Comparing Restricted Inverse Kinematic Alignment to Restricted Kinematic Alignment

Presenter: Mr Edward O'Bryan MBBS (Hons) FRACS FAOrthA - Monash University, Australia

Senior Author: Prof Timothy Whitehead MBBS, FRACS, FAOrthA - OSVi, Australia

Dr Christopher Plaskos PhD - Corin, USA

Dr Alexander Orsi PhD - Corin, USA

Disclosures

EO'B

- No disclosures

TW

- Consultant for Medacta, Corin
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- Smith & Nephew APAC Board Member
- Shareholder in OSVi

Background

- Numerous alignment philosophies used in contemporary total knee arthroplasty[1,2,3]
- Current focus on achieving coronal balance while respecting constitutional alignment and joint line obliquity[4]
- Limits to degree of deviation from mechanical axis generally adopted[5,6]

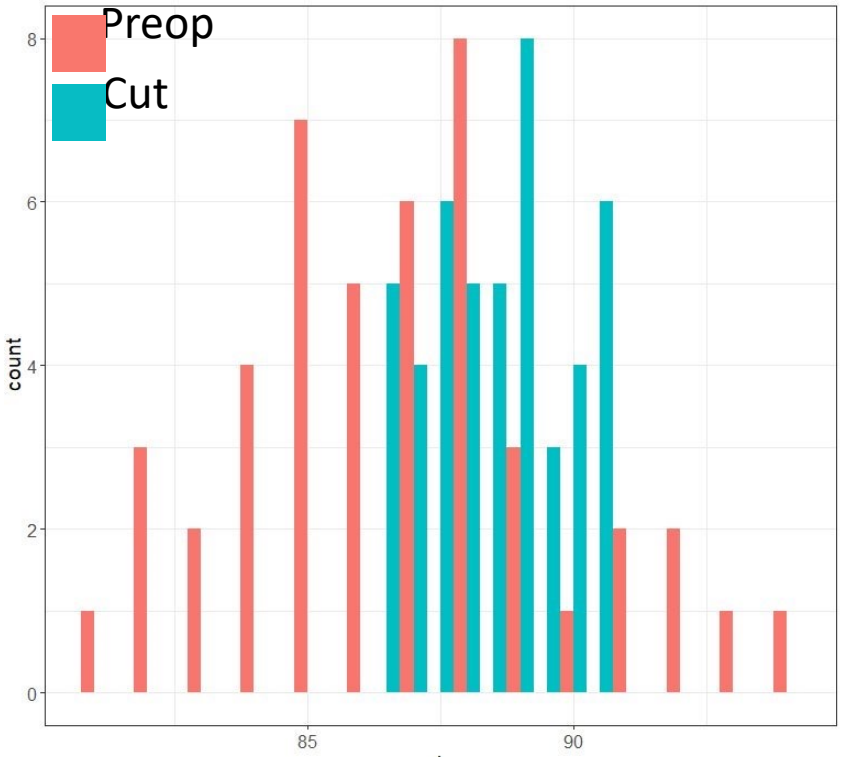
Objectives

- To compare restricted inverse kinematic alignment (riKA) and restricted kinematic alignment (rKA) regarding:
- Joint laxity
- Coronal balance
(lateral-medial laxity where 0=balanced)
- Frequency of tibial recut rate for extension balance within 2mm
- CPAK restoration

