Conservative Approaches to Kinematic Alignment and Patient Reported Outcomes

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Declaration of Interest

I declare that in the past three years I have:

• held shares in:

• received royalties from:

• done consulting work for:

• given paid presentations for:

• received institutional support from:

Signed:
Introduction

- Kinematic alignment aims to restore native alignment
- Mechanical alignment aims to reconstruct the joint

<table>
<thead>
<tr>
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<th>Mechanical Alignment</th>
<th>Kinematic Alignment</th>
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<tbody>
<tr>
<td>Femoral Coronal</td>
<td>Neutral to the MA</td>
<td>Match femoral joint line</td>
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<tr>
<td>Femoral Rotation</td>
<td>Parallel to the TEA (+ variants)</td>
<td>Match the posterior axis</td>
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<tr>
<td>Tibial Coronal</td>
<td>Neutral to the MA</td>
<td>Match tibial joint line</td>
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Introduction

- Some evidence that kinematic alignment has superior short term patient outcomes
  - Long term questions regarding survivorship are unanswered\(^1\,^2\) particularly around outlier anatomy

- Conservative alignment techniques are emerging in an attempt to accommodate outlier anatomy

KA as described by Howell et al. should be followed in all cases\(^3\)

rKA is one alternative:

- In 49% of cases this will be identical to KA\(^4\)
- At anatomical extremes, this approach will NOT return to MA
- Little to no evidence of patient outcomes using these more conservative alignment techniques\(^5\)
- This study sought to investigate the relationship between outcome and the achieved alignment state
Methods

• Retrospective review of 360 Knee Systems registry
• All cases:
  • Pre-operative CT scan and surgical planning
  • Post-operative CT scan
  • KOOS score @ 12 months after surgery
• Variety of delivery techniques (Nav, Instrumented, PSI) and approaches from 9 different surgeons
• Common implant design (Omni Apex)
Methods – Preoperative

- Preoperative CT Imaging
- Segmentation & 3D Reconstruction
- Landmarking

KA Surgical Plan
- 8° Valgus

rKA Surgical Plan
- 5° Valgus

MA Surgical Plan
- Neutral
Methods – Postoperative

- Postoperative Imaging
- Register Implant & Preop Bone Models
- Compare to Preoperative Plans
- Determine Closest Plan to that Achieved
Results

When comparing the three alignments separately:

• No meaningful differences in KOOS Symptoms

• KOOS Pain score shows somewhat lower 12 month pain score for Restricted Kinematic Alignment but not significant (p=0.093)
Results

When breaking down to strategies of:

- Always restricted KA: Pain Score = 82.4 ± 16.3
- Full KA or MA: Pain Score = 87.0 ± 15.2

Differences are significant (p=0.046)
Splitting the patients into those who achieved >70 and those who achieved less:

- Restricted KA has a 26% long term pain result
- MA or Full KA are 14% (p = 0.020)

Risk of pain outcome **1.8x** higher under restricted KA strategy
Discussion

- Initial analysis demonstrates worse outcomes (KOOS Pain scores) for rKA
  - Suggests a preference for either MA or KA
- However, limitations exist:
  - The study incorporates 9 surgeons’ results which may not be sufficient to generalise
  - There might be an ‘error effect’ in this analysis as a restricted KA may just be an MA with accuracy errors
  - The alignment analysis only assessed the coronal plane
    - Ongoing analysis in 3 planes will allow more accurate categorisation of alignment strategy achieved and will be a more valid comparison