Comparison of Radiographs and Computed Tomography for the Diagnosis of Anterior Inferior Iliac Spine Impingement

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Schindler, BR; Venderley, MB; Mikula, JD; Chahla, J; Dornan, GJ; Turnbull, TL; LaPrade, RF; Philippon, MJ
Disclosures

- Dr. Robert F. LaPrade is a consultant and receives royalties from Arthrex, Ossur and Smith & Nephew.

- Dr. Marc J. Philippon disclosures are:
  - Smith & Nephew\textsuperscript{a,b}, Arthrosurface\textsuperscript{b}, HIPCO\textsuperscript{b}, MIS\textsuperscript{b}, ConMed Linvatec\textsuperscript{a}, Bledsoe\textsuperscript{a}, Slack\textsuperscript{a}, Elsevier\textsuperscript{a}, DonJoy\textsuperscript{a}, Ossur\textsuperscript{b}, Arthrex\textsuperscript{b}, Siemens\textsuperscript{b}, Vail Valley Surgery Center\textsuperscript{c}, SPRI\textsuperscript{c}, ASIAM\textsuperscript{c}, Vail Health Services\textsuperscript{c}, ISHA\textsuperscript{c}

  A. Consulting/Royalty
  B. Research Support
  C. Board Member

The co-authors have no disclosures.
Background

• Assessment of the anterior inferior iliac spine (AIIS) impingement → Validated for CT scans.

• Radiographic protocols → Limit radiation exposure.

• No comparison of radiographic and 3D CT measurements exists to determine whether radiographs are a valid methodology.
Purpose

1. Define radiographic and 3D CT measurements related to the AIIS
2. Compare radiographic and 3D CT imaging modalities for the diagnosis of AIIS impingement

• Hypothesis: High correlation $\rightarrow$ radiographic measurements vs. CT imaging modalities.
Methods

- Ten human cadaveric fresh-frozen pelvises
- Radio-opaque hardware on landmarks
- Image collection
  - Radiographic anteroposterior (AP) and false-profile views using an alignment fixture
  - Clinical-grade CT scans, followed by computational modeling software to create a 3D bone model
Radiographic (AP)
- Landmarks: AIIS-L (most lateral location of AIIS), AIIS-A (most anterior location of AIIS), 12 Rim (12 o’clock position)
- Measurements: AP Distance (12 Rim to AIIS-L), AP Angle (AIIS-L to Sagittal plane)
Radiographic (False-Profile)
- Landmarks: AIIS-A (most anterior location of AIIS), 12 Rim (12 o’clock position)
- Measurements: False-Profile Distance (12 Rim to AIIS-L), False-Profile Angle (AIIS-L to Sagittal plane)
Computed Tomography
- Each pelvis was computationally oriented to a normalized position and measurements were made (AP Distance and AP Angle)
- Each pelvis was computationally transformed to the false-profile view and measurements were made (False-Profile Distance and False-Profile Angle)
## Results

- **Distance and angle measurements (Median)**

<table>
<thead>
<tr>
<th></th>
<th>AP Distance (mm)</th>
<th>False-Profile Distance (mm)</th>
<th>AP Angle (°)</th>
<th>False-Profile Angle (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiographs</td>
<td>16.4</td>
<td>41.4</td>
<td>33.5</td>
<td>50.2</td>
</tr>
<tr>
<td>3D CT</td>
<td>20.2</td>
<td>42.5</td>
<td>28.1</td>
<td>42.8</td>
</tr>
</tbody>
</table>

AP Distance: 12 Rim to AIIS-L
False-Profile Distance: 12 Rim to AIIS-A
AP Angle: AIIS-L to Sagittal Plane
False-Profile Angle: AIIS-A to Sagittal Plane
Results

- Intra-method Analyses

<table>
<thead>
<tr>
<th></th>
<th>AP Distance ICC</th>
<th>False-Profile Distance ICC</th>
<th>AP Angle ICC</th>
<th>False-Profile Angle ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrarater</td>
<td>0.980</td>
<td>0.995</td>
<td>0.962</td>
<td>0.995</td>
</tr>
<tr>
<td>Interrater</td>
<td>0.838</td>
<td>0.883</td>
<td>0.914</td>
<td>0.980</td>
</tr>
</tbody>
</table>

- Excellent reproducibility
- **False-profile**: Most repeatable angle and distance measurements
Results

**Inter-method Analysis**

<table>
<thead>
<tr>
<th></th>
<th>AP Distance</th>
<th>False-Profile Distance</th>
<th>AP Angle</th>
<th>False-Profile Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ICC</strong></td>
<td>0.322</td>
<td>0.443</td>
<td>0.638</td>
<td>0.180</td>
</tr>
<tr>
<td><strong>Bias</strong></td>
<td>- 4.1 mm</td>
<td>- 0.1 mm</td>
<td>6.7°</td>
<td>8.3°</td>
</tr>
<tr>
<td><strong>Agreement</strong></td>
<td>Poor</td>
<td>Fair</td>
<td>Good</td>
<td>Poor</td>
</tr>
</tbody>
</table>

The systematic, quantitative bias between modalities will remain relatively consistent because of the strong intramethod reproducibility.
Discussion & Conclusions

• Radiographic and 3D CT imaging modalities had strong reproducibility for measurements related to the AIIS.
  – The false-profile radiographic view was most accurate and reproducible to demonstrate AIIS morphology.

• Radiographs can be reliably utilized to determine and classify potentially pathologic AIIS measurements.
Thank you!

Keeping people active.