Meniscal leaflet resection decreases meniscal loading and increases peak contact stress after horizontal cleavage tear in simulated gait

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Disclosures / Acknowledgements

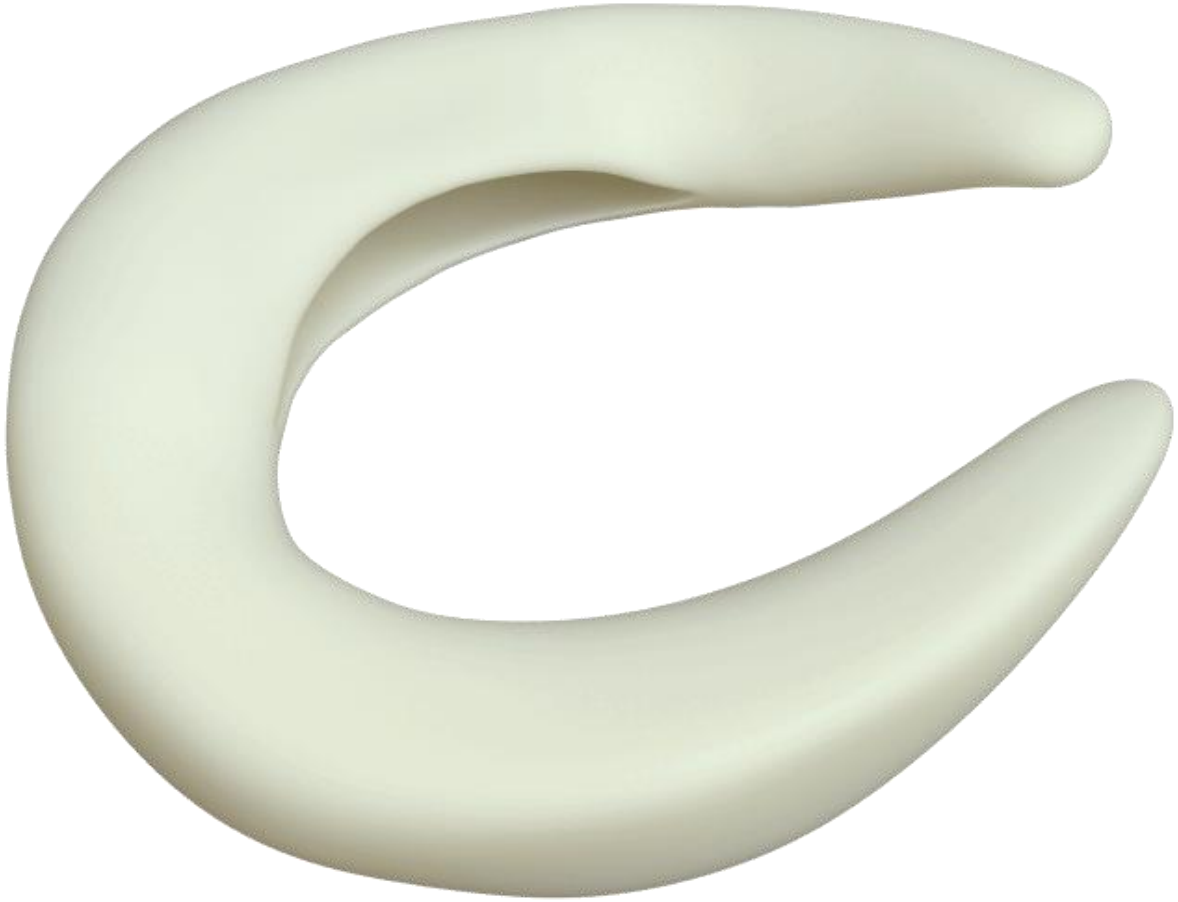
Anil Ranawat - Paid consultant for Anika, Bodycad, Cervos, CONMED Linvatec, Moximed, Newclip, Ranfac, Smith & Nephew; stock or stock options in Enhatch and Overture; IP royalties from Depuy

