239

VALIDATION AND REPRODUCIBILITY OF AN APP FOR CONTINUOUS MEASUREMENT AS AN ASSESSMENT TOOL FOR IDIOPATHIC SCOLIOSIS

Isis Navarro[1], Louis Jacob[2], Kevin Masetto[1], Francesco Dulio[1], Andrea Negrini[1], Stefano Negrini[3,4,1], Fabio Zaina[1], Alessandra Negrini[1]

[1]ISICO (Italian Scientific Spine Institute), Milan, Italy. [2]Université Paris Cité, Paris, France. [3]University of Milan, Milan, Italy. [4]IRCCS Galeazzi S.Ambrogio Hospital, Milan, Italy

Background

Idiopathic scoliosis is a three-dimensional deformity; however, clinical and research decision-making still relies largely on radiographic Cobb angle measurements. Clinical assessment of transverse and sagittal plane deformities has gained importance as a radiation-free alternative, but commonly used tools provide only discrete measurements. Continuous, reliable, and accessible assessment methods across multiple planes remain limited.

Study Design

Prospective observational reliability and validation study.

Objective (s)

To evaluate the concurrent validity and intra- and interrater reproducibility of continuous measurements of rib hump, thoracic kyphosis, and lumbar lordosis obtained using a smartphone application in adolescents with spinal deformities.

Methods

We recruited consecutive adolescents aged 10–17 years with scoliosis (>10° Cobb) or hyperkyphosis (>50° Cobb) from a specialized conservative scoliosis center. Were collected continuous measurements of angle of trunk rotation (ATR) during the Adams forward bend test and in standing position, as well as sagittal profile (thoracic kyphosis and lumbar lordosis), using the ISICO (Italian Scientific Spine Institute) app mounted on a standardized plastic tool. We assessed concurrent validity comparing to a scoliometer (gold standard) using Spearman correlation, root mean square error (RMSE), and Bland–Altman analysis. Reproducibility was evaluated through intra- and interrater intraclass correlation coefficients (ICC, model 3,k), standard error of measurement (SEM), and minimal detectable change (MDC), adopting a p-value <0.05.

Results

Thirty-two adolescents (median age 14.0 years; 71.9% female) were included for validation and intrarater analyses, and 34 for interrater analyses (age 13±3.8, 79.4% females). ATR measured with the app during the Adams test showed very high correlation with the scoliometer ($\rho = 0.97$, $p < 0.001$), with RMSE of 1.46° and minimal bias (0.26°) on Bland–Altman analysis. Standing ATR showed moderate correlation ($\rho = 0.51$, $p < 0.001$), with greater disagreement at lower values. Intrarater reliability was excellent for right rib hump during the Adams test (ICC = 0.93) and good to moderate for sagittal measures (ICC range: 0.54–0.77). Interrater reliability was excellent for rib hump during forward bending (ICC = 0.87 bilaterally) and moderate for sagittal parameters, with the lowest reliability observed for lumbar lordosis (ICC = 0.48).

Conclusion(s)

Continuous ATR measurement using the app is valid and reproducible, particularly during the Adams forward bend test. Sagittal plane measurements demonstrated moderate reproducibility,

Clinical significance

An app provides a very low-cost, radiation-free tool for continuous clinical assessment of spinal deformities across transverse and sagittal planes, potentially enhancing monitoring during growth.