In vivo knee kinematics of ACL-deficient patients after unicompartamental knee arthroplasty

EC Pegg¹, B Popat¹, M Alinejad¹, BH van Duren¹, DW Murray¹, HG Pandit¹
¹ Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences (NDORMS), University of Oxford, UK

MAIN OBJECTIVE
• Compare the knee kinematics of ACL-deficient (ACLD) vs. ACL-intact (ACLI) patients after unicompartamental knee surgery using sagittal plane video fluoroscopy.

METHODOLOGY

Patient selection
Case-control study where first ACLD patients were recruited prospectively, then ACLI patients were matched and then recruited for the control group. All patients had undergone Oxford unicompartmental knee replacement on the medial side of their knee between January 2000 and June 2011. This study was granted ethical approval in January 2013. A summary of the ACLD and ACLI cohort groups are shown below:

<table>
<thead>
<tr>
<th>Measure</th>
<th>ACLD</th>
<th>ACLI</th>
<th>p-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td># Knees</td>
<td>16</td>
<td>16</td>
<td>0.8046</td>
<td>NS</td>
</tr>
<tr>
<td># Patients</td>
<td>14</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>67.0 (50.87)</td>
<td>68.3 (49.86)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Follow-up Time</td>
<td>6.3 (1.3-12.8)</td>
<td>6.0 (2.6-11.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>12 male, 2 female</td>
<td>12 male, 1 female</td>
<td>0.3173</td>
<td>NS</td>
</tr>
<tr>
<td>Oxford Knee Score</td>
<td>40.7 (20-48)</td>
<td>42.3 (32-48)</td>
<td>0.35</td>
<td>NS</td>
</tr>
<tr>
<td>Norfolk Knee Score</td>
<td>15.9 (2-33)</td>
<td>12.9 (2-27)</td>
<td>0.57</td>
<td>NS</td>
</tr>
<tr>
<td>Tegner Activity Score</td>
<td>3.2 (2.5)</td>
<td>2.8 (0.5)</td>
<td>0.15</td>
<td>NS</td>
</tr>
<tr>
<td>VAS Pain Score</td>
<td>16.6 (0-70.3)</td>
<td>10.7 (0-85.9)</td>
<td>0.73</td>
<td>NS</td>
</tr>
</tbody>
</table>

Table 1. Description of the ACLD and ACLI patient cohorts. Data shown as: mean value (range). NS=not significant.

Measurements
The following measurements were manually made on each frame of every fluoroscopy video:
• Patellar Tendon Angle (PTA) = angle between axis ‘C’ and ‘B’
• Knee Flexion Angle (KFA) = angle between ‘A’ and ‘B’
• Bearing Movement (BM) = distance ‘D’

RESULTS
ACLD patients took ~3s longer to perform the exercises

Large anterior-posterior (AP) medial bearing movement observed in ACLD patients from 30-60 degrees of flexion

ACLD patients had a dip in PTA from 30-40 degrees of flexion

CONCLUSIONS
• Patients with ACL ligament deficiency after UKR have abnormal knee kinematics
• Differences were noticeable from 30-60 degrees of flexion and may relate to muscle imbalance [2]
• More variability was observed in AP bearing movement for ACLD patients
• The kinematics of ACLD-UKR knees were more normal than TKR, but less normal than ACLI-UKR and ACL-reconstructed-UKR knees [3].

ACKNOWLEDGEMENTS
• Biomet UK Healthcare Ltd.
• Jo Brown (NDORMS) and the hospital radiographers
• NIHR Biomedical Research Unit into Musculoskeletal Disease, NDORMS