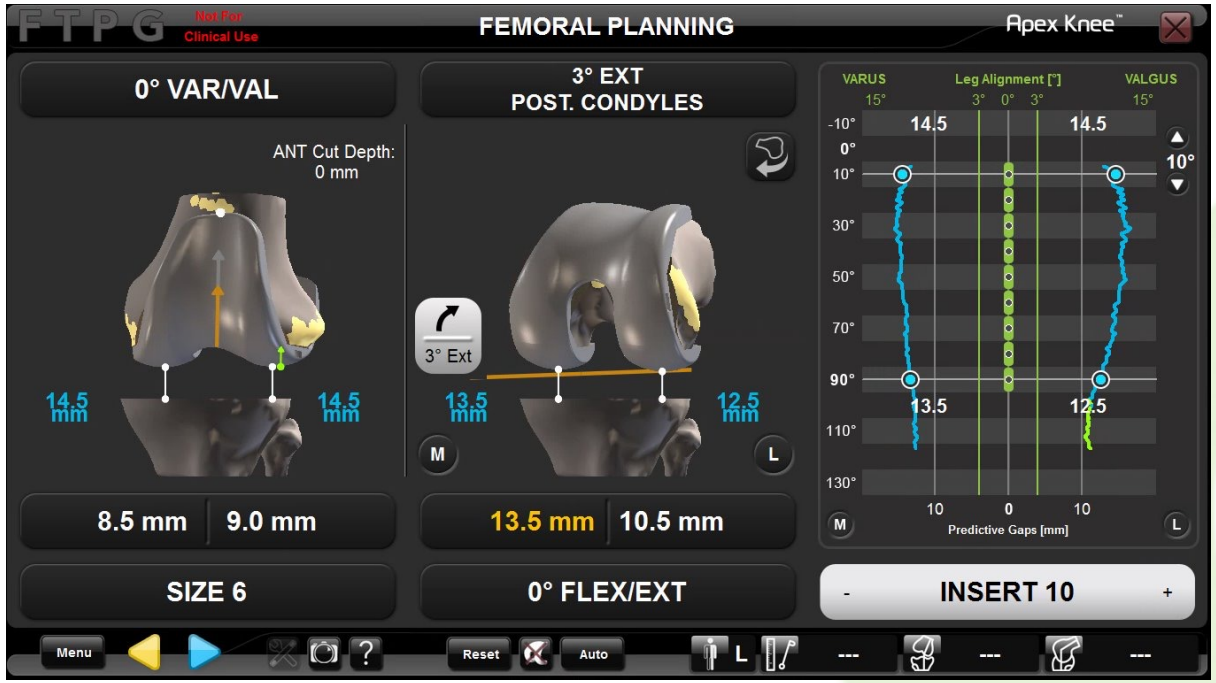
Cohort

- 50 consecutive Apex TKR using the Balancebot
- 4 exclusions (missing data)
- riKA philosophy executed
- Retrospective virtual rKA balancing from dataset

Method – riKA Surgical Technique



- Tibial cut planned from pre-operative X-ray to restore native MTPA
  - Within boundaries of 1° valgus to 3° varus



Ligament tension assessed with Omnibot

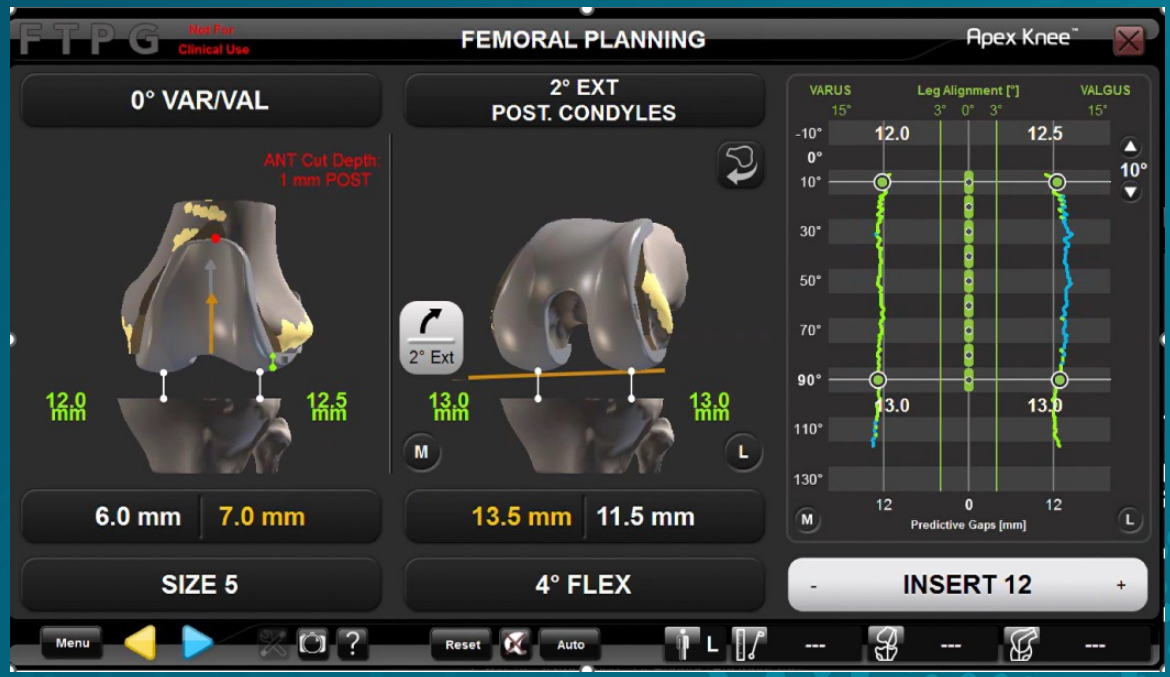
- Femoral component positioned using predictive-balancing software
- Positioned to achieve equal extension gaps allowing some lateral flexion laxity

