Corin

Connected Orthopaedic Insight

Understanding Robotic Assisted TKA with Digital Gap Planning

Dr Amber Randall

GUNDERSEN HEALTH SYSTEM

Orthopaedics New England

DeClaire LaMacchia Orthopaedic Institute

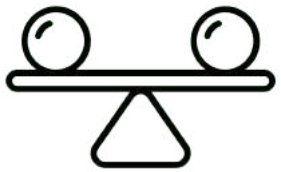
NYU Winthrop Hospital

Oklahoma Sports & Orthopedics Institute

Flagstaff Bone & Joint — Orthopaedic Excellence. Exceptional Care.

Technology Overview
Dr John Keggi

What Are We Aiming For?
Dr Jeffrey DeClaire



Challenging Tradition to Optimize Stability
Dr Jeffrey Lawrence

Data Driven Decision Making: Bringing Efficiency to the OR
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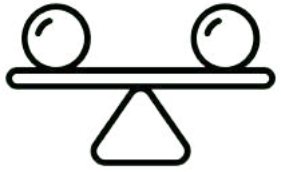

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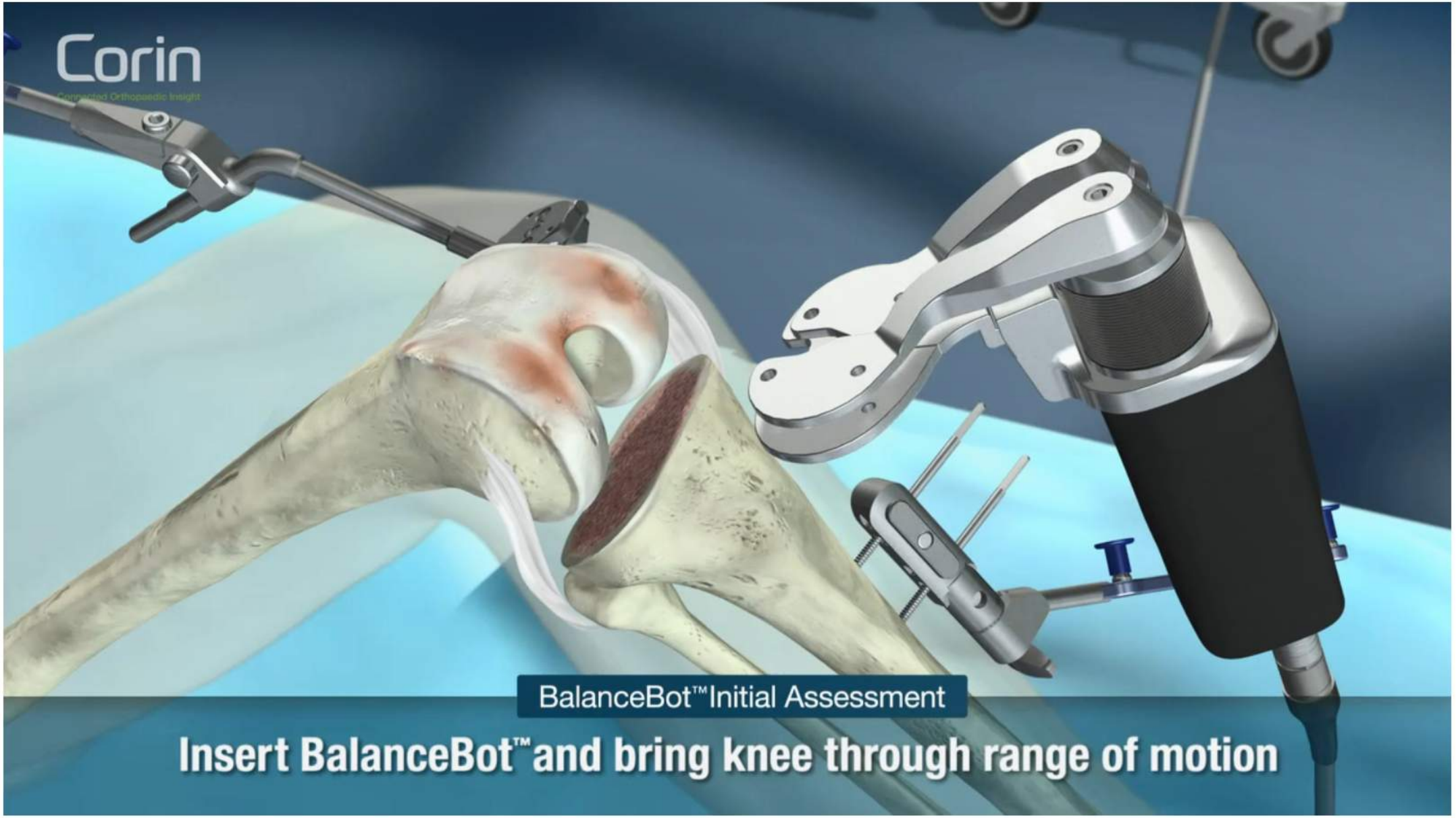
Data Driven Decision Making

- Technique Recap
- Clinical Guidelines
- Corin Joint Arthroplasty Registry (JAR)
- Managing An Efficient OR

