The Relationship between Angular Knee Deformity and Degenerative Disease of the Hip and Knee

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Disclosure

• Orthopediatrics: Royalties paid to institution
  – Direct research costs
  – Meeting costs for medical students

• Arthrocare Corp.
  – Employment

• Zimmer, Inc.
  – Employment
• Correction of angular deformity is becoming more precise
• What are the indications for correction of angular knee deformity?
  – Symptomatic deformity
  – Asymptomatic mild to moderate deformity: Where is the cutoff?
Methods

- Hamann Todd Osteological Collection
- 471 cadaveric skeletons
- Ages 40-79 years
- 60 female, 411 male
- 148 black, 322 white, 1 other
- Exclusions
  - Obvious periarticular trauma or infection
  - Obvious metabolic/rheumatologic disease
  - Incomplete skeletons
• Angular Knee Deformity
  – mLDFA and MPTA
  – Assigned 1 point for each 2.5° interval out of 85°-90°
  – Overall score based on combined mLDFA and MPTA points
Methods

• Degenerative disease grading
  – Acetabulum, Proximal Femur, Distal Femur, Proximal Tibia
  – Grades 0 to 3
  – Grouped into hip and knee joints
  – Compared to ipsilateral knee alignment
Acetabulum Grading

0  1  2  3
Proximal Femur Grading
Distal Femur Grading

0
1
2
3
Proximal Tibia Grading

0

1

2

3
Results

• Kappa Inter-relator reliability: 20 specimens
  – Acet: 0.40
  – Prox Fem: 0.22
  – Dist Fem: 0.38
  – Prox Tib: 0.23

Landis and Koch (Biometrics 1977)
- <0.00 Poor
- 0.00-0.20 Slight
- 0.21-0.40 Fair
- 0.41-0.60 Moderate
- 0.61-0.80 Substantial
- 0.81-1.00 Almost Perfect
• Average age: 56 ± 10 years
• Average grades
  – Acetabulum: 1.8 ± 0.8
  – Proximal femur: 1.6 ± 1.0
  – Distal femur: 1.7 ± 0.8
  – Proximal tibia: 1.6 ± 0.8
• Average knee alignment
  – mLDFA: 88.1° ± 2.2°
  – MPTA: 87.2° ± 2.5°

Adopted from: Paley D, Principles of Deformity Correction, 2003
# Standardized Beta: Hip

<table>
<thead>
<tr>
<th></th>
<th>Age</th>
<th>Gender</th>
<th>Race</th>
<th>mL DFA</th>
<th>MPTA</th>
<th>Overall</th>
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<tbody>
<tr>
<td>mL DFA ≥ 87.5</td>
<td>0.501</td>
<td>-0.085</td>
<td>0.038</td>
<td>0.060</td>
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<tr>
<td>MPTA ≤ 87.5</td>
<td>0.485</td>
<td>-0.017</td>
<td>0.038</td>
<td>0.037</td>
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<tr>
<td>Overall Varus</td>
<td>0.489</td>
<td>-0.031</td>
<td>0.041</td>
<td>0.058</td>
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<td>mL DFA ≤ 87.5</td>
<td>0.512</td>
<td>0.017</td>
<td>0.058</td>
<td>0.028</td>
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<tr>
<td>MPTA ≥ 87.5</td>
<td>0.542</td>
<td>-0.049</td>
<td>0.045</td>
<td>0.037</td>
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<tr>
<td>Overall Valgus</td>
<td>0.504</td>
<td>-0.030</td>
<td>0.008</td>
<td>0.038</td>
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<tr>
<td></td>
<td>Age</td>
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<tr>
<td><strong>mLDFA ≥ 87.5</strong></td>
<td>0.494</td>
<td>0.069</td>
<td>0.129</td>
<td>0.089</td>
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<tr>
<td><strong>MPTA ≤ 87.5</strong></td>
<td>0.506</td>
<td>0.052</td>
<td>0.086</td>
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<td>0.080</td>
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<tr>
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<td>0.477</td>
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<td>0.097</td>
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<td>0.116</td>
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<tr>
<td><strong>mLDFA ≤ 87.5</strong></td>
<td>0.399</td>
<td>0.030</td>
<td>0.090</td>
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<tr>
<td><strong>MPTA ≥ 87.5</strong></td>
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<tr>
<td><strong>Overall Valgus</strong></td>
<td>0.492</td>
<td>0.013</td>
<td>0.120</td>
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<td></td>
<td>0.018</td>
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</table>
• Varus deformity and knee arthritis
  – Standardized beta: overall > mLDFA > MPTA
  – For overall group
    • Unstandardized beta for age 0.070
    • Unstandardized beta for deformity grade 0.256
    • Thus, each 2.5° increment of varus equates to 3.7 years of arthritis risk
How Much Varus/Valgus?

- 503/942 overall normal
- Valgus
  - 1 grade valgus: 133
  - 2 grades valgus: 20
  - 3-4 grades valgus: 4
- Varus
  - 1 grade varus: 220
  - 2 grades varus: 52
  - 3 grades varus: 10
• Mild varus deformity is associated with increased risk of knee arthritis
• Mild valgus deformity does not have any association with knee arthritis
• Guided growth can be considered for asymptomatic mild knee varus, but should be reserved in asymptomatic mild knee valgus
Thank You