An Anatomic Study on the Validity of Using Patellar Centering to Represent a Perfect AP Radiograph of the Knee

Ademola A. Ajuwon, B.S.
Ronak J. Desai, M.D.
Kathleen Farhang, B.S.
Colin E. Lasko, B.S.
Raymond W. Liu, M.D.

Case Western Reserve University
Disclosure

- Orthopediatrics: Royalties paid to institution
  - Direct research costs
  - Meeting costs for medical students
- Arthrocare Corp.
  - Employment
- Zimmer, Inc.
  - Employment
• A patella centered between the femoral condyles at the distal femur is generally accepted as a true AP radiograph of the knee.
• A true lateral view radiograph of the knee should show the posterior and distal aspect of the femoral condyles superimposed over one another.
Research Questions

• What is the typical variance in patellar centering for the general population?

• Is there a reliable way to predict between patellar centering with standard parameters?
Methods

- Hamann Todd Osteological Collection
- 428 cadaveric skeletons
- Ages 40-79 years
- 55 female, 373 male
- 129 black, 299 white, 1 unspecified
- Exclusions
  - Obvious periarticular trauma or infection
  - Obvious metabolic/rheumatologic disease
  - Incomplete skeletons
**Methods**

- **Patellar Centering**
  - Femurs placed with posterior aspect of the femoral condyles lying flat
  - Patella then placed within the patellar groove and an AP image was obtained
  - Width measurements were then used to calculate patellar centering compared to distal femoral width
    - Centering value = 0 represents perfectly centered patella
    - Centering value > 0 represents lateral deviation
    - Centering value < 0 represents medial deviation
Methods

• Patellar centering calculation:

\[(\text{Femoral width} \times 0.5) - (\text{DPLE}) - (\text{Patellar width} \times 0.5)\]

  Femoral width

• DPLE = distance from the lateral patellar edge to the lateral condylar edge of the femur.
Methods

• Angular Measurements
  – mL DFA: mechanical lateral distal femoral angle
  – MPTA: medial proximal tibial angle

• Femoral Version
  – Measured as the angle between the bicondylar plane and the neck axis
Results

• Average age: $56 \pm 10$ years

• Average patellar centering: $0.129 \pm 0.039$
  – Intra-class correlation coefficient (20 specimens): 0.83

• Average femoral version: $1 \pm 12^\circ$

• Average knee alignment
  – mLDFA: $88.0^\circ \pm 2.2^\circ$
  – MPTA: $87.3^\circ \pm 2.4^\circ$
<table>
<thead>
<tr>
<th></th>
<th>Standardized Beta</th>
<th>P-value</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.020</td>
<td>0.564</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-0.014</td>
<td>0.678</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td>-0.006</td>
<td>0.863</td>
<td></td>
</tr>
<tr>
<td>mLDFA</td>
<td>0.099</td>
<td>0.005</td>
<td>0.009</td>
</tr>
<tr>
<td>MPTA</td>
<td>-0.010</td>
<td>0.759</td>
<td></td>
</tr>
<tr>
<td>Contralateral</td>
<td>0.233</td>
<td>&lt;0.0005</td>
<td>0.054</td>
</tr>
<tr>
<td>Centering</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Femoral Version</td>
<td>0.025</td>
<td>0.453</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
<td>0.066</td>
</tr>
</tbody>
</table>
Results
The major limitation of the study was that there were no soft tissues available.

This was an anatomic study without any actual radiographs.
Conclusions

• On a “true AP” radiograph, there is lateral deviation of the patella

• There is a high degree of variance between individuals and it was only minimally predicted by our seven measures

• A pure lateral view radiograph, followed by a subsequent orthogonal image, may produce a more accurate AP radiograph than basing the AP view on patellar centering
Thank You