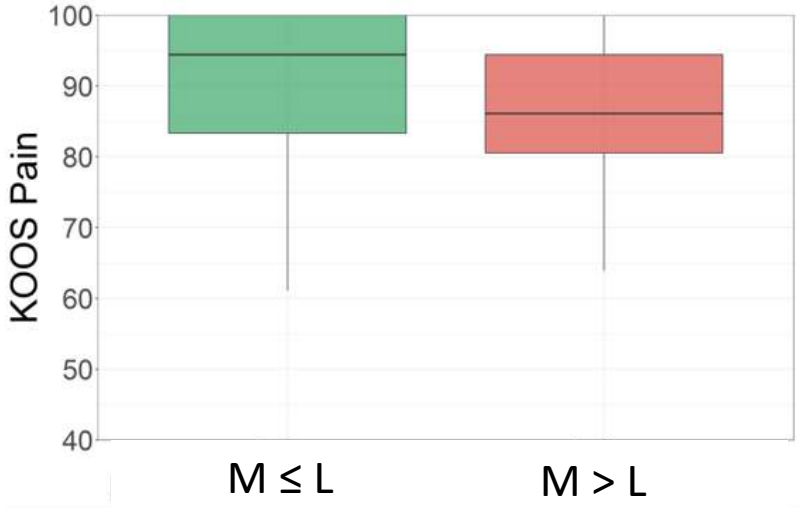
Part 1: Technique Recap

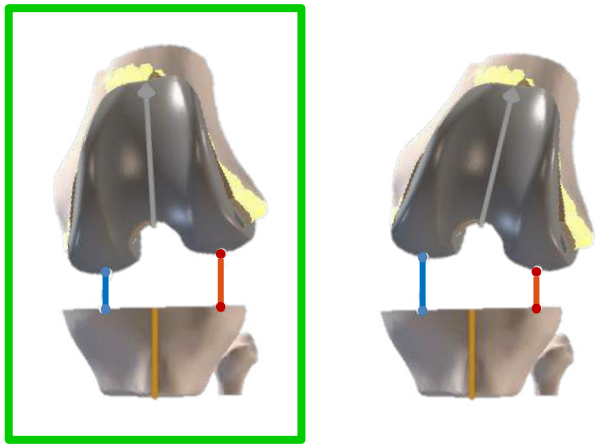
Predictive Balancing Surgical Technique Overview



