Influence of osteophyte resection of the posterior femoral condyle on extension range of motion and gap balance in cruciate retaining type total knee arthroplasty.

- Intraoperative evaluation using navigation system -

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Disclosure of Conflict of Interest

Name of first author: Sasaki E

I have no financial conflicts to disclose.
Posterior clearance (PC) in TKA: Removing posterior osteophyte

Residual osteophyte → Loss of flex.

PC improved flexion angle

Creation of flexion gap, including PC, increased prepared extension gap

Influence of PC on the kinematics and gaps are unclear.
Purpose
To evaluate the influence of PC on gaps and range of motion using a navigation system, and reveal the relationship with osteophyte size.

Materials and Methods
Subjects: TKA for medial knee OA
27 knees of 20 patients (18 women)
Age: 74.3 ± 6.9 (65 - 85) years
Prosthesis: Columbus TKA CR
Navigation: Orthopilot TKA ver.4.2 (B-Braun)
Osteophyte measurement

Sagittal
Area at center of MFC

Axial
Largest area at posterior of MFC

ICC(1,3) were all 0.99 (p<0.05)
Surgical procedure

1. Medial para-patellar approach
2. Registration
3. Tibia cut
4. Planning for femur cut
5. Pre-PC measurement
6. PC
7. Post-PC measurement
8. Implantation by cement

Navigation analysis

Kinematic data
- Extension angle
- Flexion angle
- HKA angle

Gap data
- Extension gap
- 90° flexion gap

Han SB, et al. Orthopedics. 2008
<table>
<thead>
<tr>
<th>Demographics</th>
<th>Mean ± SD</th>
<th>Min.-Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>74.3 ± 6.9</td>
<td>62 – 85</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>28.9 ± 3.2</td>
<td>22.9 – 33.5</td>
</tr>
<tr>
<td>Pre ext. angle (°)</td>
<td>-11.3 ± 8.2</td>
<td>-30 - 0</td>
</tr>
<tr>
<td>Pre flex. angle (°)</td>
<td>108.9 ± 16.1</td>
<td>80 – 130</td>
</tr>
<tr>
<td>Ope time (min.)</td>
<td>99.8 ± 13.3</td>
<td>74 - 128</td>
</tr>
<tr>
<td>Bleeding (ml)</td>
<td>21.6 ± 19.4</td>
<td>1 – 73</td>
</tr>
<tr>
<td>Osteophyte area (mm²)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>in radiograph</td>
<td>262.4 ± 128.6</td>
<td>70.4 – 515.5</td>
</tr>
<tr>
<td>in CT sagittal plane</td>
<td>146.6 ± 46.8</td>
<td>91.4 – 239.2</td>
</tr>
<tr>
<td>in CT axial plane</td>
<td>284.9 ± 94.2</td>
<td>108.9 – 483.2</td>
</tr>
</tbody>
</table>
## Kinematics and gap changes

<table>
<thead>
<tr>
<th></th>
<th>Pre-PC</th>
<th>Post-PC</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Angle (°)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extension</td>
<td>-3.8±3.6</td>
<td>0.8±2.5*</td>
<td>4.9±1.6</td>
</tr>
<tr>
<td>Flexion</td>
<td>118.7±8.2</td>
<td>126.8±7.5*</td>
<td>6.5±5.0</td>
</tr>
<tr>
<td>HKA</td>
<td>1.2±1.1</td>
<td>0.7±0.9*</td>
<td>0.4±0.9</td>
</tr>
<tr>
<td><strong>Extension gap (mm)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medial</td>
<td>10.6±1.8</td>
<td>11.3±1.9*</td>
<td>0.7±0.9</td>
</tr>
<tr>
<td>Lateral</td>
<td>11.9±2.6</td>
<td>12.7±2.7*</td>
<td>0.9±1.5</td>
</tr>
<tr>
<td><strong>Flexion gap (mm)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medial</td>
<td>12.7±3.5</td>
<td>13.3±3.9*</td>
<td>0.6±1.0</td>
</tr>
<tr>
<td>Lateral</td>
<td>14.4±3.3</td>
<td>15.1±3.6*</td>
<td>0.7±1.6</td>
</tr>
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</table>

Paired t-test, *: p<0.05
Correlation between osteophyte area and extension increase by PC

Spearman’s correlation coefficients

<table>
<thead>
<tr>
<th></th>
<th>Radiograph</th>
<th>CT sagittal</th>
<th>CT axial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteophyte area</td>
<td>r = 0.681</td>
<td>r = 0.631</td>
<td>r = 0.626</td>
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<tr>
<td>Increase of extension angle by PC</td>
<td></td>
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</tbody>
</table>

Multivariable regression analysis
(Step wise method, adjusted by age, sex and BMI)

Increase of extension angle by PC (°)
= 0.021 x CT sagittal plane + 2.09
Discussion: PC increased extension (Gap balance was not disturbed)

This study: Extension angle increased by PC

**Imbalance of medial / lateral gaps**

Defined by coronal stabilizer
MCL in extension / PLC in flexion

PC = Did not affect MCL or PCL

PC = Reduce the compression and tension to posterior capsule

Only extension angle increased by PC, gap balance and implant size was not disturbed
In conclusion

Extension and flexion gaps increased less than 1 mm in the medial and lateral compartments.

Extension angle increase by PC was correlated with osteophyte size.

PC achieving an additional 5° extension angle could promote full extension in severely deformed knees with a large posterior osteophyte.