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

*Isis Navarro, Louis Jacob, Kevin Masetto, Francesco Dulio, Andrea Negrini,Stefano Negrini, Fabio Zaina, Alessandra Negrini*

**ISICO (Italian Scientific Spine Institute)**, Milan, Italy
**Université Paris Cité,** Paris, France
**Department of Biomedical Sciences for Health, University of Milan,** Milan, Italy
**IRCCS Galeazzi S.Ambrogio Hospital**, Milan, Italy

**A smartphone app enables valid and reproducible continuous ATR assessment, with the highest accuracy during Adams forward bend test.**

## BACKGROUND

- Idiopathic scoliosis is a three-dimensional deformity
- Clinical assessment complements radiographic Cobb angle evaluation
- Current tools provide **discrete, single-point measurements**
- Continuous, multi-plane assessment methods remain limited

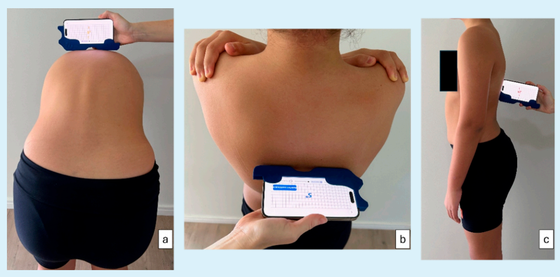
## AIM

**To evaluate the validity and intra- and interrater reproducibility of continuous measurements obtained with a smartphone app in adolescents with spinal deformities.**

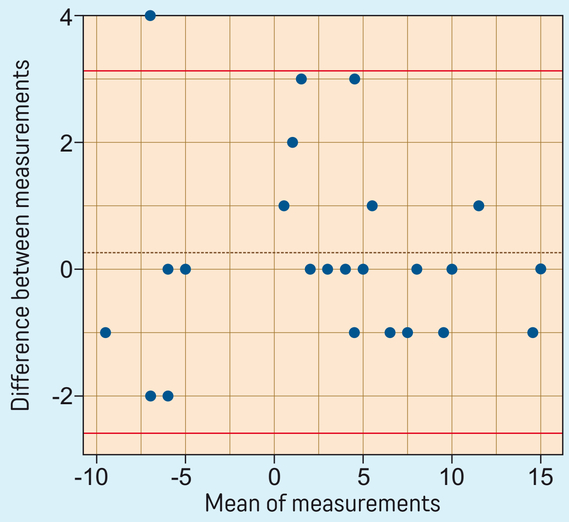
## METHODS

- Adolescents (10–17 years) with scoliosis or hyperkyphosis
- Continuous measurements using **ISICO app + standardized support tool**
- ATR measured during **Adams test and standing position**
- Comparison with **scoliometer (gold standard)**
- Validity: correlation, RMSE, Bland–Altman
- Reliability: ICC, SEM, MDC

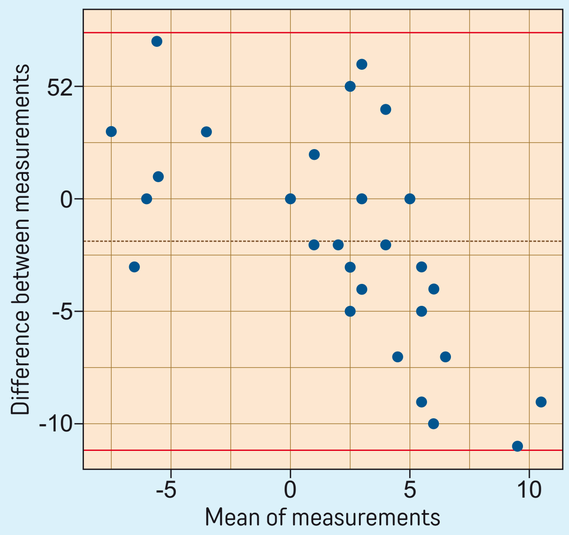
**Validity and reproducibility of app-based continuous measurements were assessed.**




**Agreement between app and scoliometer during the Adams forward bend test**




**Agreement between app and scoliometer in standing position**




**App measurements show excellent agreement during the Adams test, with lower accuracy in standing and moderate reliability for sagittal parameters.**

## RESULTS

- **32 adolescents** included for validation, **34** for interrater analyses
- ATR (Adams test): **very high correlation** ($\rho = 0.97$), minimal bias
- Standing ATR: **moderate correlation** ($\rho = 0.51$), greater variability
- Intrarater reliability: **excellent for rib hump** (ICC = 0.93)
- Interrater reliability: **excellent for rib hump** (ICC = 0.87)
- Sagittal parameters: **moderate reproducibility** (ICC = 0.54-0.77)

## DISCUSSION

- High validity in the transverse plane (strong correlation, low error, good agreement); moderate–excellent reliability
- Moderate reliability in sagittal parameters
- Enables radiation-free monitoring, crucial during growth (10–14 years)
- Allows assessment in both Adams test and standing, with graphical rib hump visualization
- Requires operator training; lower reproducibility in sagittal plane
- Lack of radiographic comparison → further studies needed

## CLINICAL SIGNIFICANCE

**The app provides a low-cost, radiation-free tool for continuous assessment of trunk deformities.It enables reliable monitoring of transverse plane deformities, particularly during the Adams forward bend test.**

**CONTACT:**
**isis.navarro@isico.it**
**https://en.isico.it**
Isis Navarro, PT

Alessandra Negrini and Stefano Negrini own stock of ISICO.
All other authors have no conflicts of interests to declare.