Reviewer’s report

Title: Evaluation of the iPhone versus the Scoliometer for rib hump measurement in scoliosis

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In this interesting article the authors present a novel use of plaster torsos as rib hump models for iPhone rib hump measurements, and they assess the inter- and intra-observer measurement variability using the iPhone and compare it to that of the Scoliometer.

In their introduction the authors state a very inaccurate statement, which is “Axial vertebral rotation combined with rotary distortion within the spinal vertebrae is exhibited in the scoliosis patient by a twisting of the ribcage which is most easily visible when the patient is standing in the forward flexed position, known as the Adams forward bending test”.


The question then is what exactly the scoliometer assess? The scoliometer reads and documents trunkal asymmetry and not scoliosis per se. It does not assess the deformity of the spinal column (the central axis), that is the scoliotic curve, which is traditionally assessed using the radiographs – (Cobb angle), even though in a number of publications the authors attempt to correlate these measurements, with the aim to reduce the exposure of the children to radiation. Scoliosis and trunkal asymmetry are not equivalent measurements, especially at a younger age, and it is now established that the surface asymmetry/deformity does not accurately predict the magnitude of scoliosis, especially in younger children.1,2 This is because, in younger children, trunkal surface and spinal asymmetry do not correlate statistically. The relationship of these two asymmetries becomes statistically significant in older children.1 This is additionally discussed below in connection to Amendt et al 1990 publication.

1. Grivas TB, Vasiliadis ES, Mihas C, Savvidou O. The effect of growth on the
correlation between the spinal and rib cage deformity: implications on idiopathic scoliosis pathogenesis. Scoliosis 2007;14;2:11.


The accuracy (inter and intra reliability) of scoliometer, which is an instrument which assesses trunkal asymmetry - as described above, has previously reported. The method used for the reliability study and the results was reported in the article by Grivas TB, Vasiliadis ES, Polyzois VD, Mouzakis V (2006). Trunk asymmetry and handedness in 8245 school children. DOI 10.1080/10428190500343027. Pediatr Rehabil. 2006 Jul-Sep;9(3):259-66. see Table III of this article. This article could also be included for the elaboration of the discussion of the reliability study.

In discussion section, the authors state that “As with the Bunnell Scoliometer, the iPhone together with the Scoliguage software application is a simple, inexpensive and portable method of measuring rib hump progression and a practical way to decrease exposure to radiation from repeated radiographs [3,4,11]”. It would be useful to comment on the limitations of this statement, using what is reported by Amendt et al 1990. They write that the Scoliometer measurements made by two raters on 65 persons with idiopathic scoliosis were correlated with radiographic agreement of vertebral (pedicle) rotation and lateral curvature (Cobb method). Correlations ranged from .32 to .46 with pedicle rotation and from .46 to .54 with the Cobb angle. Frequency analysis revealed relatively good specificity, sensitivity, and predictive capability of the Scoliometer. Intrarater and interrater reliability coefficients were high (r = .86-.97). These results indicate good measurement reproducibility. The less than optimal between method correlation coefficients suggest that the validity of Scoliometer measurements is not sufficient to use this method alone for determining patient diagnosis and management. Based on the positive-frequency analysis however, the use of this tool as a screening device would be appropriate. Amendt LE, Ause-Ellias KL, Eybers JL, Wadsworth CT, Nielsen DH, Weinstein SL. Validity and reliability testing of the scoliometer. Physical Therapy 1990;70:108–117.

These findings can be accepted especially if we consider some new knowledge based on the recent published research on the correlation of surface (trunkal) and axial (spinal) deformity, by Grivas et al 2007, which was also discussed above; Grivas TB, Vasiliadis ES, Mihas C and Savvidou O (2007): The effect of growth on the correlation between the spinal and rib cage deformity: implications on idiopathic scoliosis pathogenesis. Scoliosis 2007, 2:11 doi:10.1186/1748-7161-2-11

We thing that it is important to emphasize again that this research documented that growth has a significant effect in the correlation between the thoracic and the spinal deformity in girls with idiopathic scoliosis. In younger children the concordance of the surface and spinal deformity is weak and it becomes stronger as the children are growing up. Therefore, in younger children with surface/trunk
asymmetry, the prediction of the spinal deformity alone from the surface topography is inaccurate. Consequently this knowledge should be taken into consideration when trying to assess the spinal deformity from surface measurements and correlate surface and radiological readings.

Huang 1988 also reported on the effectiveness of this instrument but he studied the correlation of scoliometer with radiographical readings. Based on his findings of this correlation he concluded that the value of the scoliometer in school scoliosis screening still needs further evaluation, a statement that according to our opinion underestimates the value of the Scoliometer for screening asymmetry and is non acceptable. The age range of screened children by Huang et al was 12 – 14 years old. As we previously discussed in this age range of screened children the correlation of surface and radiographical deformity is not statistically significant, therefore the author’s findings were expected and predicted.


Finally one possible limitation of the introduced torso model is that the examiner could not easily palpate-recognize the spinous processes on it, as he/she can easily do “in vivo”, making the measurements inaccurate.

Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.