Part 2: Clinical Guidelines

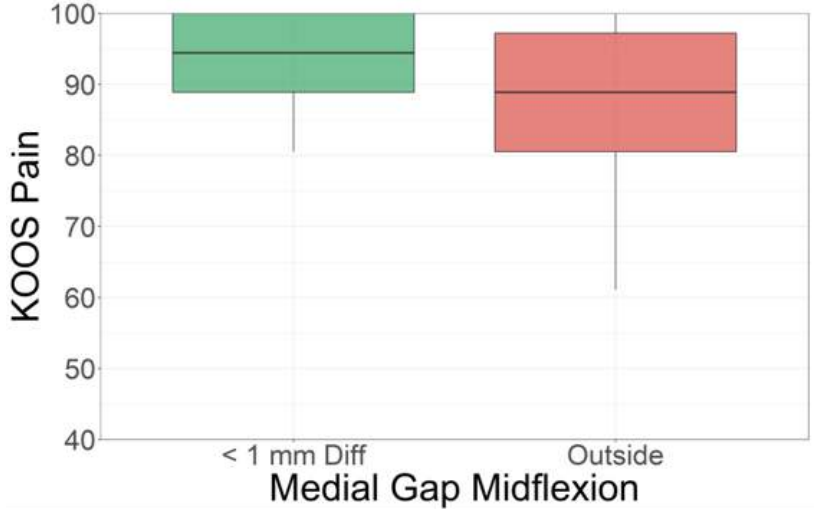
Extension

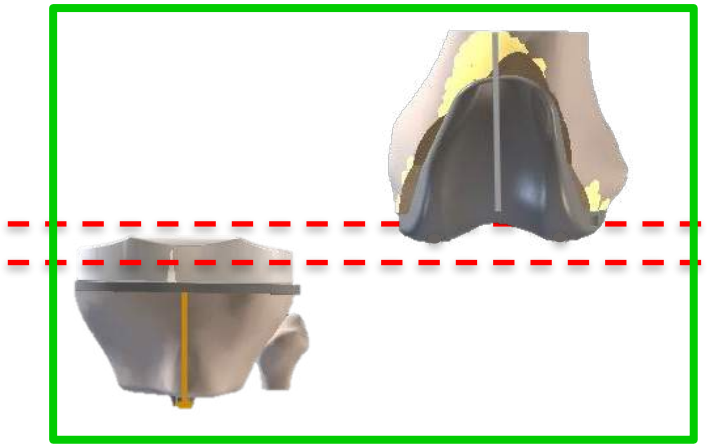




Δ 8.3, p = 0.007

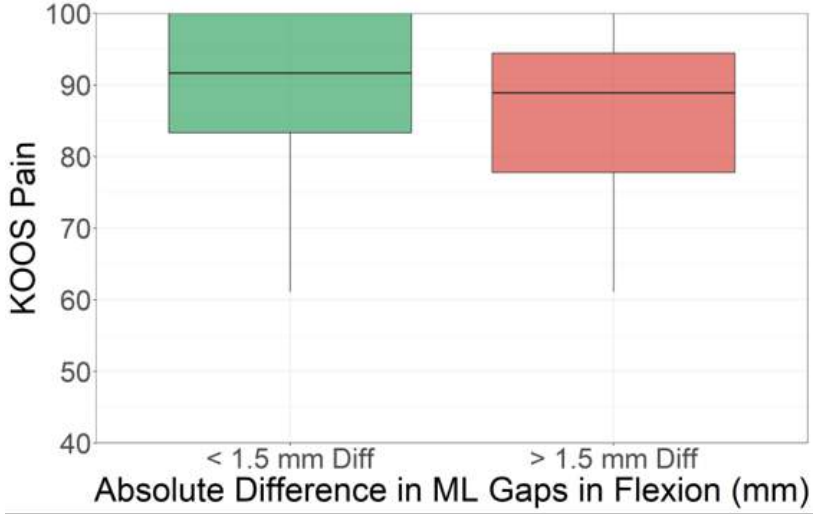
MidFlexion

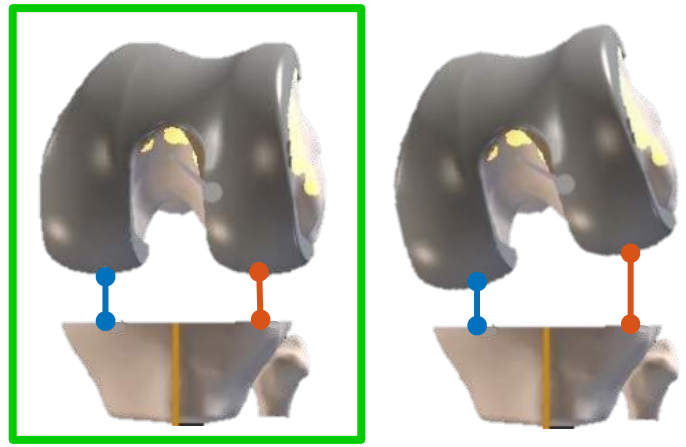




Δ 5.5, p = 0.006

Flexion

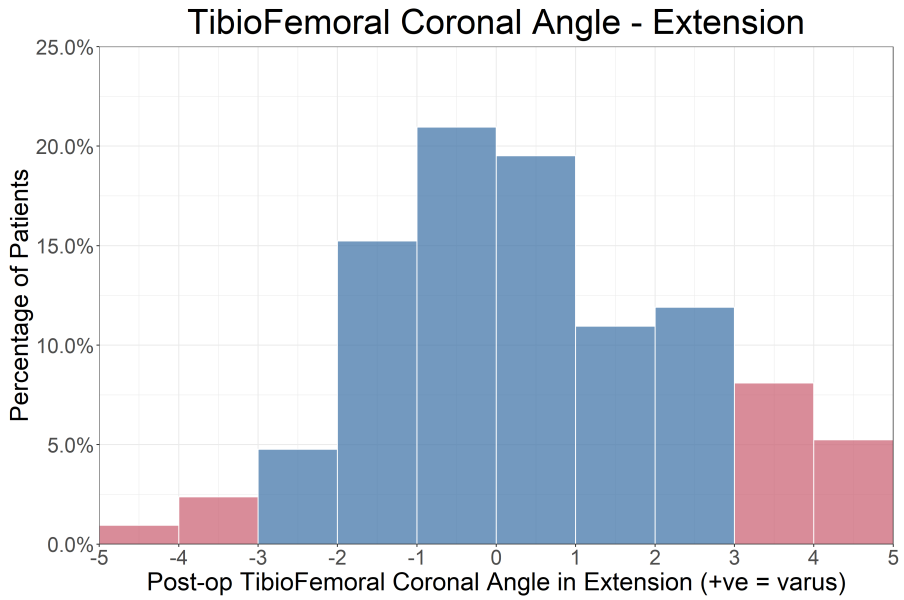


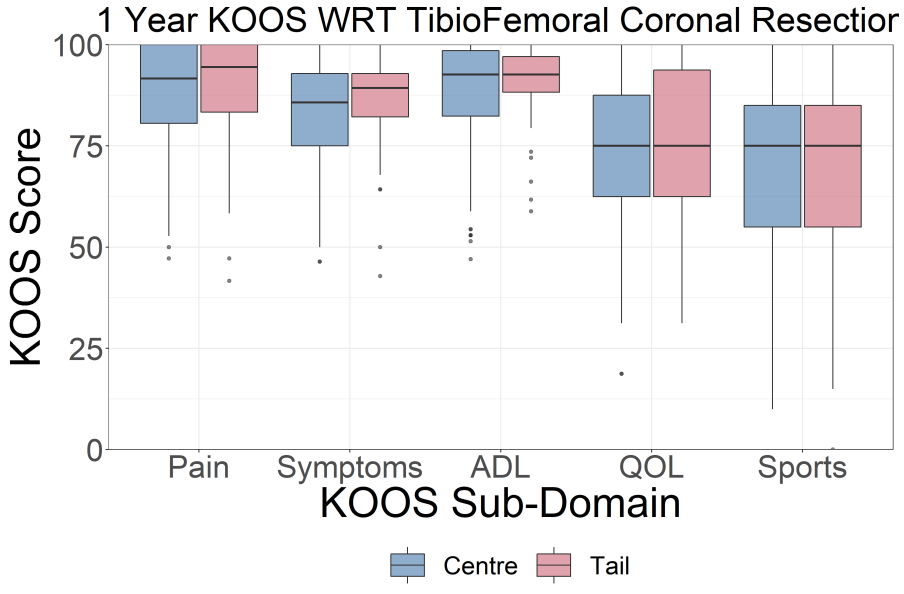


Δ 2.8, p = 0.012

Target Alignment

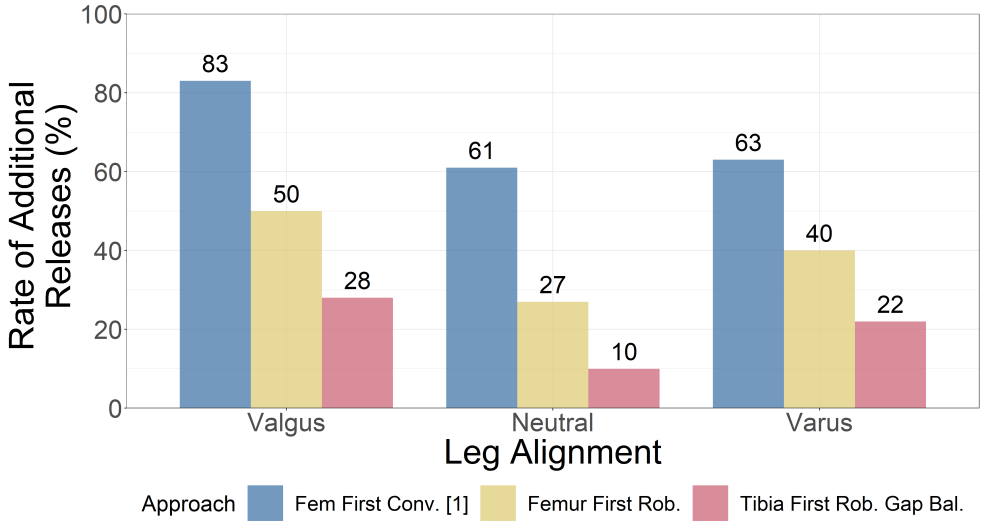
- Long leg alignment did **not** correlate with outcome
- Balance may have a greater effect on outcome than alignment
- What is the safe *limit* of non-neutral alignment?

