

# Clinical Outcomes of Functional versus Mechanical Alignment in Robotic-Arm Assisted Total Knee Arthroplasty: A Randomised Controlled Trial

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**ISAKOS**  
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**MUNICH**  
**GERMANY**  
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# Faculty Disclosure Information

- Nothing to disclose



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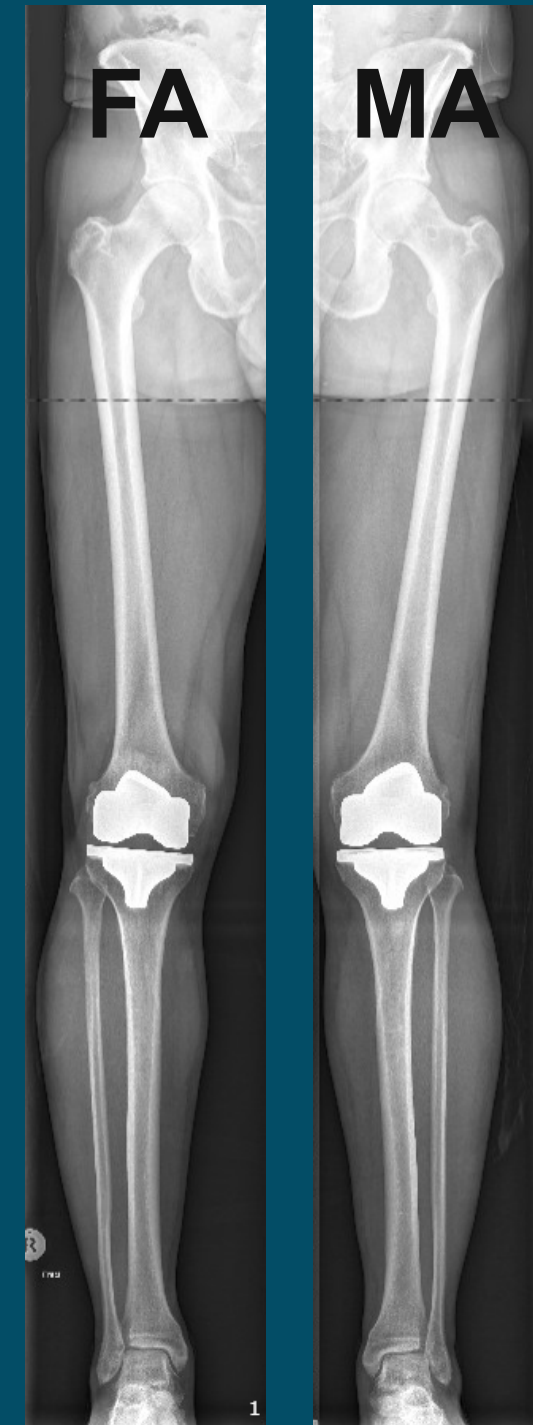


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# Mechanical vs. functional alignment

- The traditional target for total knee arthroplasty (TKA) is mechanical alignment (MA)
- Functional alignment (FA) is a potential alternative and builds on kinematic alignment (KA) philosophies
- Evidence is lacking for any advantage of KA or FA over MA

	Functional	Mechanical
<b>Initial alignment</b>	Kinematic <i>Symmetrical bone resections, adjusting for wear</i>	Mechanical <i>Perpendicular bone resections relative to mechanical axis</i>
<b>Soft tissue balancing</b>	Adjustments to component position (bone balancing)  <i>Soft tissue releases only if balance not achieved within alignment boundaries</i>	Soft tissue releases  <i>Bone recuts only if flexion/extension imbalance, or tibial under-resection (no angular changes)</i>





# CAMELOT study

- Single centre, multi-surgeon, single-blinded RCT
- All cases performed using robotic assistance (Stryker MAKO)
- Inclusions:
  - aged 40-80
  - diagnosis of OA
  - suitable for CR + patellar resurfacing
- Exclusions:
  - previous osteotomy
  - >15° deformity
  - BMI >41
- **Primary outcome: Forgotten Joint Score at 2 years**

