Assessing the Reliability of Forearm Length Measurements in a Pediatric Population

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Conclusions
Our customized forearm length measurement tool has strong intra- and inter-rater reliabilities, as demonstrated by ICC coefficients of 0.99, indicating it’s a functional tool for routine use in orthopedic surgery clinic to measure forearm lengths of patients with idiopathic scoliosis. Continuation of this study is ongoing to determine if forearm length can predict growth velocity and estimate scoliosis curve progression, which may have a significant impact on the future treatment and outcomes of idiopathic scoliosis.

Background
A relationship exists between growth velocity and scoliosis curvature progression, suggesting growth velocity may be a surrogate marker for scoliosis treatment initiation. Longitudinal long bone growth is increased in patients with scoliosis, but long bone length has yet to be correlated with growth velocity. Therefore, forearm length measurements may provide a practical and non-radiographic tool to estimate growth velocity and scoliosis curve progression.

Methods
- Created a customized tool for forearm length measurements
- Forearm length = distance from the distal tip of the right middle phalanx to most proximal aspect of the olecranon
- Inclusion Criteria
  - Ages: 8 - 17 years; Sex: either
  - Patients presenting to orthopedic surgery clinic; excluding neuromuscular conditions or right arm trauma
- Three measurements made by Rater A, blinded to readings prior to recording. Then Rater B, blinded to initial results, made three measurements on the same patient. Patient’s arm removed from devise and repositioned between each measurement.

Results & Statistical Analysis
- A total of 41 patients consented and enrolled
  - Age range: 8 to 17 years
  - 23 Female, 18 Male
- SPSS 19 software used for statistical analysis
- Intra- and Inter-Class Correlation (ICC) coefficients calculated with 95% confidence intervals
  - Individual Raters: One-way random modeling
  - Between Raters: Two-way random modeling with absolute agreement parameters

<table>
<thead>
<tr>
<th>Reliability</th>
<th>Rater A</th>
<th>Rater B</th>
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<tbody>
<tr>
<td>Average Standard Deviation</td>
<td>0.66</td>
<td>0.73</td>
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<tr>
<td>Variance</td>
<td>0.41</td>
<td>0.48</td>
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<tr>
<td>Intra-CC Coefficient</td>
<td>0.99</td>
<td>0.99</td>
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<tr>
<td>Inter-CC Coefficient</td>
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<td>0.99</td>
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References