Method – Restrospective rKA Simulation

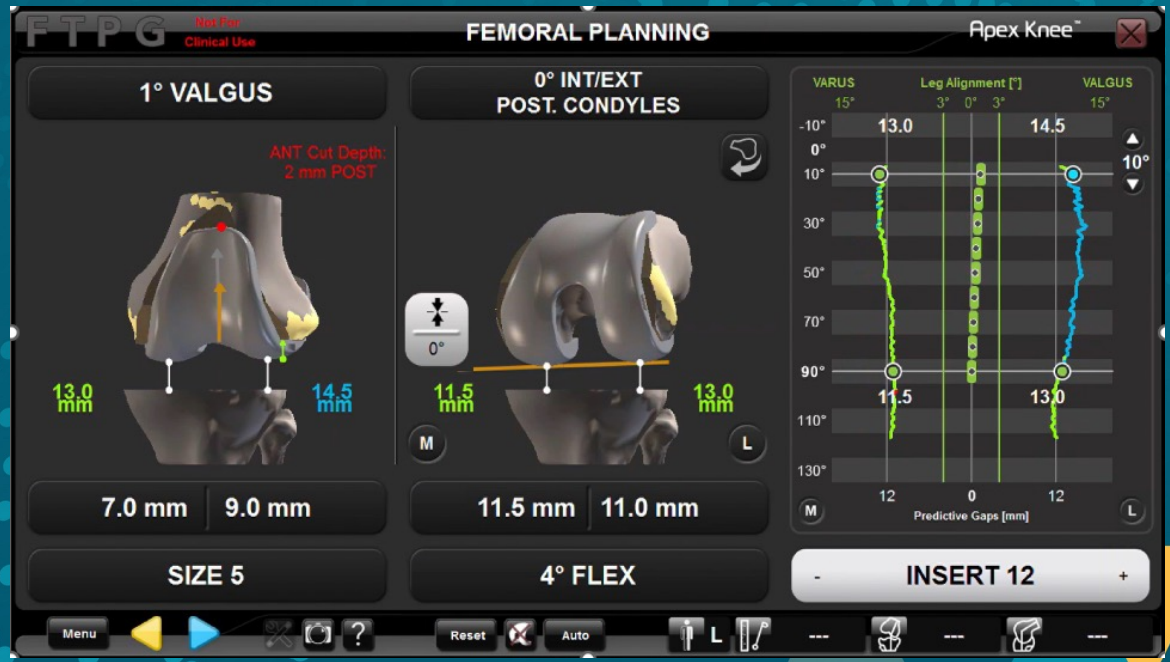
- Post-hoc rKA simulation on software using wear levels recorded from pre-operative radiographs
- Tibial resections identical to riKA cases
- Femoral resections simulated to restore native joint line
- Neutral rotation of femoral components
- Laxity for rKA calculated by subtracting resection differences from riKA gap data

