Biomechanical Effect of Location and Number of Bone Tunnels in Transtibial Pull-out Repair for Medial Meniscus Posterior Root Tear

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ISAKOS 2025
COI Disclosure

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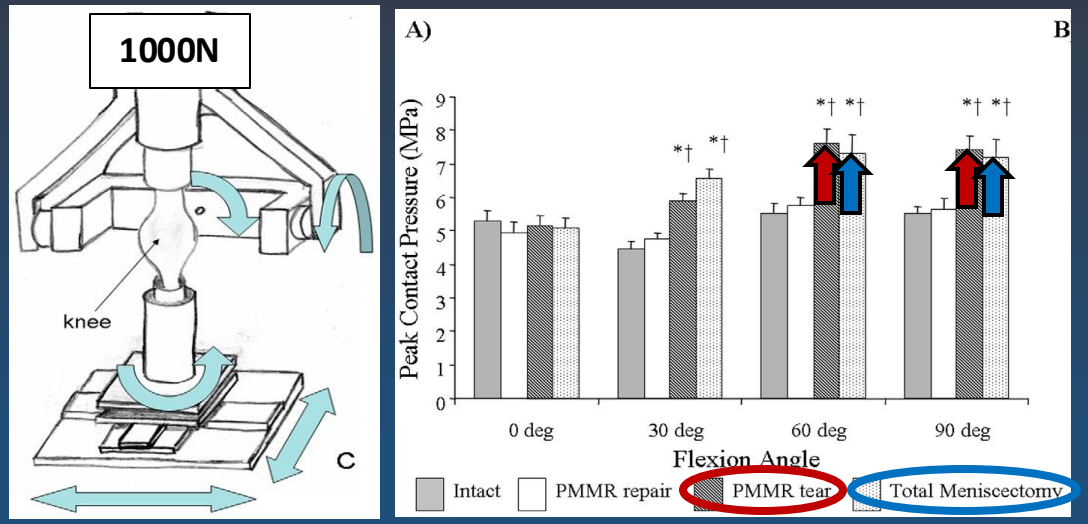
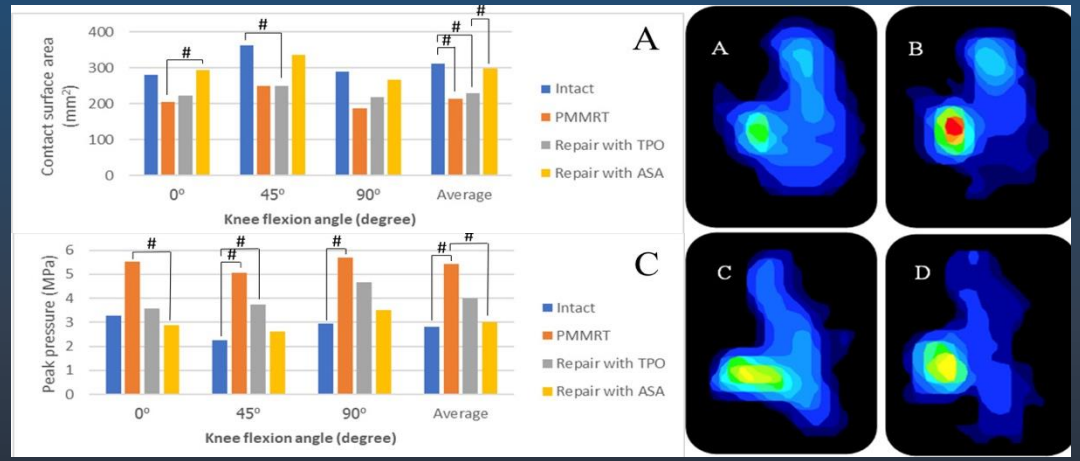
The authors declare no conflicts of interest related to this presentation.