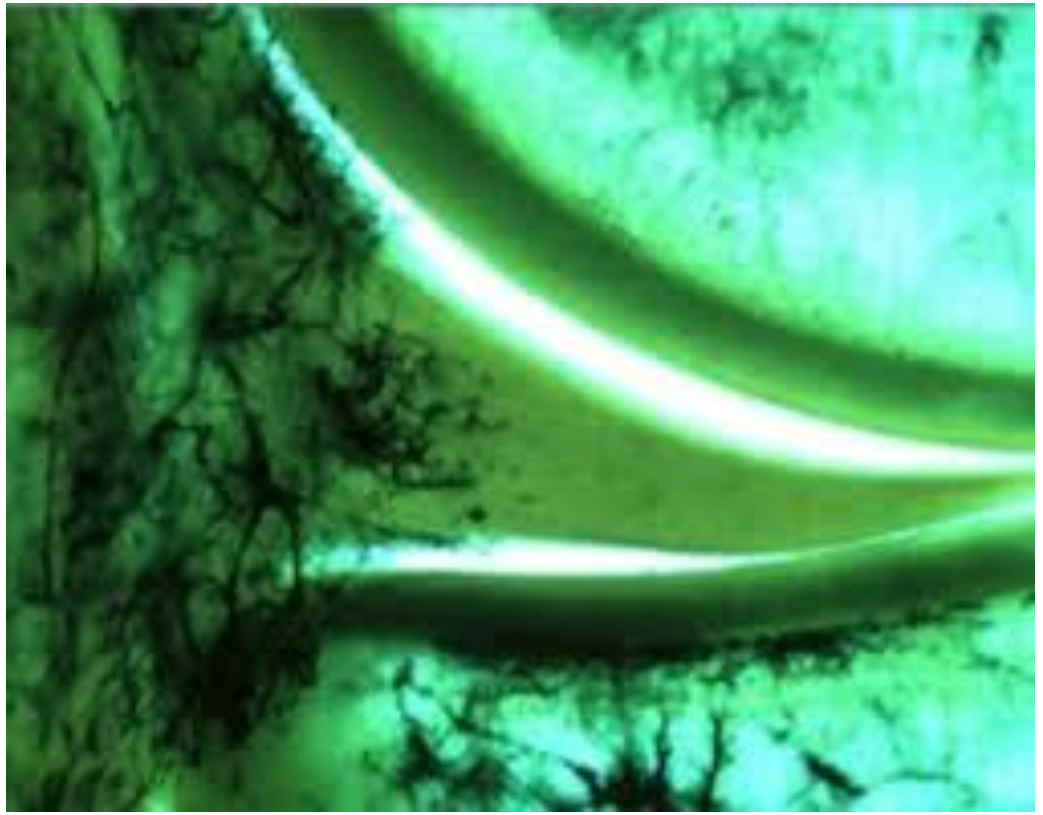
Suzanne Maher - Stock or stock options in AGelity Biomechanics Corp.