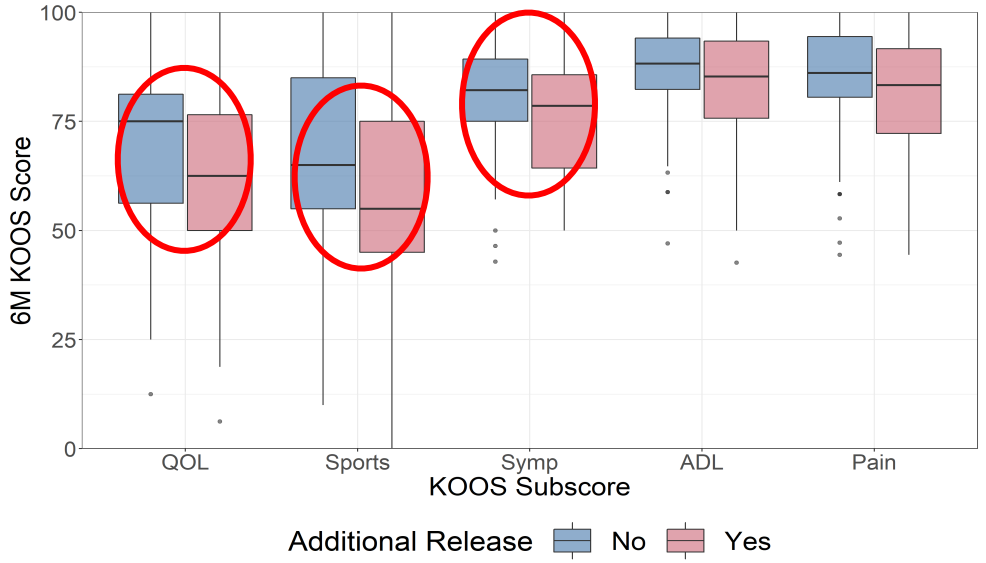




Soft Tissue Releases

- Predictive balance reduces the rate of soft tissue release across all deformities
- Knees with increased soft tissue releases reported poorer KOOS QOL, Sports and Symptoms scores
- When should a bone recut be performed *rather* than a release?





[1] Peters et al. JBJS 2013. n = 1216

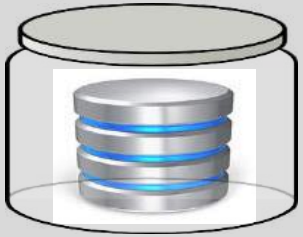
Part 3: Corin Joint Arthroplasty Registry

Corin Joint Arthropasty Registry (JAR)

Patient Profiling
Demographics
Pre/Rehabilitation
PROMs, Outcomes
Activity Monitoring

Pre-op imaging/xray/CT/MRI
Functional assessment
Implant Planning

Corin



Joint Arthroplasty Registry
(JAR) Database

Post-op analysis
Post-op imaging
PMS
National Registries

Intra-op sensing/
imaging
Soft-tissue
characterization
Ligament balancing
Implant Positioning

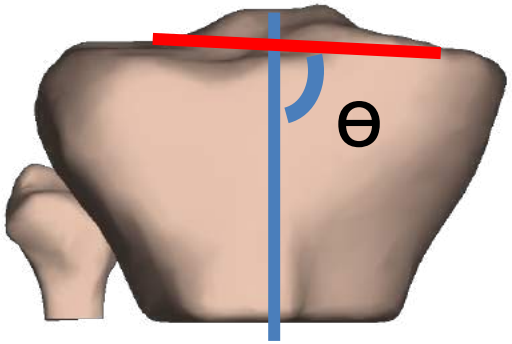
➢ Data collection through entire JA Journey

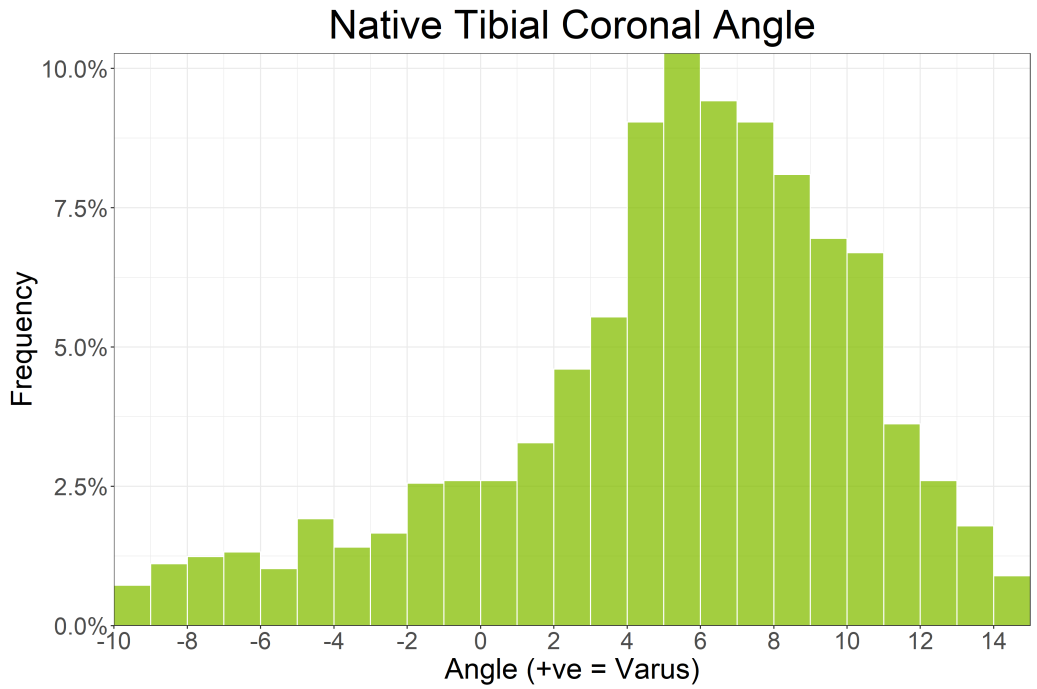
➢ Big data analysis for patient specific care