STUDY PROTOCOL

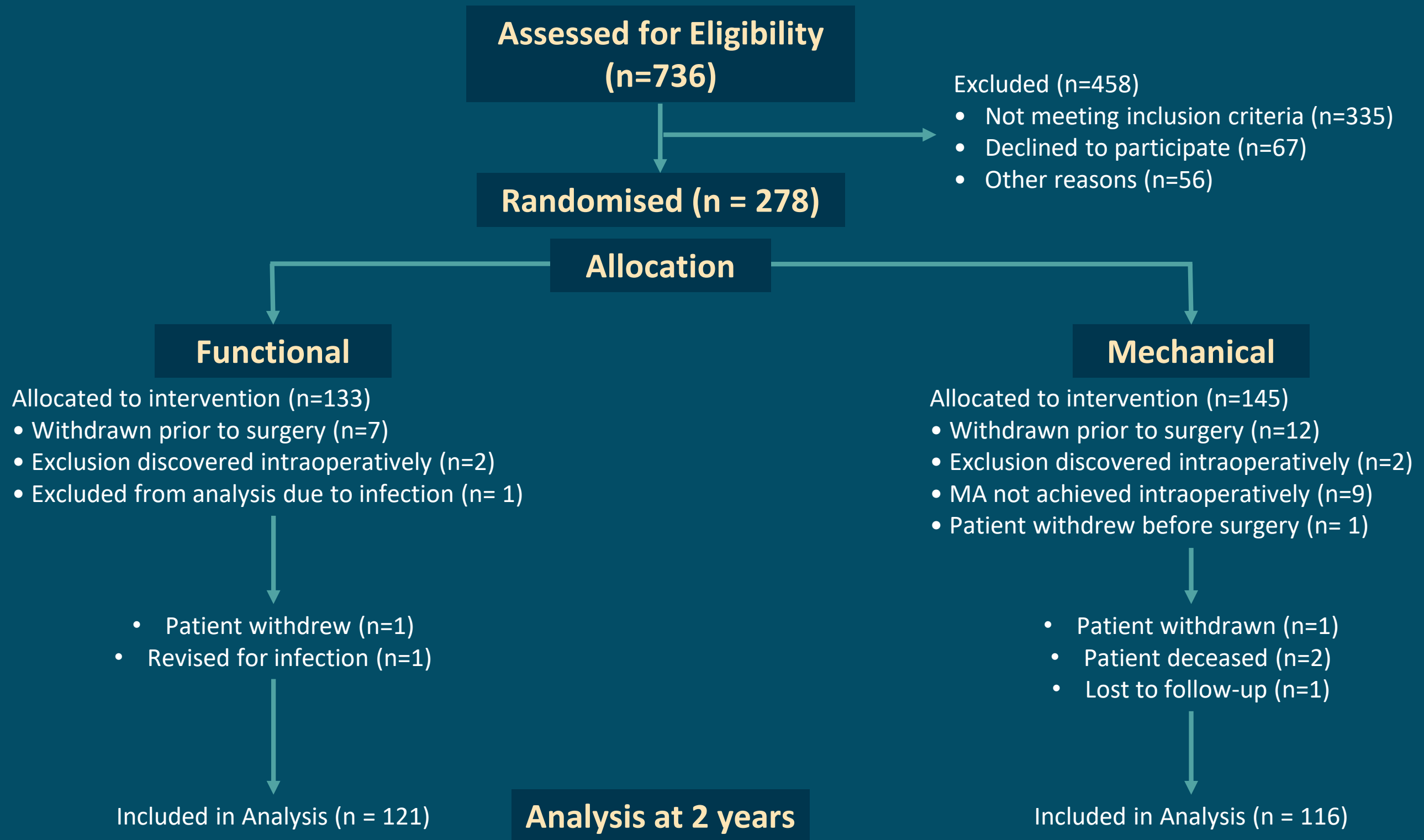
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A prospective randomised controlled trial of mechanical axis with soft tissue release balancing vs functional alignment with bony resection balancing in total knee replacement—a study using Stryker Mako robotic arm-assisted technology