Example: 4 Degree Varus Knee

riKA



rKA



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Resection Differences

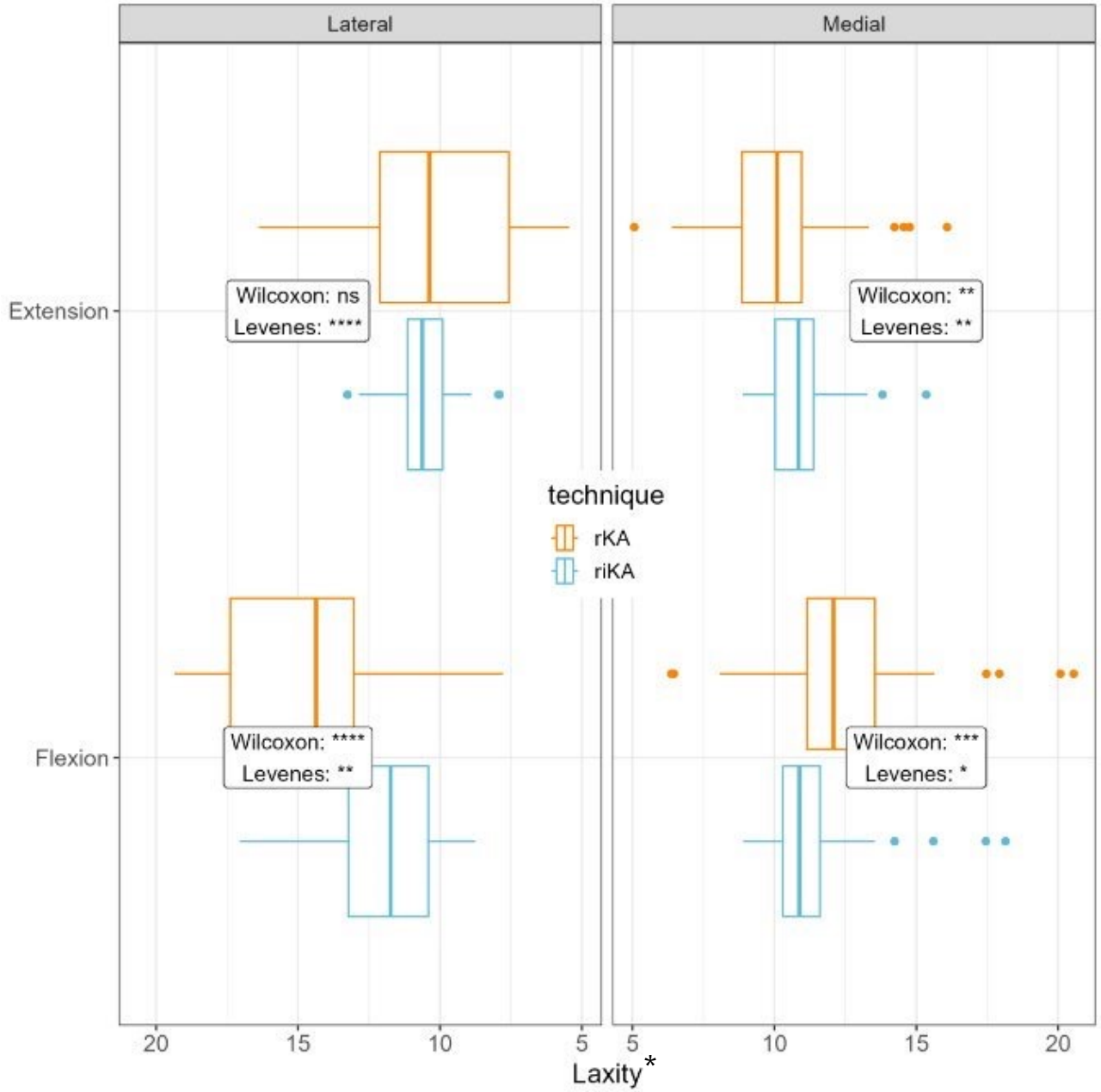
Resection		riKA	rKA
Tibia (Validated)	Lateral	9.3±1.4	
	Medial	7.9±1.8	
Distal Femur (Planned)	Lateral	8.6±2	8.1±0.9
	Medial	8.1±1.8	7.2±0.6
Posterior Femur (Planned)	Lateral	8.3±2.2	11±0
	Medial	9.8±2.1	11±0

- Achieved tibial resection used for both models – **1.5 varus +/- 1.3deg**
- rKA resected less distal femur medially and laterally
- rKA resected more posteriorly and iKA tended toward femoral ER (M>L resections)

Results: Joint Laxity

Laxity (mm)	Lateral		Medial	
Alignment	riKA	rKA	riKA	rKA
Extension	10.6±1.1	10.1±2.7	10.9±1.2	10.0±2.3
Flexion	11.9±1.9	14.6±3.3	11.3±1.9	12.5±2.9

- riKA laxity most reliable in all quadrants
- rKA tighter medially in extension than riKA
- rKA delivers looser flexion gap, with greater variability