TPR for MMPRT



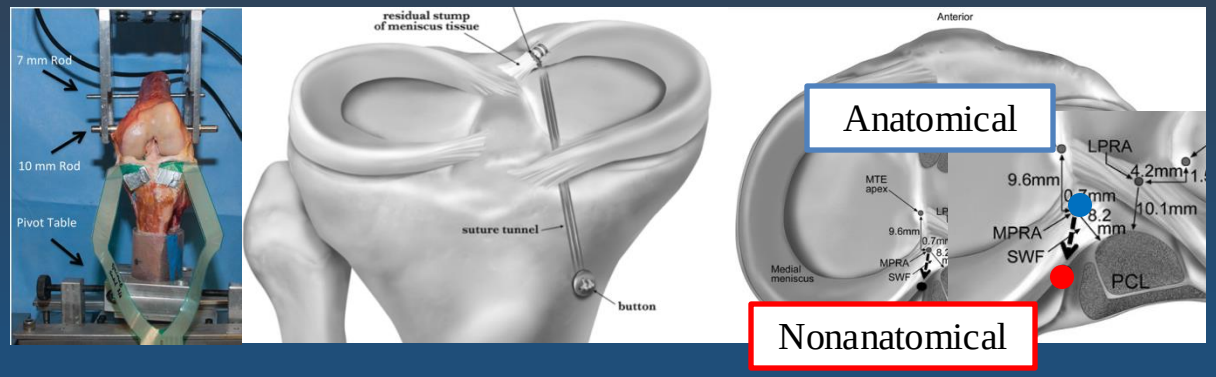
Allaire R, et al. *JBJS Am 2008*



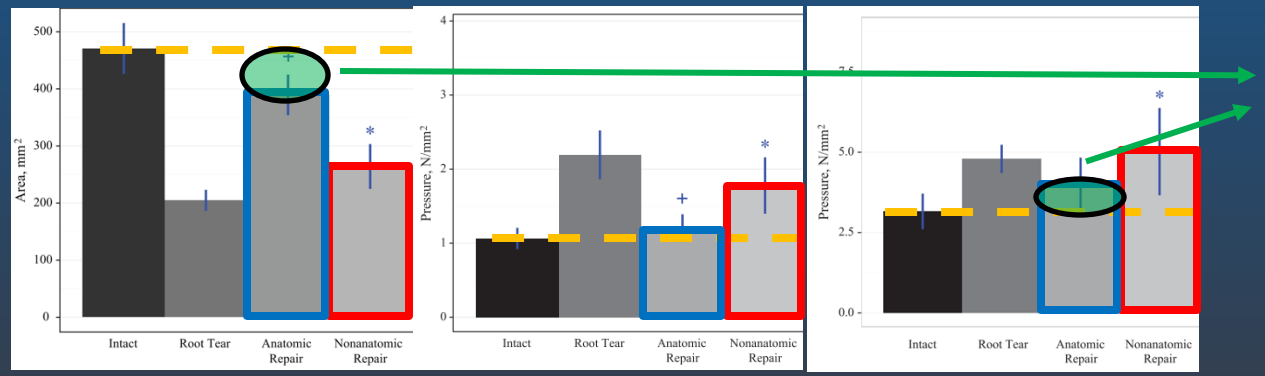
Saengpetch N, et al. *J Orthop Surg Res 2023*

- Medial meniscus posterior root tear (MMPRT) has a mechanical effect on tibio-femoral contact mechanics to the level of total meniscectomy in knee flexion.
- Transtibial pull-out repair (TPR) for MMPRT has been shown to result in incomplete restoration of the mechanical function of the meniscus.

Biomechanical Evaluation of Tibial Tunnel Position in TPR for MMPRT



- A more anatomical tibial tunnel might improve the restoration of meniscal function and provide superior effects on tibio-femoral contact mechanics.