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*Trials* 2022



# Study intervention

## Boundary limits

Femur

Tibia

HKA

Femoral rotation

Tibial Slope

## Functional alignment

6° valgus – 3° varus

3° valgus – 6° varus

3° valgus – 6° varus

6° IR – 3° ER

0-7°

## Mechanical alignment

0°

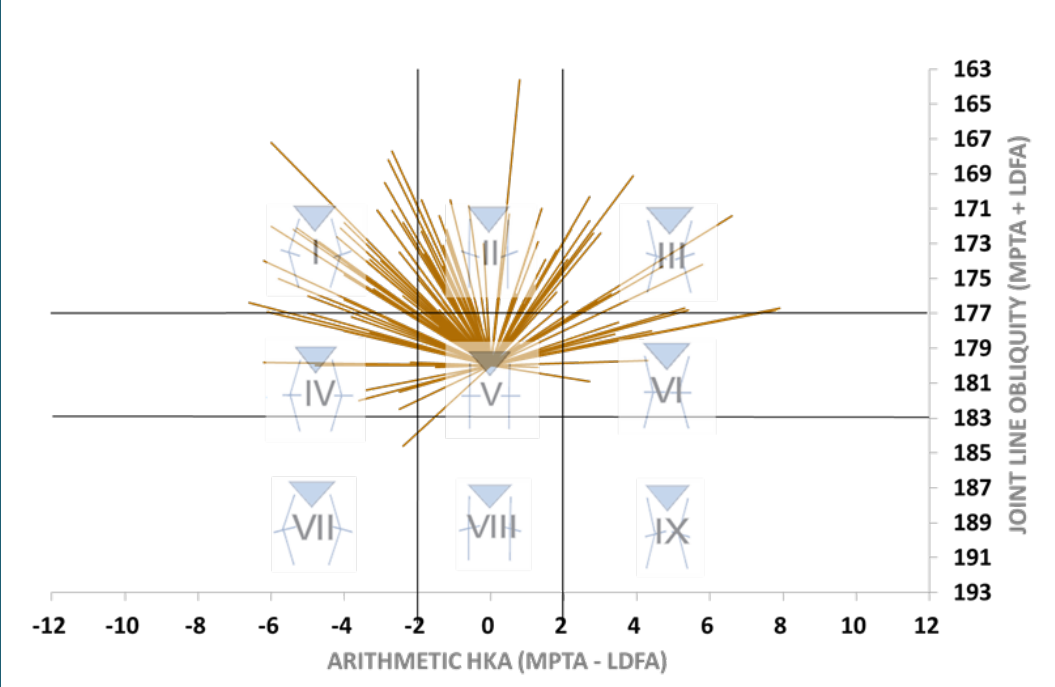
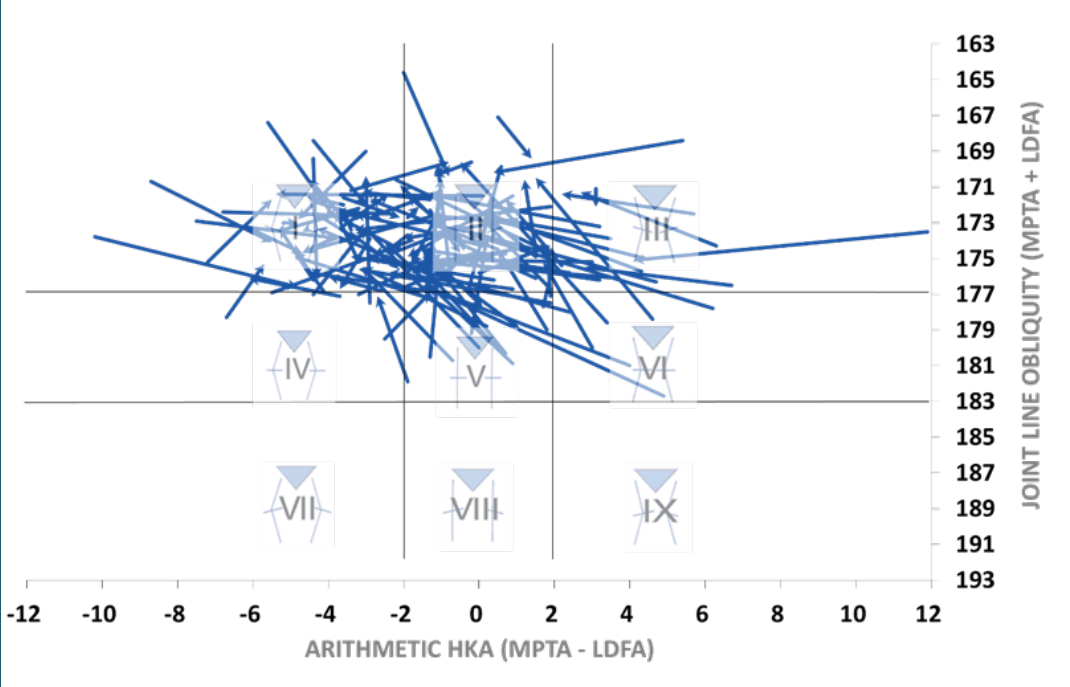
0°

