Is Anterior Femoral Notching in Total Knee Replacement a risk factor for periprosthetic fracture?

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Introduction
The possible role of notching of the anterior femoral cortex in distal femoral fractures following TKR has been observed clinically and studied biomechanically. It has been hypothesised that femoral notching weakens the cortex of the femur which can predispose to femoral fractures in the early post operative period. This study looks at the relationship between notching of the anterior femoral cortex during total knee replacement (TKR) and supracondylar fracture and validity of the Tayside classification system.

Materials and Methods
- Post-operative lateral radiographs of 200 TKR reviewed at a mean of 9 years (range, 6 to 15 year follow-up period).
- 98 women (63%) and 57 men (37%), mean age of 69 years.
- 45 patients had bilateral procedures.
- Notches were classified into four grades using our Tayside classification (Fig 1 and 2).

Results
- The median inter-observer reliability Kappa coefficient for this classification system using four observers was 0.74 (0.65 to 0.84). i.e. substantially reliable(Landis and Koch 1977).
- This suggests that modification of the jig design to cut the distal femur in the Kinemax knee system does not alter the incidence and degree of notching compared to the kinematic condylar knee system.
- The patient with the notched knee developed an undisplaced supracondylar fracture of the femur 9 years after surgery caused by a fall at home.
- The null hypothesis that notching of the anterior femoral cortex does not increase the risk of supracondylar fracture in total knee replacement was accepted (P =0.8).

Discussion

Results (continued)

<table>
<thead>
<tr>
<th>Knee prosthesis</th>
<th>Notch</th>
<th>No notch</th>
<th>Unclassifiable</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinematic condylar</td>
<td>35</td>
<td>46</td>
<td>12</td>
<td>92</td>
</tr>
<tr>
<td>Kinemax</td>
<td>37</td>
<td>56</td>
<td>14</td>
<td>108</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notched knee</th>
<th>Grade I</th>
<th>Grade II</th>
<th>Grade III</th>
<th>Grade IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinematic condylar</td>
<td>19</td>
<td>13</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Kinemax</td>
<td>20</td>
<td>15</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Grade I Violation of the outer table of the anterior femoral cortex
Grade II Violation of the outer and the inner table of the anterior femoral cortex
Grade III Violation up to 25% of the medullary canal (from the inner table to the centre of the medullary canal)
Grade IV Violation up to 50% of the medullary canal (from the inner table to the centre of the medullary canal)
Unclassifiable

Results
- Notching 72 of 174 knees (41%)
- No notch 102
- Unclassifiable 26
- Supracondylar 3 (1.5%) - 2 had no notching but had rheumatoid arthritis. 1 patient had osteoarthritis and grade 2 notching

- Incidence
  - Notching in TKR 41% 30% (Ritter, Thong 2005)
  - Supracondylar fracture of the femur after TKR 1.5% 0.3 to 2.5% (Ritter, Thong 2005)
  - Supracondylar fracture of the femur in TKR with anterior femoral notching 1.4% 0.5 to 52% (Booth 1994)

Conclusion
There is no relationship between Grade 1 and 2 anterior femoral notching and supracondylar fracture of the femur in TKR.

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