All other authors do not have any conflicts to disclose

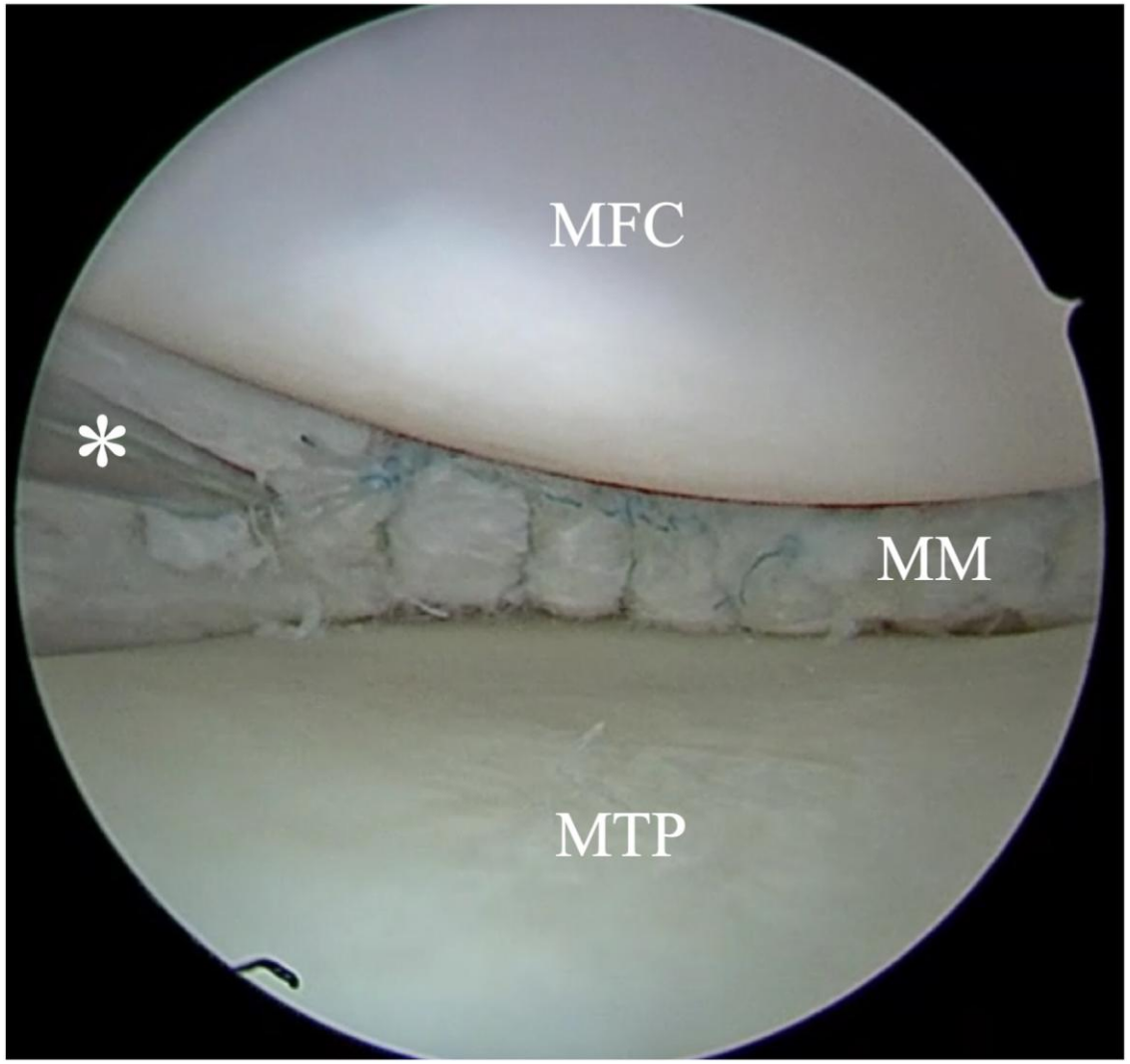
We thank the following sources of support: The National Institutes of Health (AR075523), the Russell Warren Chair for Tissue Engineering, and the HSS Surgeon-in-Chief Fund

Horizontal Cleavage Tear (HCT)





HCT Repair



HCT Biomechanical Literature

- Koh et al. (JBJS 2016 & CORR 2018)
  - 12 cadaveric knees (medial meniscus), 11 knees (lateral meniscus)
  - Leaflet resection → decreased contact area, increased contact pressure
  - HCT repair → no significant difference from baseline

- Beamer et al. (Arthroscopy 2017)
  - 10 cadaveric knees
  - HCT → 70% increased contact pressure
  - HCT repair → restored contact pressure/area within 15% of baseline