0°

0°

3°

Change in preoperative to  
planned alignments in  
study patients



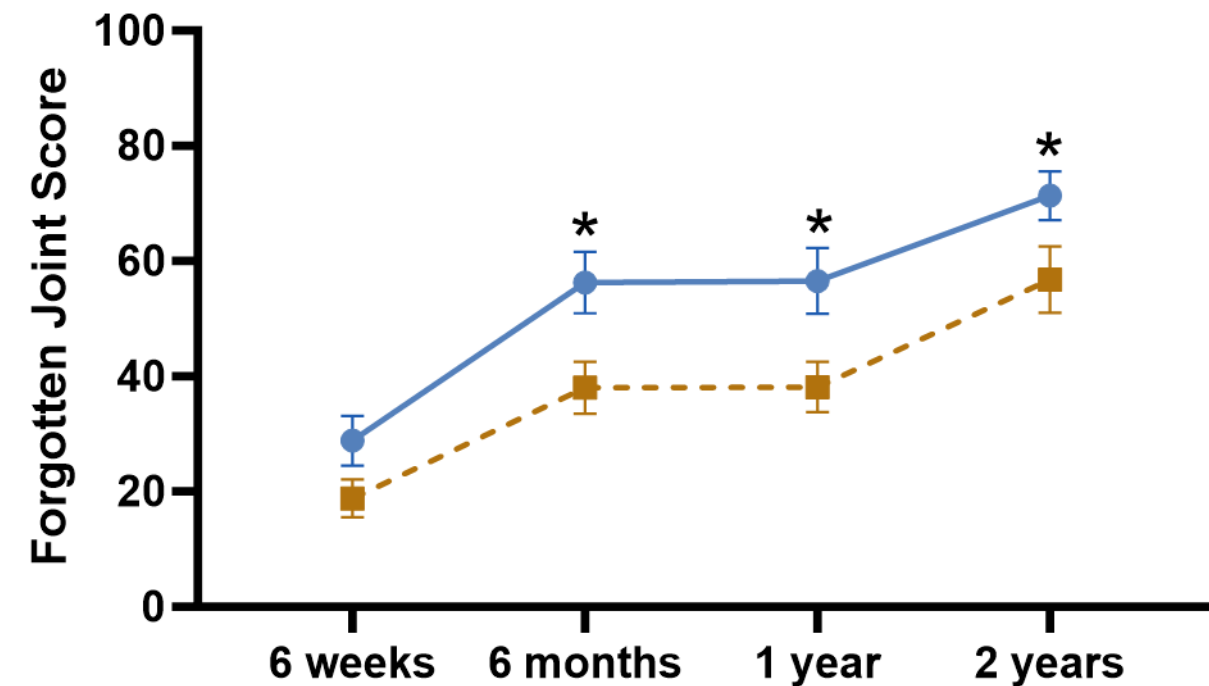
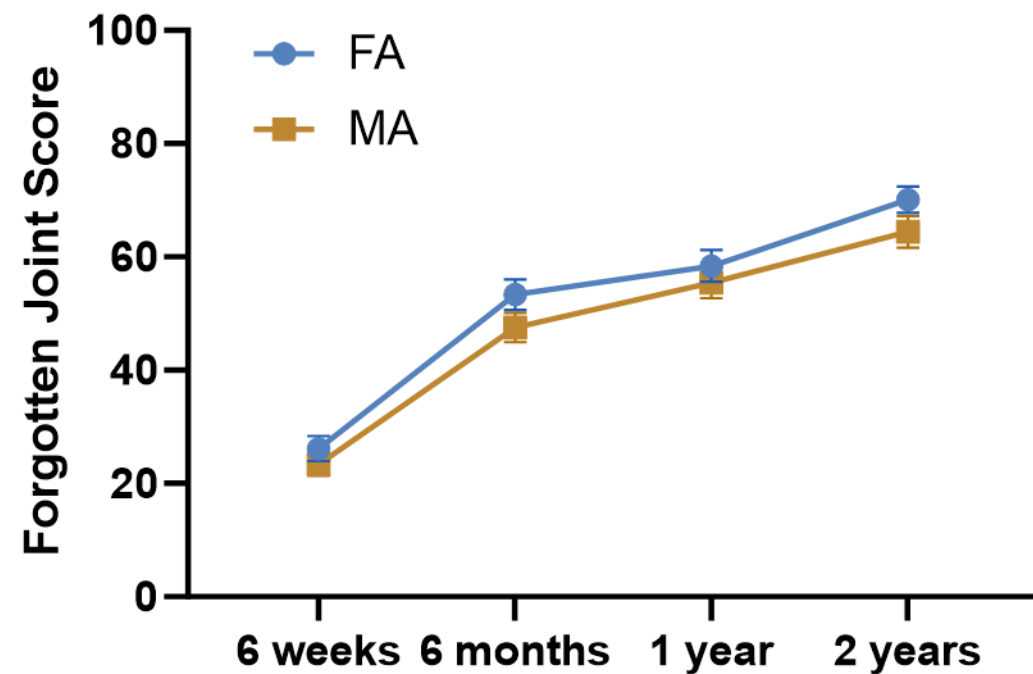
# Patient demographics