Contact area *Mean contact pressure* *Max. contact pressure*

LaPrade CM, et al. *AJSM 2015*

Incomplete restoration of meniscal function to the intact level, even with an anatomical tunnel, could be due to not "truly" anatomical creation of the tunnel (location, number)

Purpose

To compare the mechanical effects of TPR for MMPRT

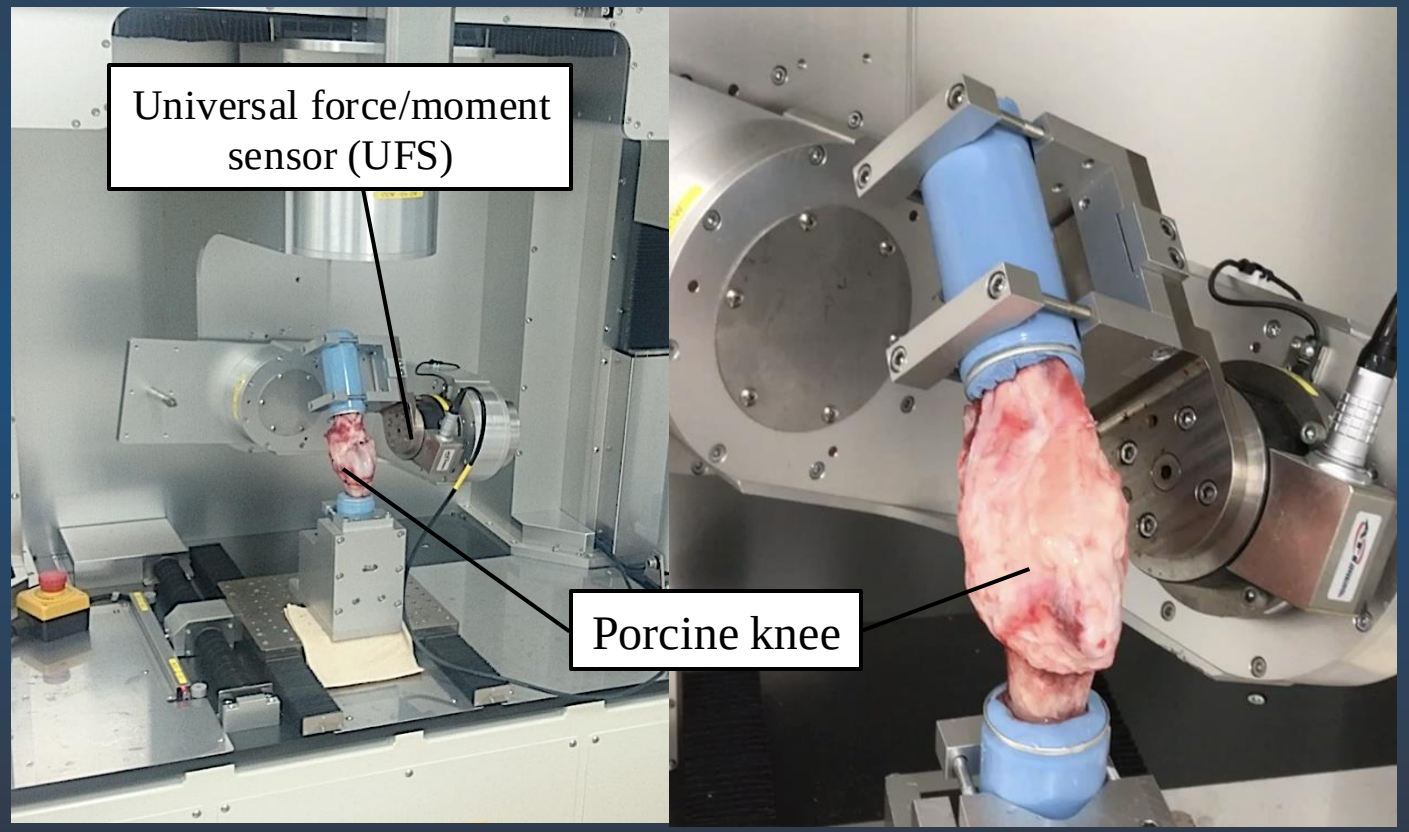
by the location and number of the bone tunnels.