OBJECTIVE

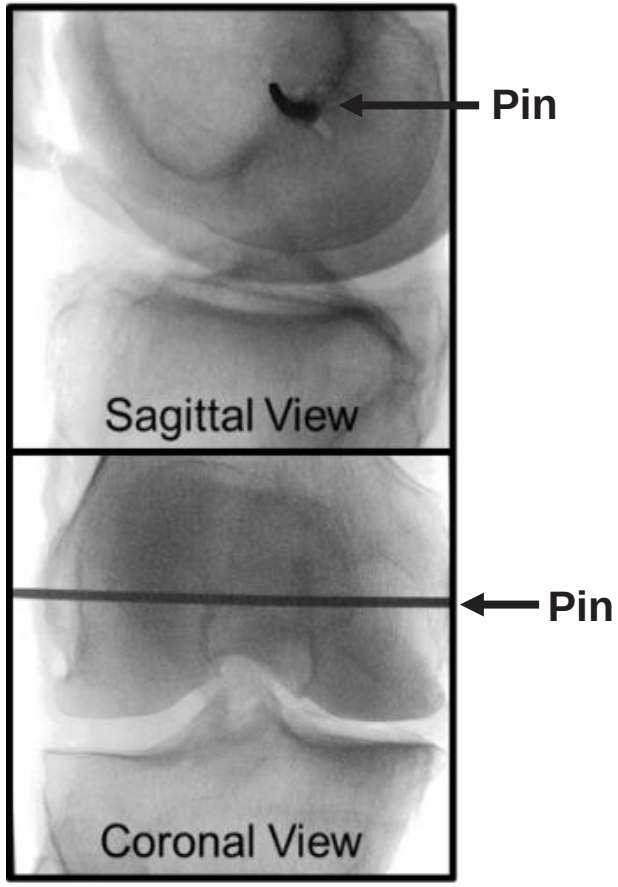
To quantify the effects of horizontal cleavage tear (HCT), repair, and leaflet resection on joint biomechanics and contact force redistribution during simulated gait

HYPOTHESIS

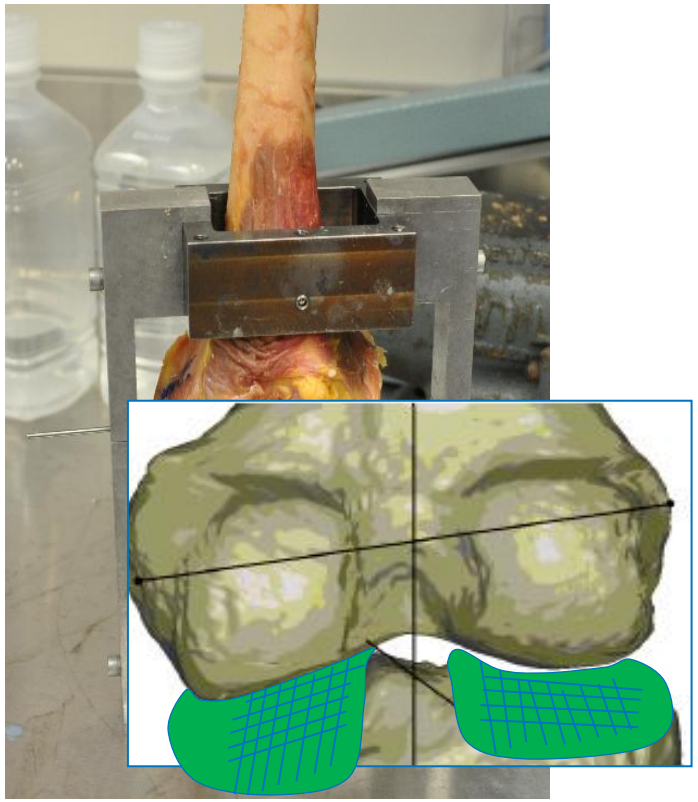
Meniscal leaflet resection will increase contact stresses and decrease contact area, whereas HCT repair will not change contact mechanics compared to the intact meniscus

Methods: Cadaver Preparation

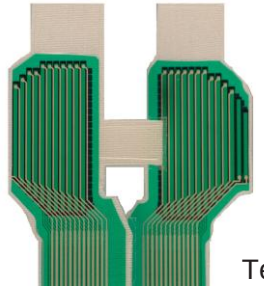
1. Strip and pin knee through epicondylar axis