	Functional alignment (n = 123)		Mechanical alignment (n = 121)	
	Mean	SD	Mean	SD
Age (years)	66.5	7.1	68.5	7.5
Male	63	51%	65	54%
Female	60	49%	56	46%
BMI (kg/m <sup>2</sup> )	31.1	4.6	30.9	5.0
ASA score (number, %)				
1	6	4.9%	6	5.0%
2	85	69.1%	79	65.3%
3	32	26.0%	36	29.8%

ASA, American Society of Anesthesiologists; BMI, body mass index; SD, standard deviation

# Results:

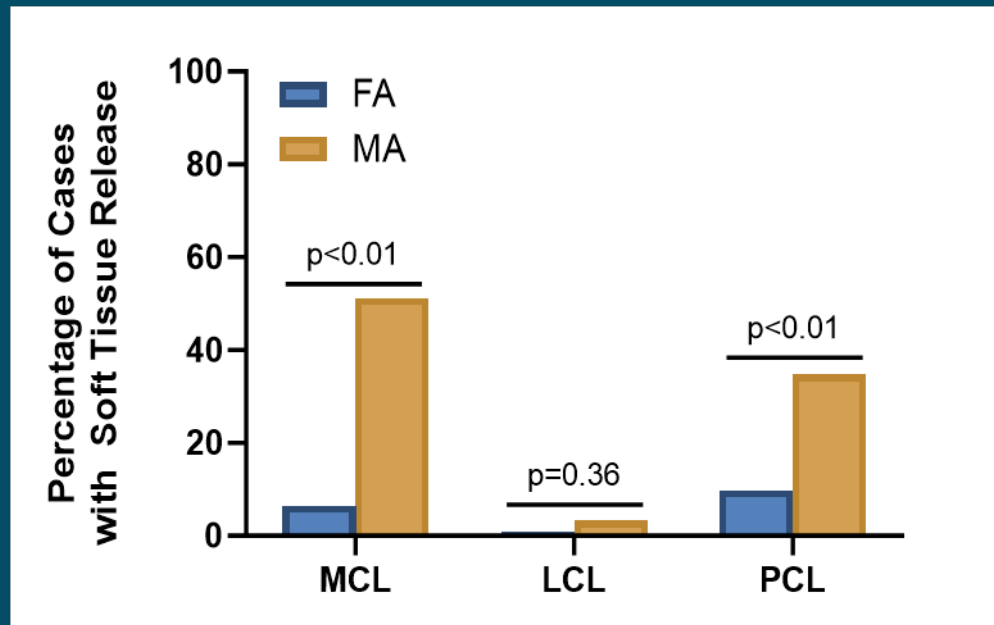
- No difference in Forgotten Joint Score (FJS) **overall**
- Improvement in FJS for patients with **constitutionally varus knees (CPAK I)**





