosis is a medical condition defined as a 3D spine deformity with curvature of more than 10 degrees in the coronal plane. Scoliosis is usually seen in teenagers and known as adolescent idiopathic scoliosis (AIS). Recently, a number of organizations, including American Academy of Pediatrics (AAP), have endorsed a position statement on "Screening for the Early Detection for Idiopathic Scoliosis in Adolescents", indicating the importance of earlier diagnosis and non-surgical management of AIS. (http://pediatrics.aappublications.org/)

The traditional scoliosis examination is X-ray radiography. However, there are some health risks posed by the radiation exposure – including an increased incidence of lung and breast cancers. Although there are several radiation-free screening approaches, but none of them are accurate enough, thus using X-ray us inevitable for AIS during diagnosis, curve progression monitoring, and treatment outcome evaluation, as well as during brace treatment. Accordingly, we developed a novel technology that enables safer and more frequent monitoring for scoliosis.

Scolioscan takes the advantage of 3D ultrasound imaging techniques and can provide 3D view of spine without any radiation. Ultrasound probe is scanned over the spine to collect a series of image together with spatial information, and advanced imaging processing methods are used to form images in coronal views as well as in 3D. Scolioscan has been used for scanning over 3000 scoliosis patients in Hong Kong, China, Macau, and The Netherlands.

In this talk, we will introduce the principle of Scolioscan, its automatic angle measurement function, 3D spinal model formation, and its excellent intra- and inter-rater repeatability of spinous process angle (ICC>0.8) and good correlation with X-ray Cobb's angle (R>0.85) in human subject trials. Its applications for sagittal analysis, transverse rotation analysis, forward-bending study, lateral flexibility test, brace design and fitting, longitudinal follow-up as well monitoring during Halo traction will also be introduced.

A series of study have demonstrated that Scolioscan, using 3D ultrasound imaging, is a very promising technique for providing radiation-free while accurate assessment of scoliosis, and has the ability for evaluating spine deformity in 3D, thus is a unique tool for scoliosis screening and monitoring.