Pre-anesthetic knee flexion angle is the most accurate predictor of flexion angle after total knee arthroplasty

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Primary total knee arthroplasty (TKA) is a successful procedure for treating end-stage OA knee.

- Overall dissatisfaction rate = 8-10% during 5-10 years post-TKA.
- Decreased post-TKA range of motion (ROM) associated with patient dissatisfaction.
Knee flexion angle is a crucial parameter of knee motion. Kneeling, squatting, floor sitting, gardening, sexual performance, praying, and using a squatting toilet are activities that require knee flexion. Predicting knee flexion angle after TKA is important.
Intra-operative drop leg test (after implanting all prosthesis components)

Post-anesthetic knee flexion angle (examination under anesthesia)

Pre-anesthetic knee flexion angle
Which perioperative parameter of knee flexion angle had the highest correlation with the knee flexion angle at 6 months after TKA?
Prospective, single centered cohort study by 3 experienced surgeons

Primary TKA, 6-month follow-up of knee flexion angle

### Inclusion criteria

- Unilateral primary TKA patients
- Older than 50 years
- Able to communicate

### Exclusion criteria

- Inflammatory arthritis
- Complex surgical procedure
- Intra-operative complications
- E.g. fracture, ligament avulsion
- Post-operative complications
- E.g. fracture, infection, wound dehiscence
- Same surgical technique
  - Medial parapatellar approach
  - PS design, Zimmer Nexgen LPS-flex
  - Selectively resurfaced patella
- Same post-operative protocol, rehabilitation program,

Pre-anesthetic knee flexion angle
Post-anesthetic knee flexion angle
Intra-op drop leg knee flexion angle

6-month Follow-up knee flexion angle

Pearson’s Correlation

TKA  Routine follow-up
Resurfacing patella criteria

- Good patella cartilage
- Adequate patella femoral congruency
- No history of crystalline and inflammatory synovitis
- The patellar was not resurfaced

Kotani et al. found the degree of correlation between pre- and post-operative ROM was weakly positive \( (r=0.32, P = 0.007) \)

- The null hypothesis was defined as 0 (no correlation)
- Alternative hypothesis of moderate positive correlate with 0.5 correlation coefficient
- Type I alpha level 0.05
- Type II beta level 0.2
- Minimum effect size of difference of 0.25

\[
\text{Total sample size} = N = \left(\frac{Z_\alpha + Z_\beta}{C}\right)^2 + 3 = 160
\]

A minimum sample size was 160
To compensate for 20% of possible loss to follow-up
Total of 200 subjects was required
<table>
<thead>
<tr>
<th>Correlation coefficients</th>
<th>Level of correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 – 0.3</td>
<td>Weak</td>
</tr>
<tr>
<td>0.3 – 0.6</td>
<td>Moderate</td>
</tr>
<tr>
<td>&gt; 0.6</td>
<td>Strong</td>
</tr>
</tbody>
</table>

Chan YH. Biostatistics 104: Correlational analysis.
Subgroup analysis

Pre-operative knee flexion

Group A
less than 90°

Group B
90° to 120°

Group C
more than 120°
Unilateral primary TKA: N=212

Exclusion criteria (n=10)
- Inflammatory arthritis (n=2)
- Complex surgical procedure (n=3)
- Peri-operative complications (n=5)

Patient enrollment: n=202

Lost follow-up during 6 month (n=2)

Data analysis at 6 months (n=200)
### Patient characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total (n=200)</th>
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<tbody>
<tr>
<td>Mean age ± SD (yrs)</td>
<td>68.7 ± 7.9</td>
</tr>
<tr>
<td>Female (%)</td>
<td>178 (89%)</td>
</tr>
<tr>
<td>Mean BMI ± SD (kg/m²)</td>
<td>29.1 ± 3.7</td>
</tr>
<tr>
<td>Non-resurfacing patella</td>
<td>165 (82.5%)</td>
</tr>
<tr>
<td><strong>Pre-operative knee flexion angle, n (%)</strong></td>
<td></td>
</tr>
<tr>
<td>Group A: less than 90°</td>
<td>12 (6%)</td>
</tr>
<tr>
<td>Group B: 90° to 120°</td>
<td>124 (62.0%)</td>
</tr>
<tr>
<td>Group C: more than 120°</td>
<td>64 (32.0%)</td>
</tr>
</tbody>
</table>
Mean ± SD (degrees) and correlation of knee flexion angle parameter

- Overall cases (n=200)
- Group A (n=12)
- Group B (n=124)
- Group C (n=64)

- Moderately correlated
- Strongly correlated

p-value < 0.001

- Pre anesthetic
- Post anesthetic
- Intra-operative
- 6-month F/U
Our study is the first study to compare the correlation of each peri-operative parameter and 6-month knee flexion angle.

Pre-anesthetic knee flexion angle was recommended as the highest angle to predict 6-month knee flexion angle.
Limitations

- Recruited only primary OA knee
- Few patients had pre-operative knee flexion angle of less than 90°
Pre-anesthetic knee flexion angle had the highest correlation with the final knee flexion angle at 6 months after unilateral primary TKA.
Thank you for your attention