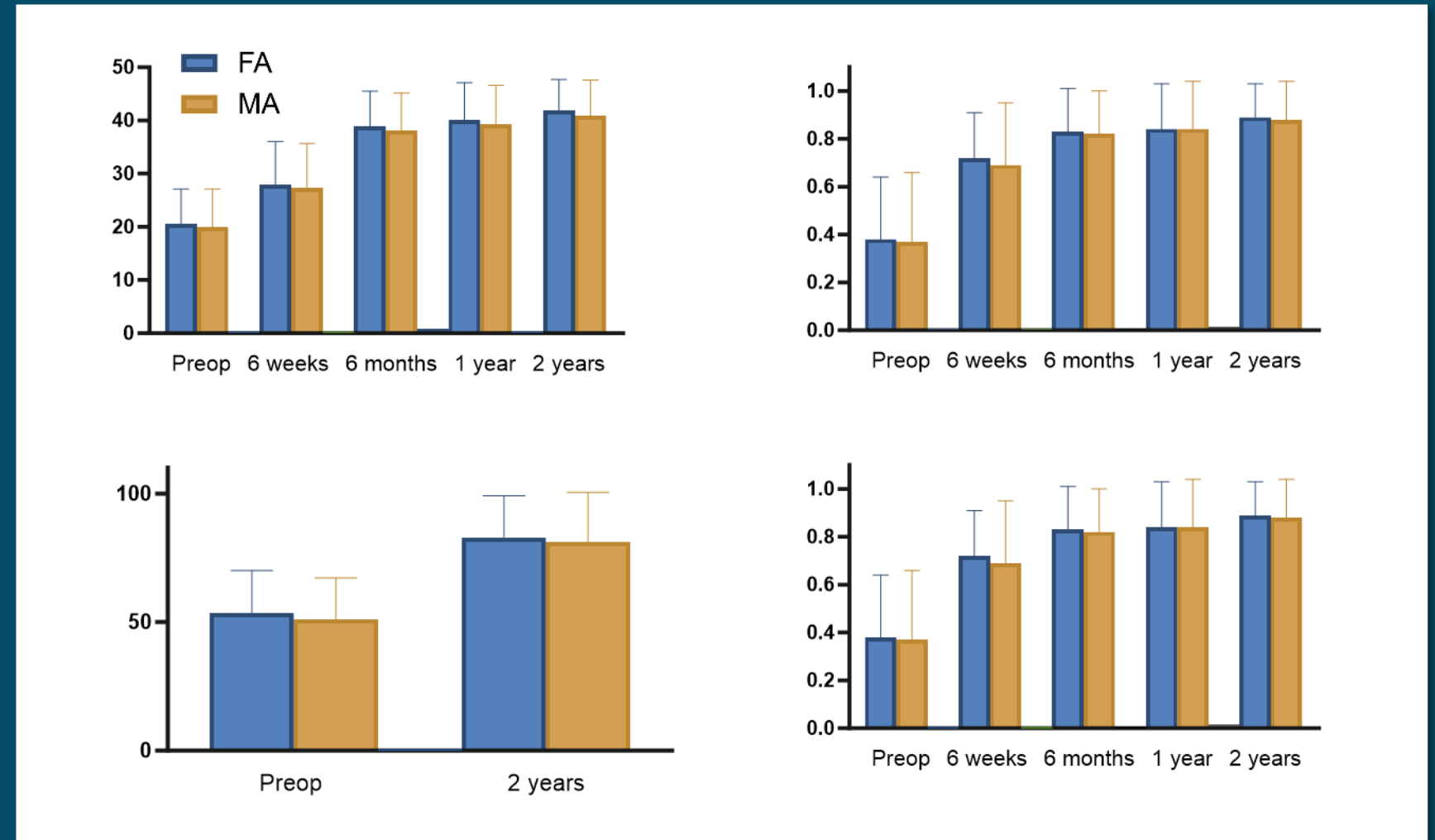
# Results

- No difference in surgical releases performed



- Similarly, no differences found for constitutionally varus knees (CPAK I)

- No difference in other patient-reported outcomes



# Results:

- No difference in reoperations

Reoperations	Functional (n=123)		Mechanical (n=121)		Relative risk <sup>‡</sup> (95% CI) p-value
	Number	Percent	Number	Percent	
Stiffness/MUA	1	0.8%	5	4.1%	0.33 (0.05-1.95) 0.13
Deep infection	1	0.8%	0	-	-

# Conclusions

## Functional vs Mechanical Alignment

Similar overall patient-reported and clinical outcomes at 2 years

Functional alignment may provide benefit for certain patient subgroups  
based on their preoperative alignment

# References

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