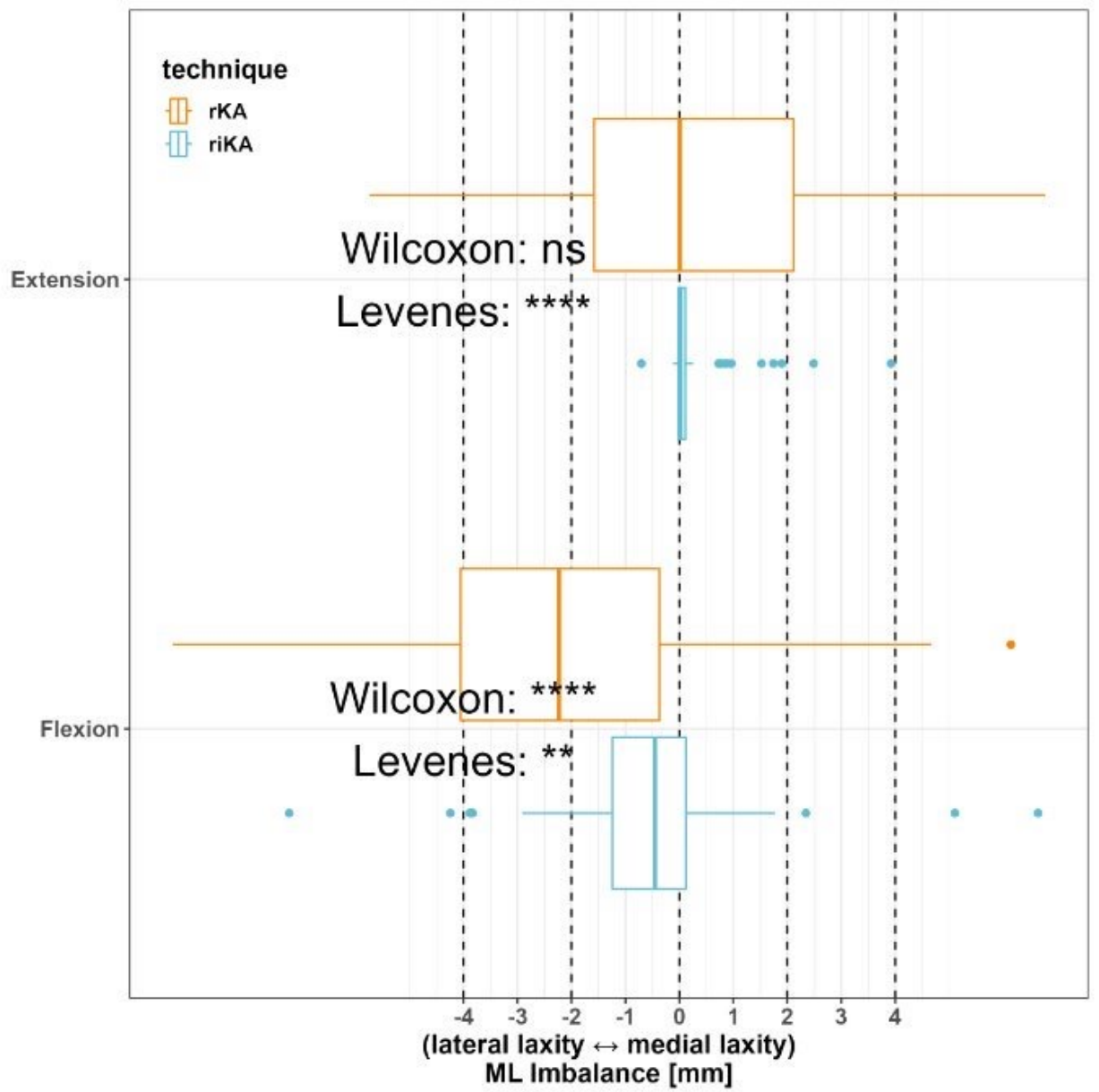


*calculated from tibial resection to planned femoral implant surface

Results: Coronal Balance

Balance	riKA	rKA
Extension	0.3±0.8	0.0±2.9
Flexion	-0.6±2.2	-2.1±3.2

- riKA more reliable in extension
- No difference in mean values
- More rKA patients had coronal extension imbalance
  - >1 mm: **67% vs 11%**, p<0.0001
  - >2 mm: **48% vs 4%,** p<0.0001