Pre-operative Tibial Deformity

- 2447 OMNIBotics cases recorded in the registry

- Mean = 4.9° varus
- SD = 7.0°





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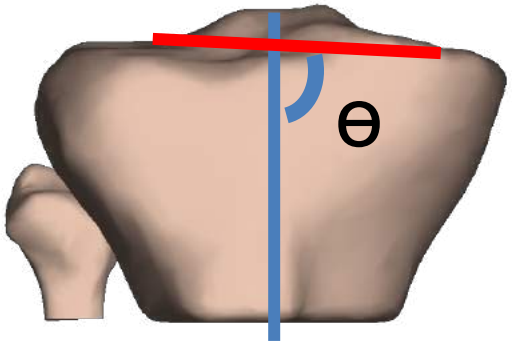
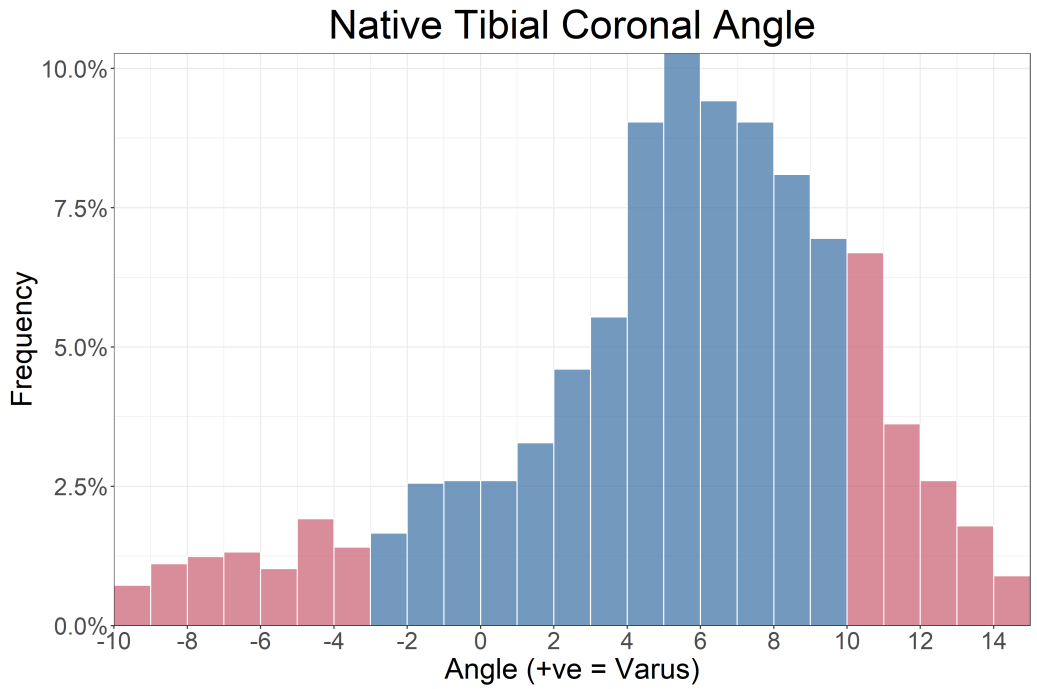


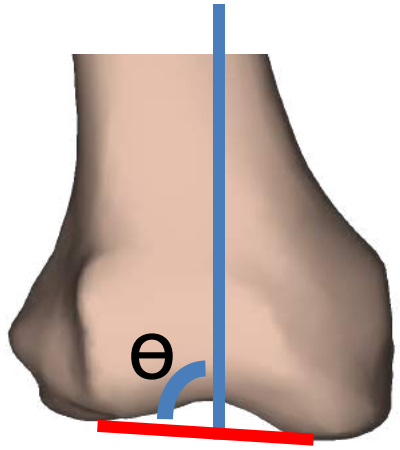


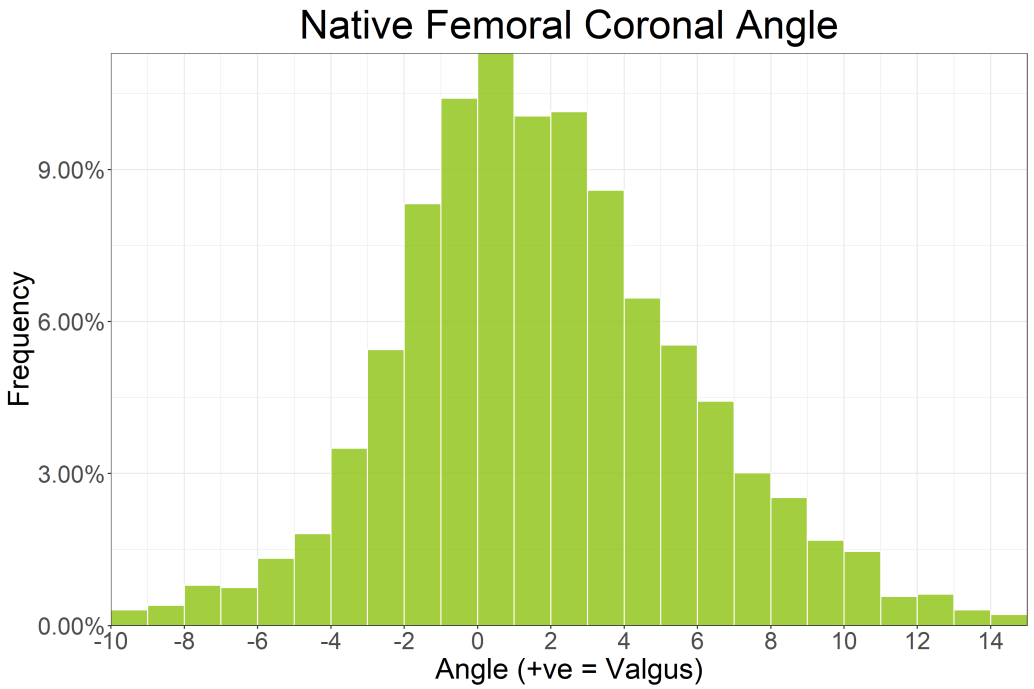
- Inlier defined as between -3° – 10° varus
- 27% knees present outlier tibial anatomy