2. Pot femur and tibia



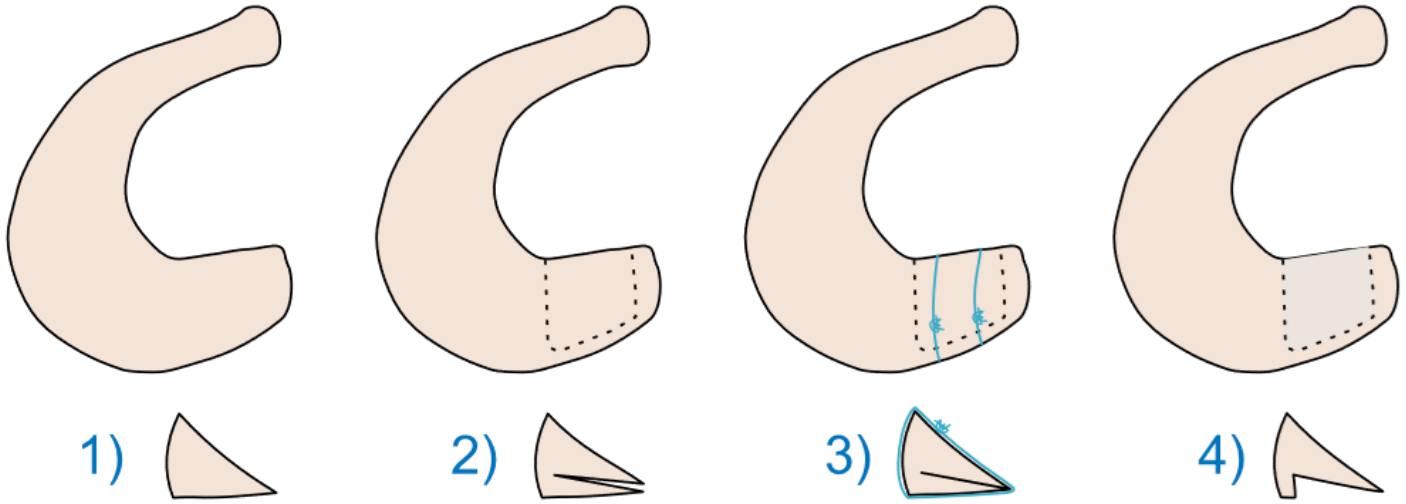
3. Insert Tekscan sensor – secured to ACL and posterior capsule



