Application of Scolioscan for Child Spine Health

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Background and Aims

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). The prevalence of AIS is 2-4% of the general population, and it is regarded as the most common spinal diseases among kids. Scoliosis does not only affect the appearance in adolescents but also the imbalance of muscle tension, which may cause back pain. Severe scoliosis may also affect lung and heart function, even leading to death. Therefore, when the deformity is larger than 45 degrees, complicated surgical procedure is normally required to correct the deformed spine. 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 detection 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 a number of 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. Thus, we developed a novel technology that enables safer and more frequent monitoring for scoliosis.

Fig. 1 – The Scolioscan system and operation

Methods

Scolioscan takes the advantage of 3D ultrasound imaging techniques and can provide 3D view of spine without any radiation (Fig. 1). 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 [1-6]. Scolioscan has been used for scanning over 3000 scoliosis patients in Hong Kong, China, Macau, and The Netherlands.

Results

As shown in Figure 1, 3D US imaging of the spine is achieved. 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) were obtained respectively in human trials [5]. In addition, semi-automatic and automatic results obtained using different algorithms showed good agreement with manual and X-ray Cobb's angle [6].

Conclusions

Scolioscan can provide 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. Effects on spinal curvature under different postures and properties of spinal muscles can also be investigated in patients with scoliosis or other musculoskeletal diseases in children using Scolioscan.

References

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