Pre-operative Femoral Deformity

- 2447 OMNIBotics cases recorded in the registry

- Mean = 1.5° valgus
- SD = 5.5°





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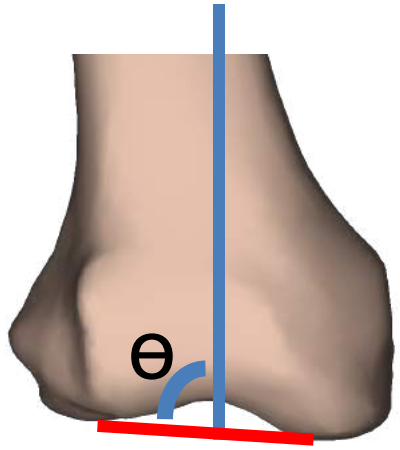
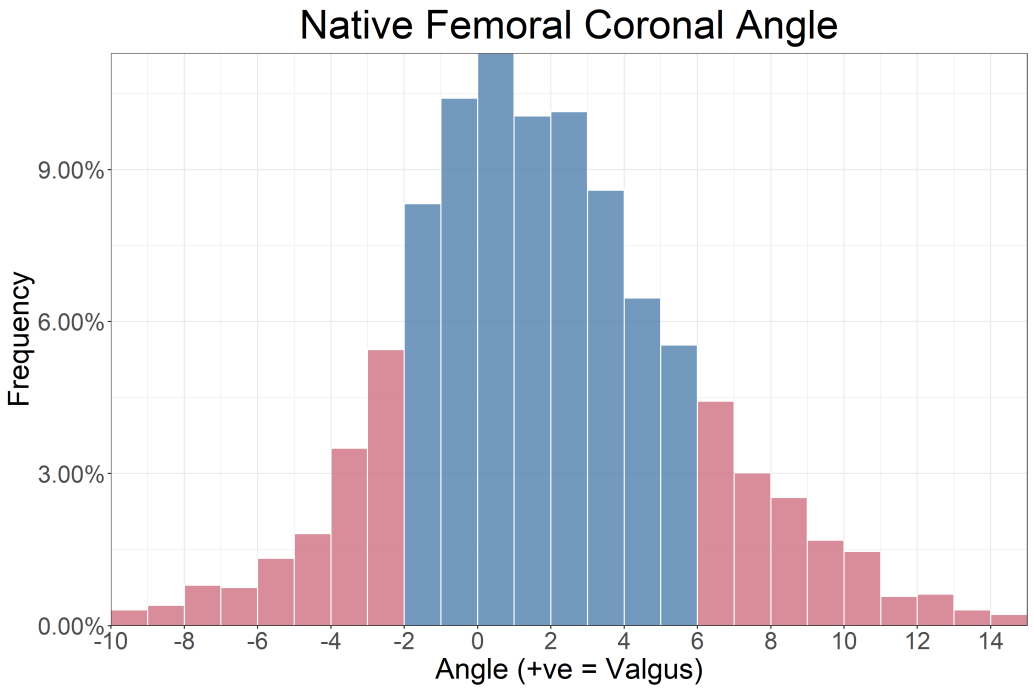


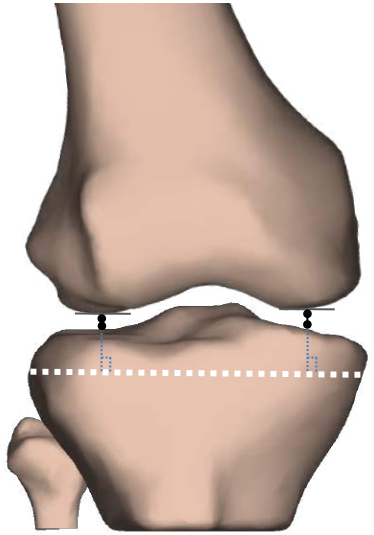


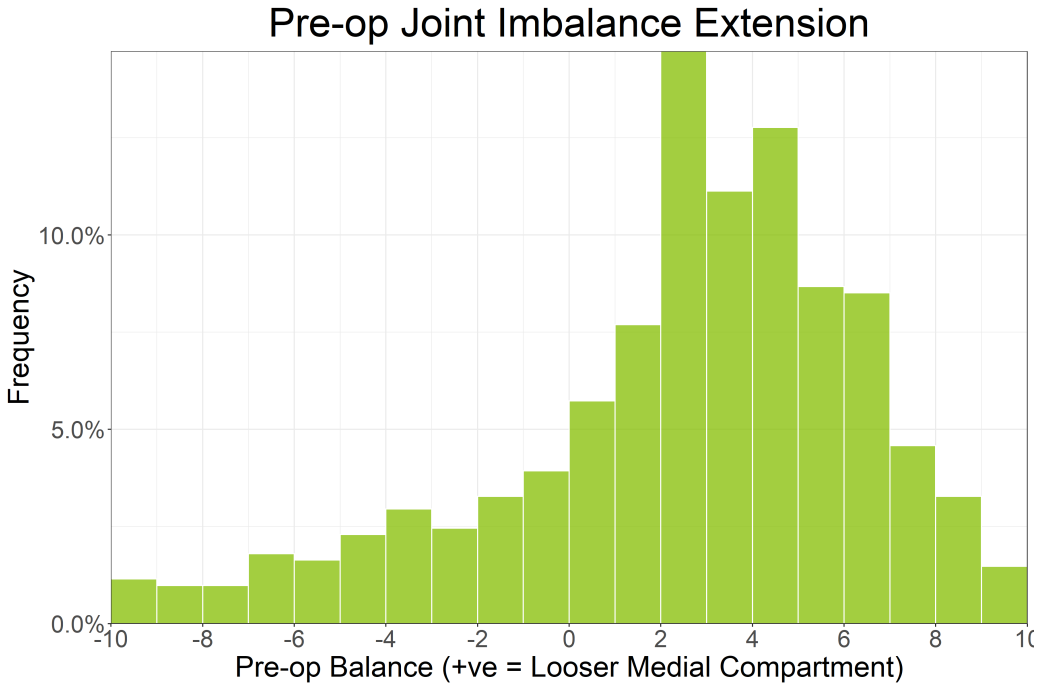
- Inlier defined as between -2° – 6° valgus
- 34% knees present outlier femoral anatomy