Material and methods

- Fresh Frosen Porcine knees
- 6-degree of freedom (DOF) robotic system: FRS-2010

  (Technology Service Ltd., Nagano)

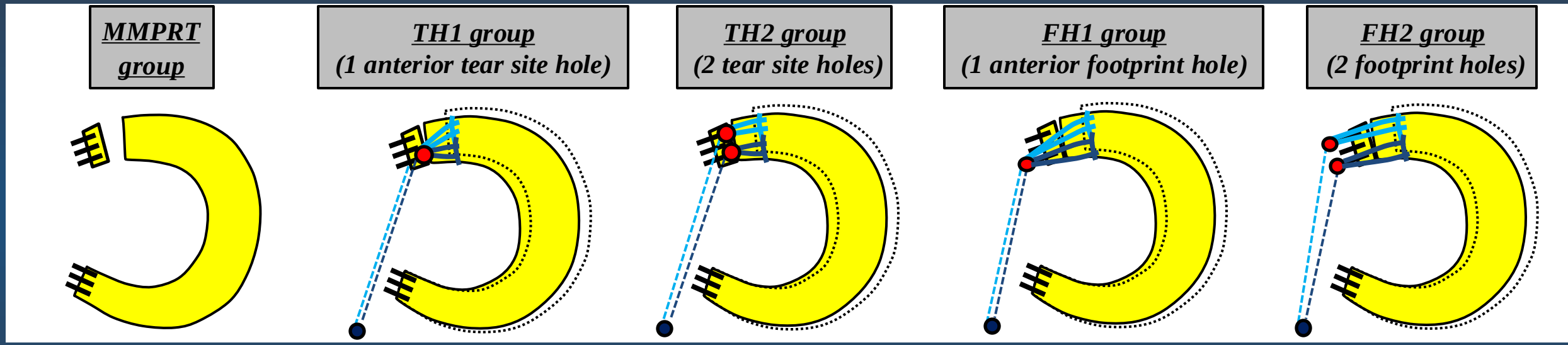
➢ This system can manipulate the physiological three-dimensional (3D) motion of the knee joint by controling the force/moment on the knee joint at zero except for the operator's intended direction.

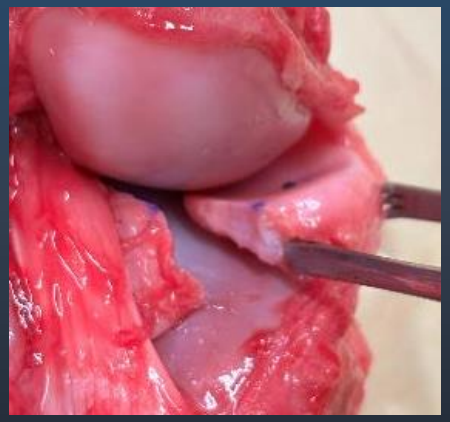


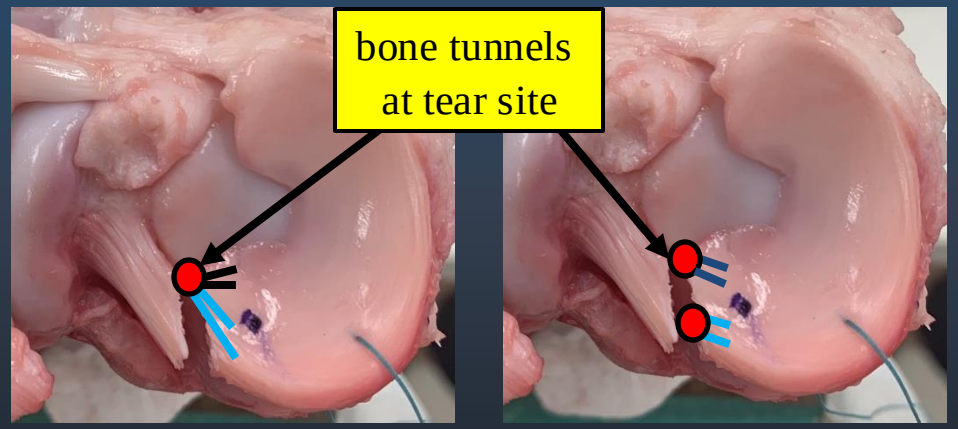
Fujie H, et al. *J Biomech Eng 1993,2004*
Fujie H, et al. *J Biomech 1996*

