Tibial Tray Positioning, Coverage and Relationship to Short Term Outcome following TKR

- David Dickison
- Michael Solomon
- Joshua Twiggs
- Edgar Wakelin
- Brad Miles
Declaration of Interest

I declare that in the past three years I have:

• held shares in: 360 Knee Systems

• received royalties from: Zimmer Biomet

• done consulting work for: 360 Knee Systems, Stryker

• given paid presentations for: Stryker

• received institutional support from: Stryker

Signed:
Introduction

Tibial tray positioning must consider a number of factors:

• Rotational alignment (to numerous axes)\(^{(1)}\)

• Tibial overhang, especially posterior-lateral and antero-medial\(^{(2)}\)

• Tibial coverage and fixation\(^{(3)}\)
Introduction

• These requirements will invariably lead to a compromise

• This compromise can be reduced but not entirely avoided with tray design\(^{3,4}\)

Aim: Investigate the relationship between tibial component placement, overhang, under-coverage and patient reported outcome
Methods

Retrospective review of 360 Knee Systems registry

All cases:
• Pre-operative CT scan and surgical planning
• Post-operative CT scan
• KOOS Symptoms and Pain scores @ 12 months after surgery

Variety of delivery techniques (Nav, Instrumented, PSI) from 9 different surgeons

Common implant design (Omni Apex)
Methods

- Post-operative registration of preoperative CT scan extracted geometry & 3D implant files\(^{(5)}\)
Methods

Implant Calculations
- Deviation from two reference axes (Insall’s and Cobb’s)
- Coverage of the implant (percentage of bone that is covered)
- Overhang of the implant (percentage of implant that is not over bone)
  - Separate by region (Antero-posterior, Medio-lateral)
- Correlations with postoperative KOOS Pain, Symptoms for each measurement
Results

499 Postop Knees
- 69.6 (± 8.1) years
- 292 females (58.6%)

Mean Tibial Coverage is 76% (±4%)
237 (47%) have no overhang, 386 (77%) less than 1%

Significant correlation between increased coverage and overhang
Results

Correlation found with postoperative KOOS Symptoms scores and amount of coverage (p=0.008)

When separating by presence of significant overhang, significant difference:

Significant overhang  
74.2 ± 18.2

No overhang  
79.2 ± 15.8  
(p= 0.008)

Slight overhang has the same impact as 16% less tibial coverage
When separating by presence of significant overhang:

Significant overhang  \( 74.2 \pm 18.2 \)  
No overhang  \( 79.2 \pm 15.8 \)  
\( (p= 0.008) \)

Slight overhang has the same impact as 16% less tibial coverage
Discussion

• Limitations exist – the study incorporates 9 surgeons results which may not be sufficient for generalisability

• Study also just considers PROMs – coverage has a known relationship to tibial subsidence

• Possible mechanism for postero-lateral overhang finding – popliteal impingement?

• Possible confounder – unusual patient tibias are hard to fit to, independently relates to poor outcome
Conclusion

• General observation seems to be ‘upsize to the point of overhang’
  • No relationship with rotation to Insall’s or Cobb’s suggests there’s some freedom to rotate to fit bone

• When deciding to upsize a component, slight overhang can be tolerated if coverage gained is about 1/6 of the total bone cut area

• Findings suggest anatomical tibial tray implant designs are a desirable development
References