Pre-operative Balance Extension

- 2447 OMNIBotics cases recorded in the registry

- Mean = 2.3 mm imbalance
- SD = 4.6 mm





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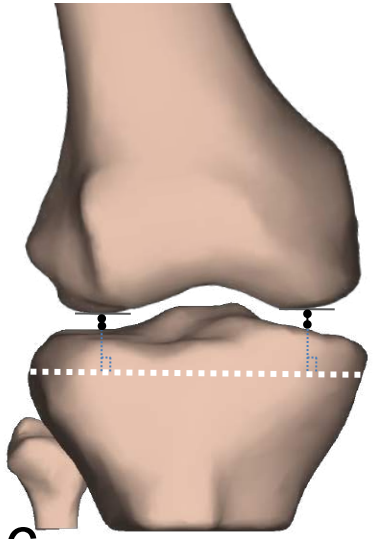
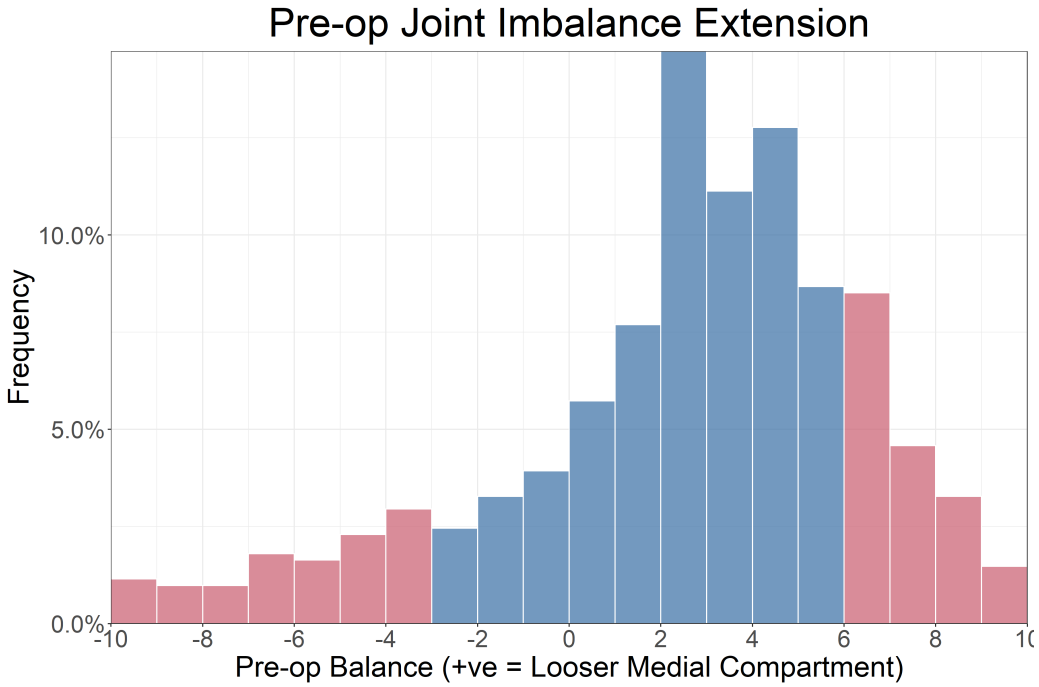




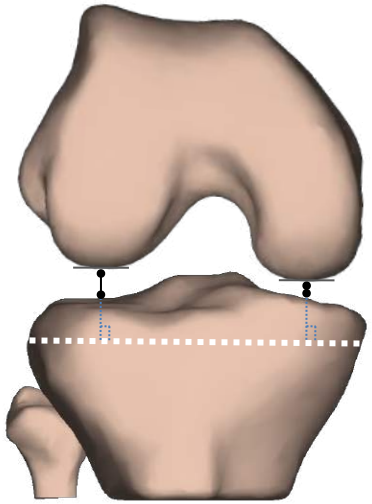
- Inlier defined as between -3 – 6 mm looser on medial side

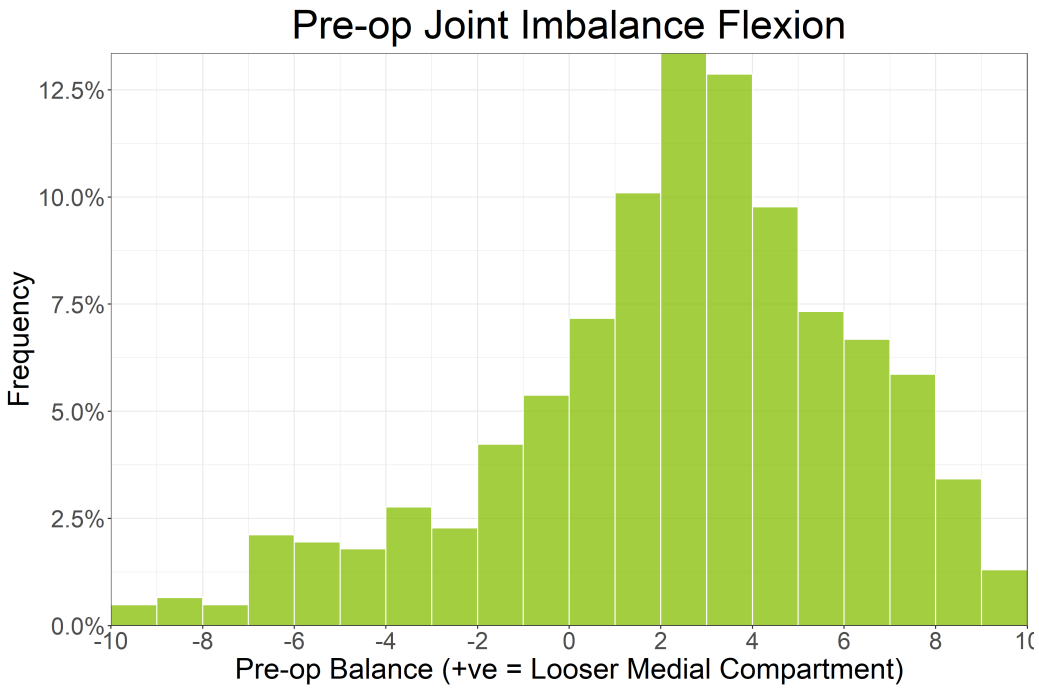
- 32% of knees present with outlier joint balance in extension

Pre-operative Balance Flexion

- 2447 OMNIBotics cases recorded in the registry

- Mean = 2.3 mm imbalance
- SD = 4.6 mm





Pre-operative Balance Flexion

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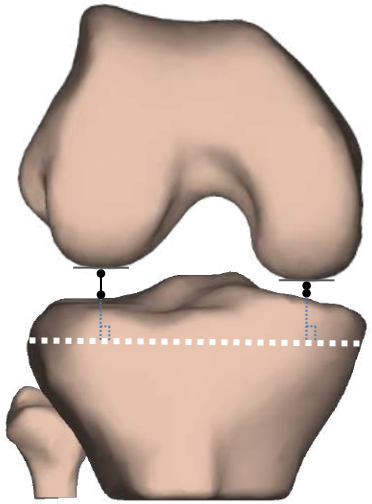