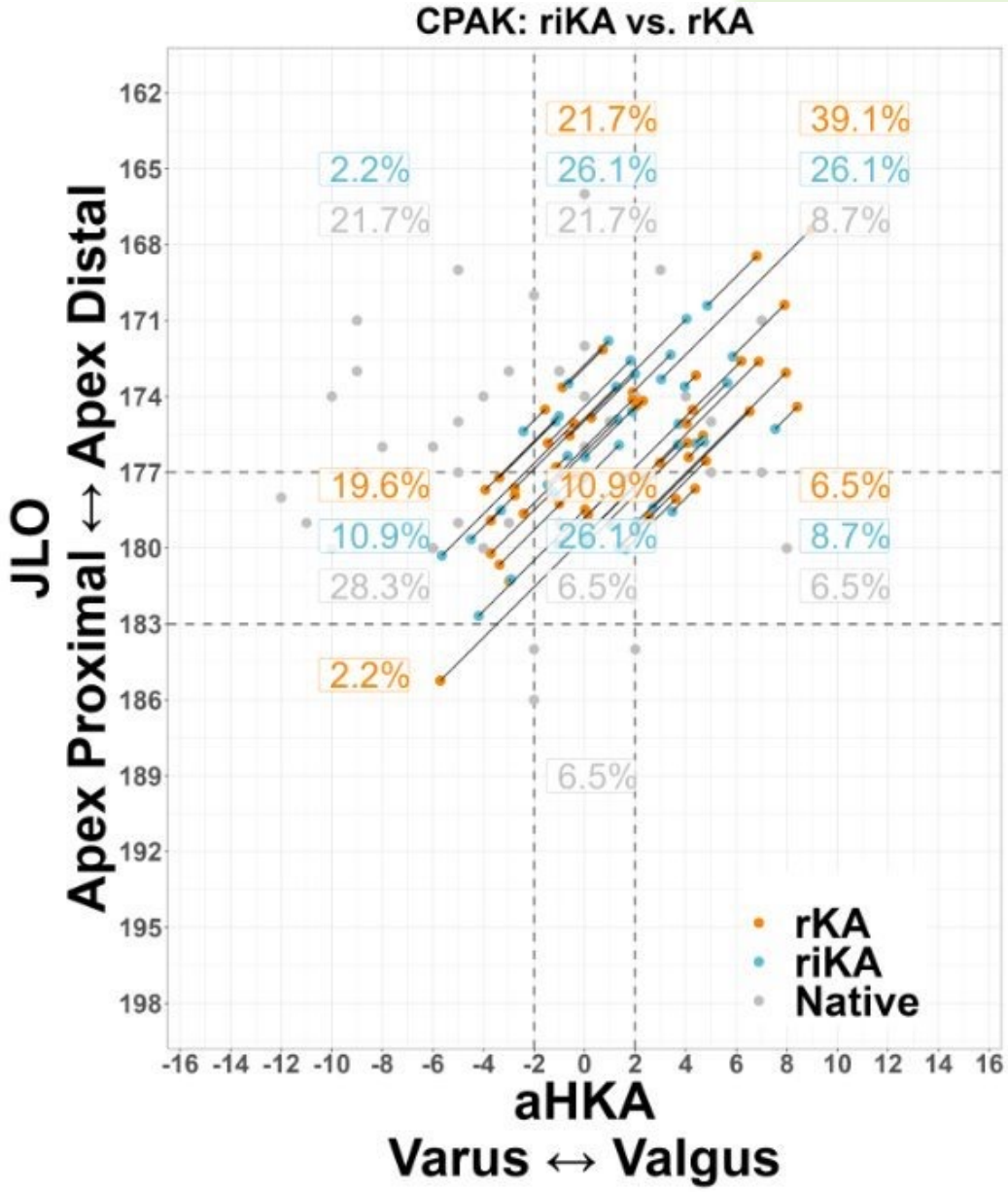
Results: Tibial Re-cuts and CPAK Restoration

Tibial Re-Cut	riKA	rKA
Recut for balance <2 mm	2/46	22/46
Recut >3° varus	0/2	7/22
Recut >5° varus	0/2	1/22
Recut >3° valgus	0/2	1/22

Frequent tibial recut to balance rKA

Majority of riKA resulted in CPAK 2 and 5

39.1% of rKA knees resulted in CPAK 3



Conclusions & Limitations

- riKA had the most reproducible joint laxity & balance
- ~50% of rKA cases required tibial recut to achieve ML balance <2 mm
- Surgical technique affects laxity and balance (tibia versus femur first)
- Objective intra-operative assessment with predictive balancing achieves desired laxity & balance within tight resection boundaries

- Wear recorded radiographically post-hoc
- All rKA femurs neutrally rotated, due to lack of posterior wear data
- Femoral resections without boundary versus tibial resections with boundaries
- Small numbers

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