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Trace (trunk aesthetic clinical evaluation), the objective clinical tool to check aesthetic: Rasch analysis validation

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Introduction: The Trunk Aesthetic Clinical Evaluation (TRACE) is a four items scale administered by a clinician to quantify the trunk aesthetic appearance in adolescent idiopathic scoliosis (AIS).

Objective: Aim of the current work is to explore the psychometric properties of the TRACE scale by means of the Rasch analysis.

Methods: TRACE items (one: Shoulders; two: Scapulae; three: Waist; four: Hemi-thorax) are scored on 3 to 5 categories, with higher the score, poorer the patient's trunk appearance. We collected 1553 TRACE scales from 1553 young patients affected by AIS (one scale per participant; mean age: 13 years, SD: 1.7 years; 1334 females). Rasch analysis (partial credit model) was conducted using the Winsteps software. The differential item functioning (DIF) was assessed for the following variables: age (children vs adolescents), gender (male vs female), disease severity (i.e. Cobb degrees; mild vs severe), bracing (i.e. number of hours/day wearing the brace), treatment (first examination vs follow-up after one year treatment). The median was chosen to dichotomize disease severity and bracing. Misfitting subjects (64, 4%) were removed.

Results: All four TRACE items showed ordered thresholds and proper fit to the Rasch model (infit: $0.81 \div 1.16$; misfit: $0.66 \div 1.14$). The score-to-measure conversion table showed proper length, ranging from -4.55 to 4.79 logit. The subjects' mean measure was -0.52 logit (S.E.: 0.04 logit), slightly below the item mean measure (0 logit). The principal component analysis on Rasch residuals supported the TRACE unidimensionality (raw variance explained by measures: 59.8%; unexplained variance in 1st contrast: 1.7 Eigenvalue units). The TRACE was free from DIF for age, gender and bracing. TRACE item two (Scapulae) showed moderate DIFs for disease severity (contrast: 0.51 logit; joint S.E.: 0.1 logit) and treatment (contrast: 0.58 logit; joint S.E.: 0.1 logit), which however were not significantly different from the 0.5 logit threshold. Person reliability was low ($0.63 \div 0.70$), indicating that the test can discriminate ~2 levels in the sample.

Conclusions and significance: Rasch analysis showed that the TRACE scale can return a genuine, Rasch-consistant, interval-level measure of trunk aesthetic appearance in young patients affected by AIS. Being free from significant DIF, the TRACE measure can be used to compare the trunk appearance in different conditions (e.g. before and after treatment) and patients' populations (es. males vs females). The biggest flaw of the TRACE is its low reliability, likely because of its small number of items.