Mobile device based surface topography is a better predictor of spinal deformity than scoliometer

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LOE: *Case control or retrospective comparative study-Level III*
FDA: *FDA Clearance is NOT APPLICABLE.*

Introduction: Non-radiographic screening and diagnosis in adolescent idiopathic scoliosis (AIS) currently relies on scoliometer measurements. White-light 3D scanning (WL3D) can generate high quality 3D representations of surface anatomy using a mobile device. We hypothesized that WL3D would provide better deformity assessments compared to scoliometers.

Methods: Patients 10 to 18 years old presenting to an outpatient pediatric orthopaedic clinic with scoliosis radiographs within 30 days of the visit for evaluation of AIS were approached for the study. 3D scans were taken in the upright and forward bend positions. Image processing software was used to make 3D measurements of trunk shift (TS), coronal balance (CB), and clavicle angle (CL) in upright position and largest angle of trunk rotation (ATR) as detected in the lumbar and thoracic spine in bending position. 3D trunk shift, coronal balance, clavicle angle were compared to their analogous radiographic measurements. 3D ATR and ATR as measured by a scoliometer (SM) were correlated to major curve magnitude (MCM). Multivariable regressions models were created to predict likely hood of coronal cobb angle>20 based on BMI and 3D measurements vs BMI and scoliometer. Model fit was compared using Akaike information criterion (AIC)

Results: Three hundred and twelve visits representing 258 patients were included. Mean age at visit was 13.7 years mean Coronal major cobb angle was 19.8+/- 13.0 for lumbar curves and 22.1+/-15.3 for thoracic curves. There was a significant ($p < 0.001$) correlation between 3D and radiographic CL ($r = 0.65$), TS ($r = 0.8$), and CB ($r = 0.8$). There was also a significant ($p < 0.001$) correlation between change in 3D vs. change in xray CL ($r = 0.74$), TS ($r = 0.63$), and CB ($r = 0.52$). Correlations between cobb angle and ATR were higher for 3D lumbar ATR ($r = 0.63$) than SM lumbar ATR ($r = 0.39$). Similarly, correlations between cobb angle and ATR were higher for 3D thoracic ATR ($r = 0.46$) than SM thoracic ATR ($r = 0.65$). A Multivariable regressions model opredictivn cobb>20 including 3D data outperformed a model based on scolimeter data (AIC=206 vs 237)

Conclusion: Mobile device based 3D scanning identifies clinically relevant scoliotic deformity and is a better predictor of major curve magnitude than scoliometer measurements.

Significance: Mobile device based 3D scanning identifies clinically relevant scoliotic deformity and can facilitate non-radiographic scoliosis screening and monitoring.