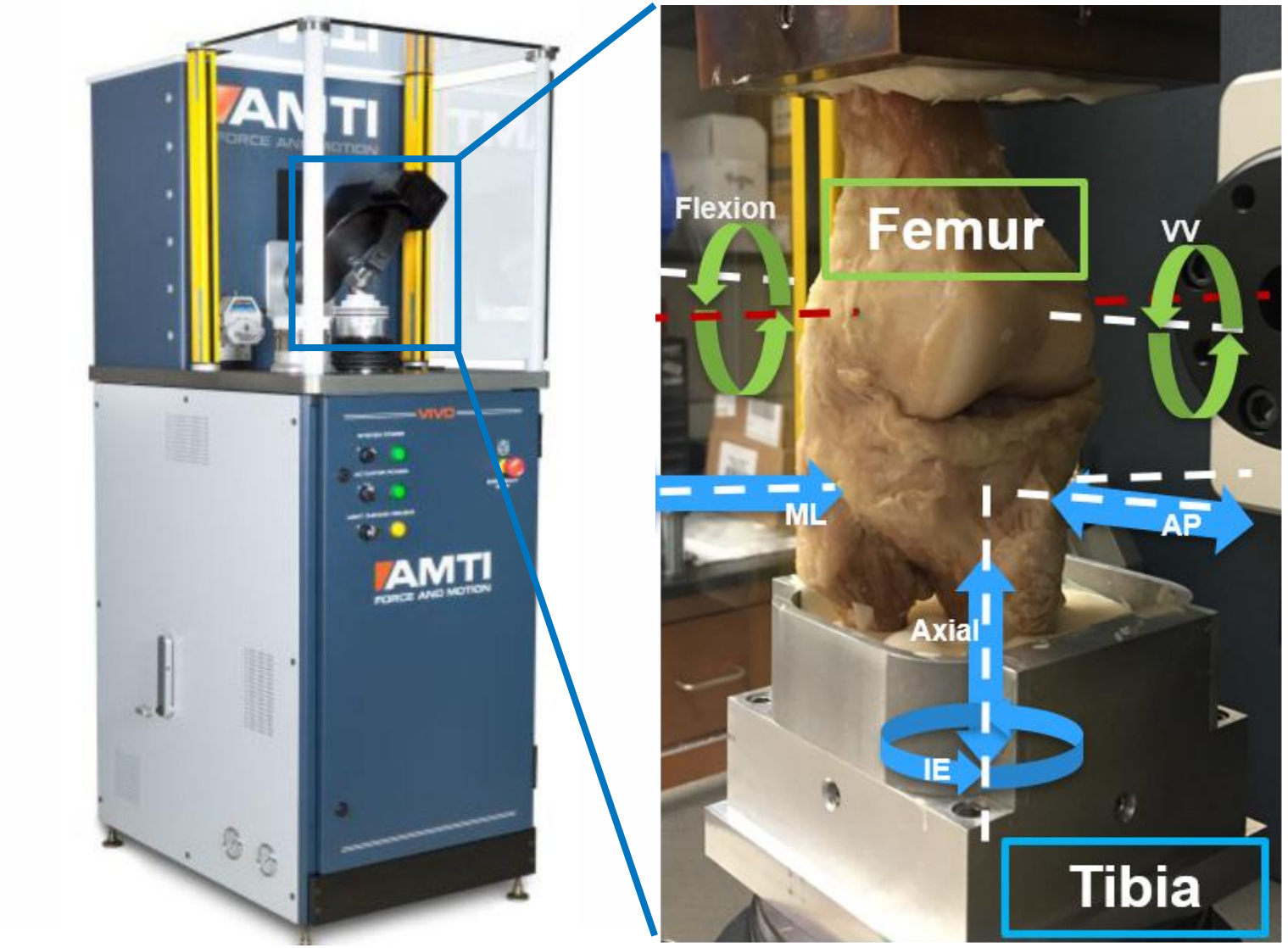
Methods: Testing Conditions

4. Femoral condyle osteotomy, 12 cycles of gait at 0.2 Hz

5. Femoral condyle osteotomy + meniscal procedure, repeat gait cycle

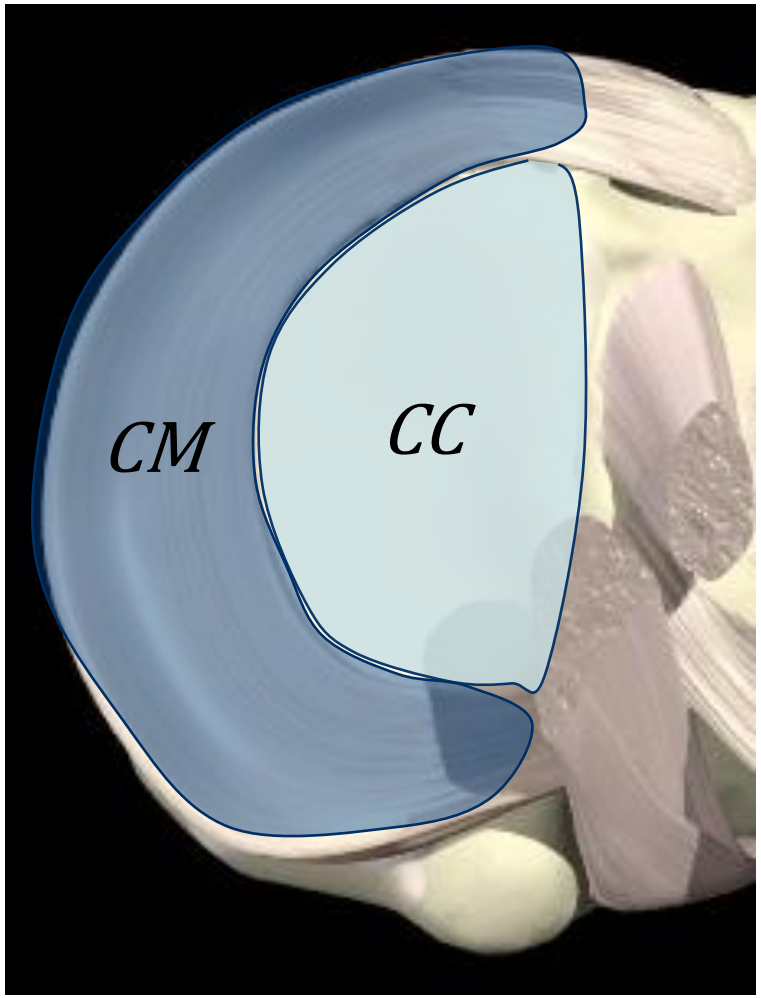


Methods: Gait Testing



X-Y-Z axis coordinate system

Methods: Force Distribution Calculation



Percent meniscal loading in medial meniscus

$$\text{Percent meniscal loading} = \left(\frac{CM}{CC+CM}\right) * 100$$

CM = Cartilage-meniscus force
CC = Cartilage-cartilage force

Range = 0% to 100%

