How Reliable is Clinical Evaluation in Hindfoot Coronal Alignment?

A diagnostic study

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Background and rationale

✓ Hindfoot alignment is an important issue to consider in many foot and ankle disorders. Since it is a determining factor in the prognosis of different entities, it should be included in a complete physical examination, as well as in the preoperative planning.

✓ The optimal hindfoot coronal alignment assessment is yet to be defined. Clinical evaluation has many sources of bias. The lack of objective landmarks and the presence of anatomical variations, make accurate measurement a great challenge.

✓ Measuring hindfoot alignment in the coronal plane radiographically is difficult due to the superimposition of the calcaneus with mid- and forefoot. Currently, both the radiographic technique and the measurements methods are still controversial.
Methods

- Cross-sectional study of 85 healthy patients who presented to our clinic with foot and/or ankle complaints.

- Clinical assessment was made through photographs and classified into varus, neutral and valgus, according to the examiner perception.

- Radiographic assessment was quantified on Long Axial View. We determine an angular measure between the tibial axis and the lateral wall of the calcaneus; results were classified as neutral, for angles up to $5^\circ$; valgus, angles greater than $5,1^\circ$ and varus, negative angles.
Methods

Clinical evaluation:

Radiographic technique:
Methods

Radiographic technique:

For tibial axis assessment we bisected the tibia into two mid-diaphyseal points (lines A and B) 30 mm apart and extended this line distally (line C). For calcaneal axis we draw a line parallel to the calcaneus lateral wall (line D).
Is clinical evaluation of hindfoot alignment reproducible?

Intra-observer ICC of 0.78 for each one (Table 1).
Interobserver ICC was 0.58 and 0.56 for the first and second measurement respectively (Table 2).
The intra-observer ICCs were good for both observers; and the interobserver ICCs were only moderate for both measurements.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Evaluation 2</th>
<th>Evalutaion 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varus</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Neutral</td>
<td>2</td>
<td>37</td>
</tr>
<tr>
<td>Valgus</td>
<td>0</td>
<td>3</td>
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<table>
<thead>
<tr>
<th>Table 2</th>
<th>Observer 2</th>
<th>Varus</th>
<th>Neutral</th>
<th>Valgus</th>
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<tbody>
<tr>
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<tr>
<td>Neutral</td>
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<td>25</td>
<td>9</td>
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<tr>
<td>Valgus</td>
<td>0</td>
<td>2</td>
<td>25</td>
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</tbody>
</table>

Highlighted cells indicate diagnostic agreement between the two observers.
Results

✓ Is radiographic evaluation of hindfoot alignment reproducible?

The intra-observer reliability was statistically significant on each observer measurement (ob. 1: \( r = 0.95 \) and ob. 2: \( r = 0.99 \); \( p < 0.0001 \)) (Table 3 - Fig 4).

The interobserver reliability was also statistically significant, \( r = 0.92 \) for the 1st measurement and \( r = 0.95 \) for the 2nd measurement; \( p < 0.0001 \) (Table 4 - Fig 5).
### Results

<table>
<thead>
<tr>
<th>Observer</th>
<th>Evaluation</th>
<th>Average</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Evaluation 1</td>
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<tr>
<td></td>
<td>Evaluation 2</td>
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<td>2</td>
<td>Evaluation 1</td>
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<tr>
<td></td>
<td>Evaluation 2</td>
<td>-1,84</td>
<td>6,72</td>
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</table>
Does clinical and radiographic evaluation of hindfoot alignment correlate?

The correlation between both methods was weak for both observers. Observer 1: ICC 0.072; p 0.24 for the first measurement and ICC 0.167 p 0.029 for the second measurement. Observer 2: ICC 0.23 p< 0.001 for the first measurement and ICC 0.137 p 0.021 for the second measurement (Table 5).

### Results

<table>
<thead>
<tr>
<th>Clinical evaluation</th>
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<th>Observer 2</th>
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<tbody>
<tr>
<td></td>
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<td>Neutral</td>
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<td>Valgus</td>
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</tr>
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Highlighted cells indicate diagnostic agreement between the two observers.
Conclusion

- Hindfoot alignment is an important issue to consider in many foot and ankle disorders.
- The correlation between clinical and radiographic assessment was weak and not statistically significant for both observers in our series.
- Although CHCAA is unreliable, we consider that patients must be evaluated from the back, forward and with a 360° visual exam, in an attempt to reduce bias. And regarding radiographic evaluation, we found that using LAV and defining the lateral wall of the calcaneus as the calcaneal axis, constitutes a reliable method.
References