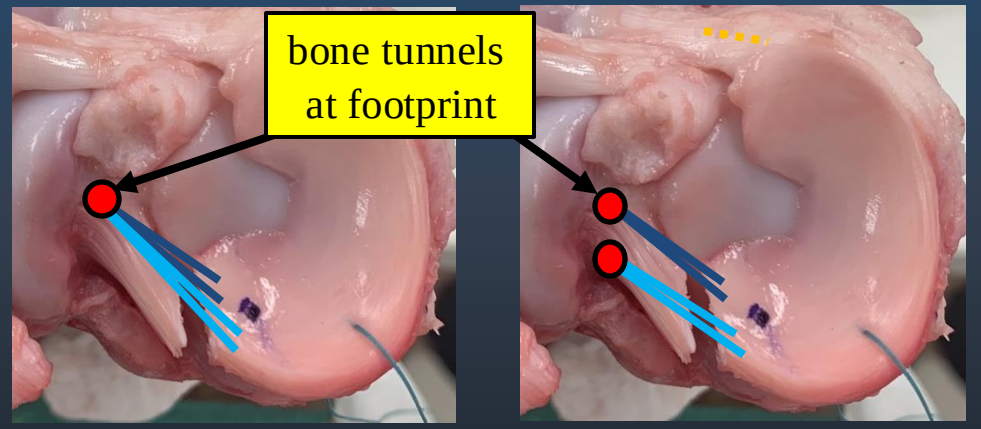
MMPRT and TPR models

- ✓ 6 groups were established (intact, MMPRT, and 4 different TPR conditions).