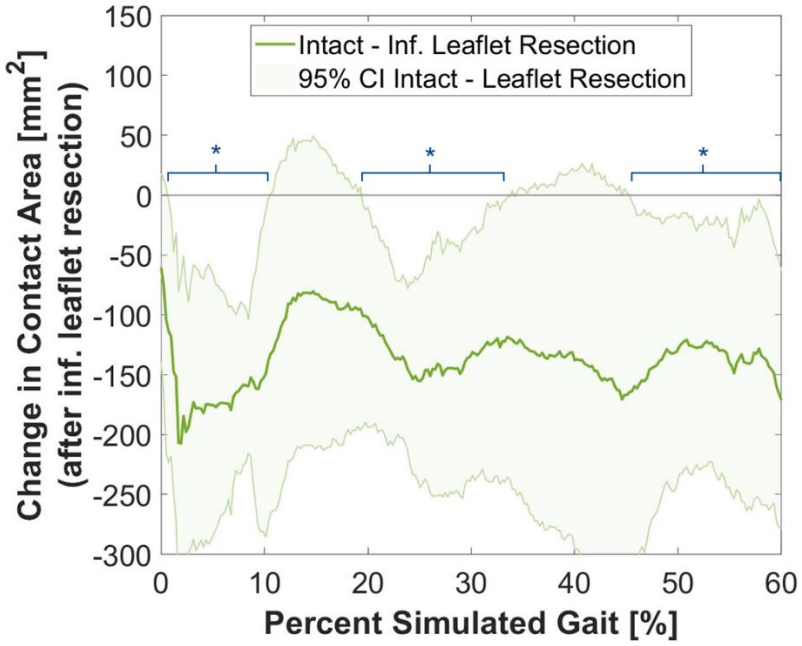
Intact Meniscus vs. HCT

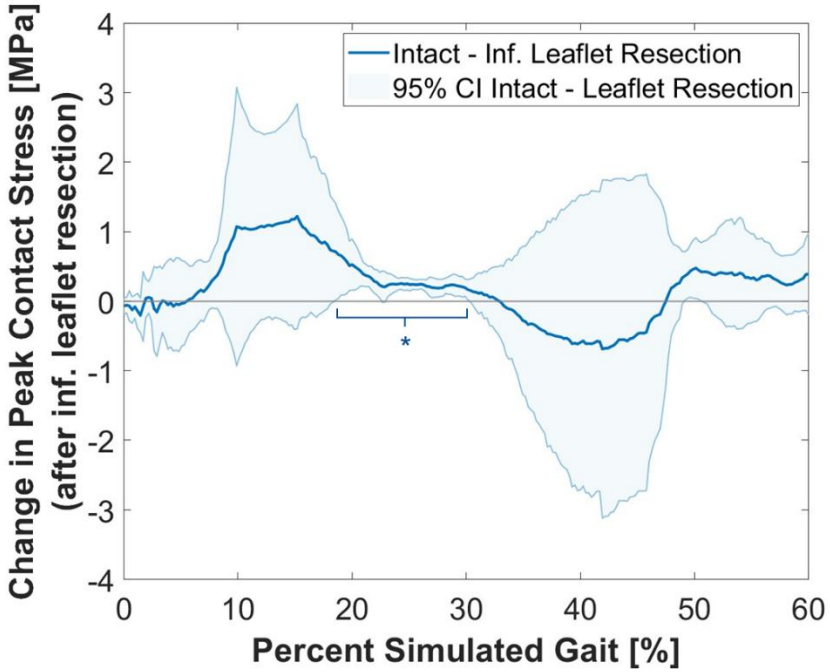
- Peak Contact Stress: no significant difference
- Contact Area: no significant difference
- Percent Meniscal Loading: no significant difference

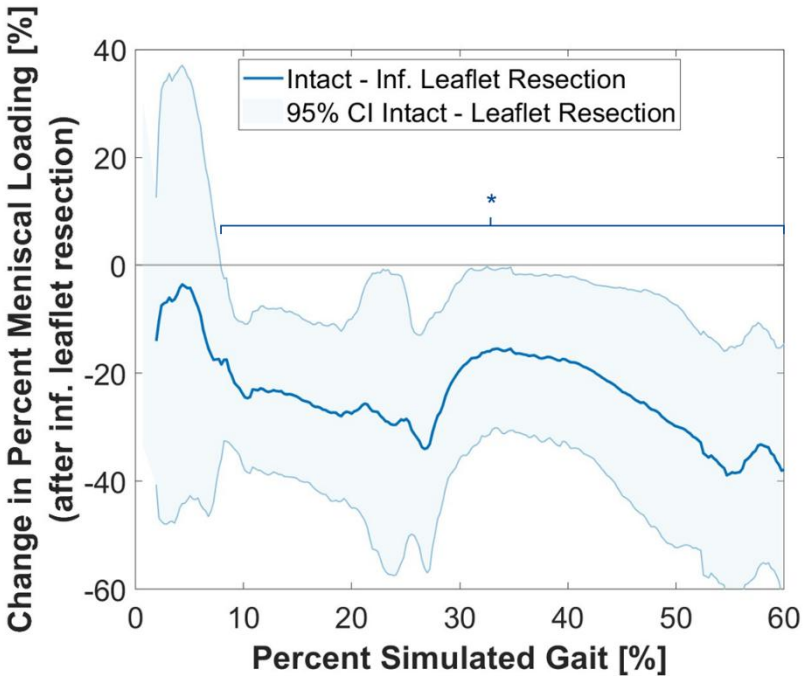
Intact Meniscus vs. HCT Repair

- Peak Contact Stress: no significant difference
- Contact Area: no significant difference
- Percent Meniscal Loading: no significant difference

Intact Meniscus vs. Inferior Leaflet Resection







Limitations

- Only assessed medial meniscus
- Meniscal HCT was isolated to posterior horn
- Did not evaluate the role of coronal plane alignment
- Gait protocol was designed to simulate level-ground walking

Conclusions

- No difference in joint contact mechanics between intact meniscus and meniscal HCT repair
- Resection of inferior leaflet → decreased percent meniscal loading, decreased contact area, increased peak contact stress
- Results support meniscal preservation for HCTs

Thank you to

The National Institutes of Health (AR075523)