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The relationship between pelvic torsion and anatomical leg length inequality: a review of the literature

In Reply:

We appreciate the opportunity to explore issues related to the appropriate use of statistical analysis to

determine level of agreement between measuring methods. Our correspondent feels we misrepresented the findings by Rhodes et al¹ by stating there was “poor agreement found ... between visual methods of leg checking and upright radiographs.”² The authors found that the correlation coefficient (*r*) was 0.719 and conclude, “most statisticians characterize this as a ‘moderate positive’ correlation.” We did not consider this finding as relevant as the investigators’ own qualitative interpretation: “Results indicated ... the relationship was not as strong as anticipated. Measurement differences between methods in this investigation, which were greater than 3 mm 48% of the time, indicated that prone measurement by itself is not accurate as a predictor of X-ray leg length differences.” The results section of the Rhodes et al article documents considerable divergence of the prone leg check and radiographic findings. The highly dispersed scatter plot in their Fig 2 speaks for itself; the

Fig 1. Upper left, scatterplot and trendline for raw data; upper right, limits of agreement; lower left, Bland-Altman plot; lower right, histogram of differences. (Color version of figure is available online.)

interpretation of the slope of the regression line is mathematically incorrect and thus misleading.

How can we reconcile a high value for the Pearson product moment correlation coefficient (r), whereas inspection of the data tells a different story? Bland and Altman³ discuss the common error of using the Pearson statistic to determine agreement between 2 measuring methods: “ r measures the strength of a relation between two variables, not the agreement between them ... it would be amazing if two methods designed to measure the same quantity were not related.” As an alternative, Bland and Altman advocate a “difference vs means plot,” which plots the difference between measures as a function of their average. It includes confidence intervals between which 95% of the differences would lie (“limits of agreement”). Because Rhodes et al provided their raw data, we were able to calculate the following: lower limit = -11.6 mm, upper limit = 10.4 mm (Fig 1). The statistical calculations and outputs were performed using Analyse-it version 2.21 (Analyse-it Software, Ltd; Leeds, United Kingdom). More simply, the standard deviation of the absolute value of the differences between the 2 measuring methods is 5.6 mm; so 95% of the differences would be about ± 11 mm. Although the Pearson value of 0.719 shows high correlation between prone leg checks and radiograph measures, at best, they will be within about a centimeter of each other.

Although our correspondent states that we should have distinguished between anatomical and functional leg length inequality (LLI), we cannot determine why, nor why “Methods which incorporate both anatomical and functional LLI without distinction ... overestimate the incidence of anatomical LLI.” We do not believe

that weight-bearing LLI includes a functional component. In our view, functional LLI can only manifest in the non-weight-bearing position, when asymmetry in suprapelvic muscle tone may pull on the iliac crest and thus the lower extremity on that side, creating an apparent short leg.⁴⁻⁷

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