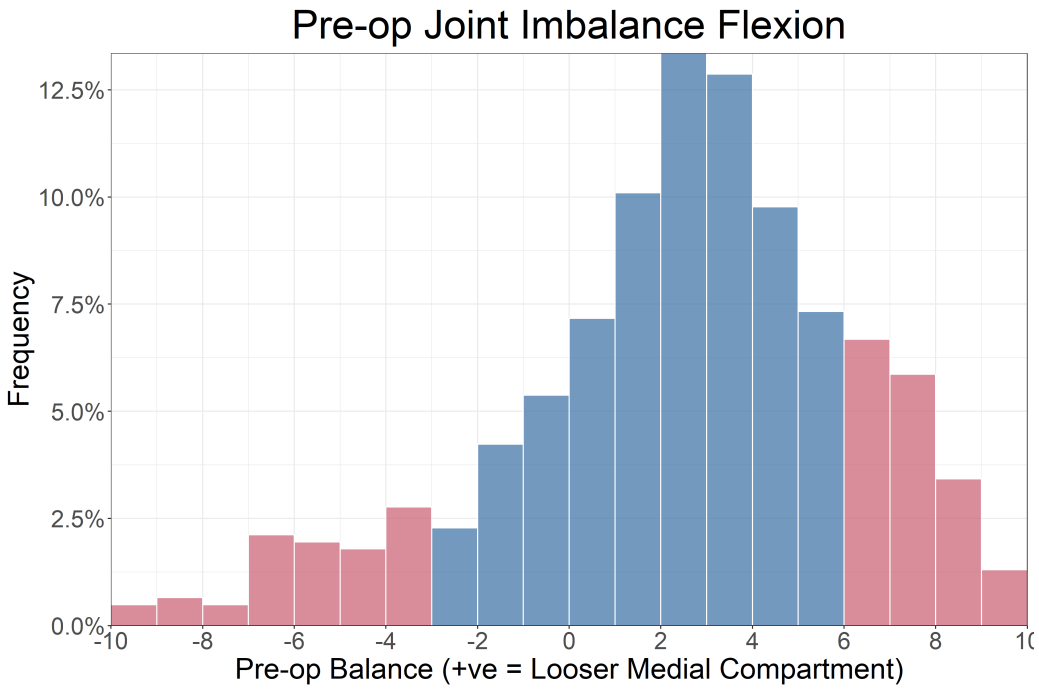

- Inlier defined as between -3 – 6 mm looser on medial side
- 30% of knees present with outlier joint balance in extension

How often is an outlier knee observed

Variable	Frequency (%)
Tibial VV (-3° - 10°)	27
Femoral VV (-2° – 6°)	34
Pre-operative extension balance (-3 – 6 mm)	32
Pre-operative flexion balance (-3 – 6 mm)	30
Satisfies at least 1 criteria	**69**

So how do I do this efficiently in the OR?

Part 4: Managing an Efficient OR with OmniBotics

Background

- Education and training:
  - A.B., Harvard and Radcliffe Colleges
  - MD, Harvard Medical School
  - Internship and Residency: UMass Medical Center
  - Fellowship: Otto Aufranc fellowship in Adult Reconstruction, Boston, MA
- My evolution and history with respect to soft-tissue management in TKA

My OMNIBotics Experience

- Began OMNIBotics in July of 2017
- BalanceBot in October of 2017
- Average 4-5 knees and 4-5 hips per day, in 2 rooms with dedicated staff
- Approximately 600+ cases per year

The beginnings: Why and how?

Soft tissues

- Bony alignment and measured resection
- Manual guides, intramedullary versus extramedullary
- Femur first preparation
- Memorizing algorithms of releases to employ to balance gaps after resections already completely made

Soft tissues

- Traditional methods versus navigation: a natural evolution
  - More accurate bony alignment
  - Sometimes, inaccurate bone cuts contributed to inequal gaps
  - With navigation, we became better at preparing the bone

Soft tissues

- "Cheated navigation"
  - A game of sorts I used to play, to see if I could adjust the navigated parameters in such a way to "predict" a well balanced knee

I began to cut distal femur first, then the tibia, and use a tensioner in flexion

Running an Efficient OR

- Running an Efficient OR with OMNIBotics
  - Multifactorial:
    - Preparation and planning (surgeon must oversee all steps)
    - Precise division of labor
      - Orthopedic specialty hospital
      - Dedicated scrub and RN staff, with cross-training
      - 2 scrub techs per case
      - 2 assistants per case (PA and CFA)
- Staff retention is critical

Timeline of Operation

- 2 cases – 1 easy, 1 hard (this is the important bit)
- Dr Randall to communicate which cases

Average Operation: 171 cases

- Average Total Tourniquet: 1 Hr 7 Min
- Average OMNIBotics time: 36 Min

- Landmarking: 4 mins
- Pre-operative kinematics: 1 min
- Tibia cut block position and planning: 4 min
- Tibia resection and validation: 2 min
- Pre-operative joint balance: 2 min
- Femoral planning: 3 min
- Robotic alignment and calibration: 3 min
- Femoral resections: 4 min
- Post-operative joint balance: 3 min
- Trialing, Cementing and Final Alignment: 10 min

Conclusion: unique and adaptable

- The BalanceBot is the next step in navigation; building upon the navigated base of the tibial cut, with real-time assessment of the functional status of the soft tissues; enabling reacquisition of data after releases; and predictive mapping of total knee behavior

Conclusion

- Conclusion
  - Good System
  - Great (improved) outcomes
  - How to combat “robots are inefficient” when presented with that argument.

Further Clinical Questions

- Every knee is different and presents its own unique challenges and compromises

- To provide robust patient specific guidelines to achieve optimal outcomes, more data is required:
  - Pre-operative disease
  - Activity
  - Psychological condition
  - Soft tissue characterization
  - Rehabilitation

- And all of this is needed on a large population!

Take Away Messages

- Integrated soft tissue balancing and robotics
  - **Real time gap and resection planning**
  - **Surgical execution of desired post-operative joint balance**
- Some clinical guidelines can be determined from clinical studies but more data is required
- Robotics (and data capture) can be efficient
- A wide variety of anatomy and soft tissue balance is present in the TKA population presenting a multitude of clinical challenges