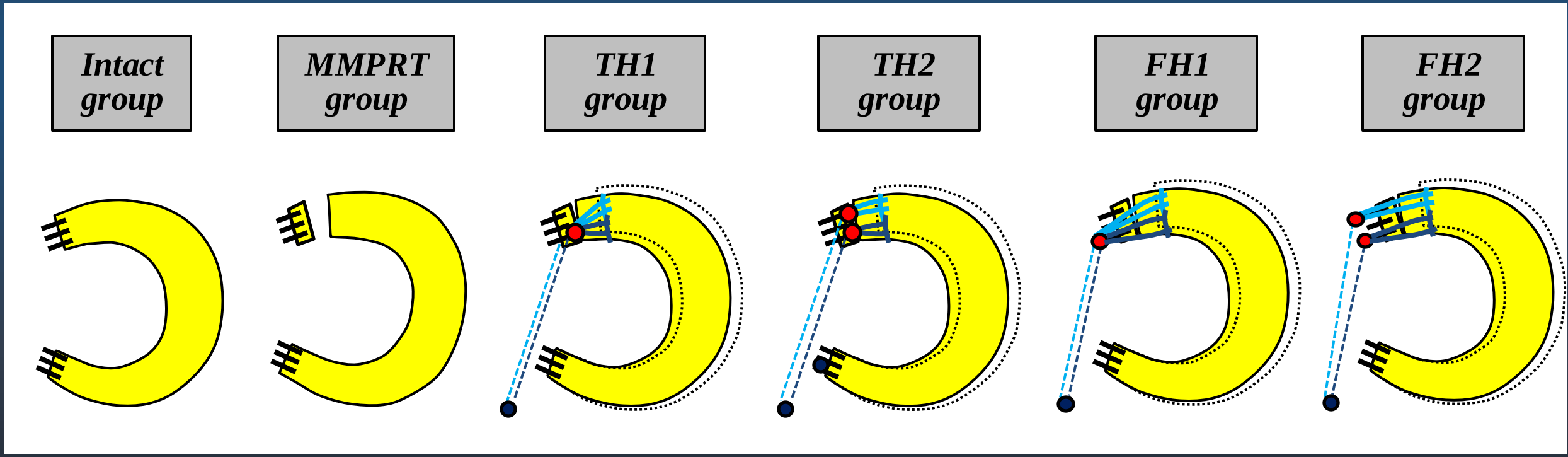




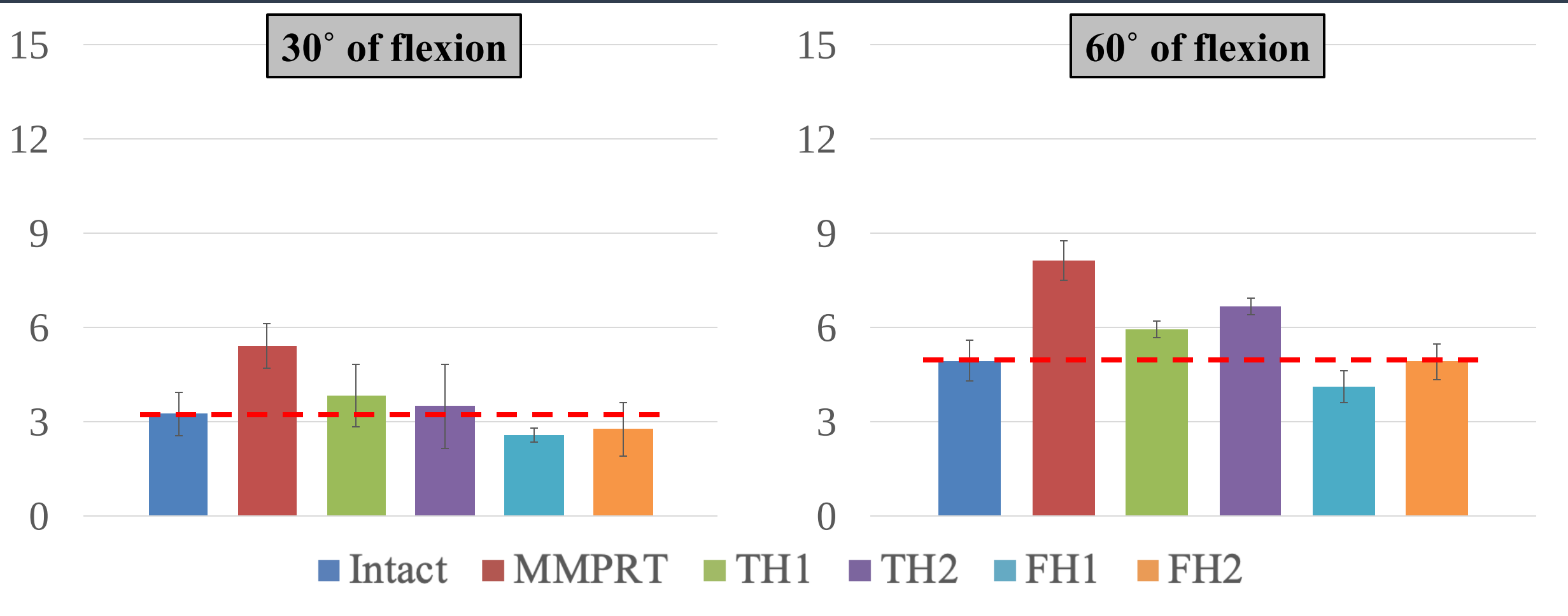


Measurement

- 5 N·m varus torque was applied to the knee joint @ 30˚/60˚/90˚/120˚ of flexion.
- Max. knee varus angle (˚) were calculated and compared among the 6 groups.

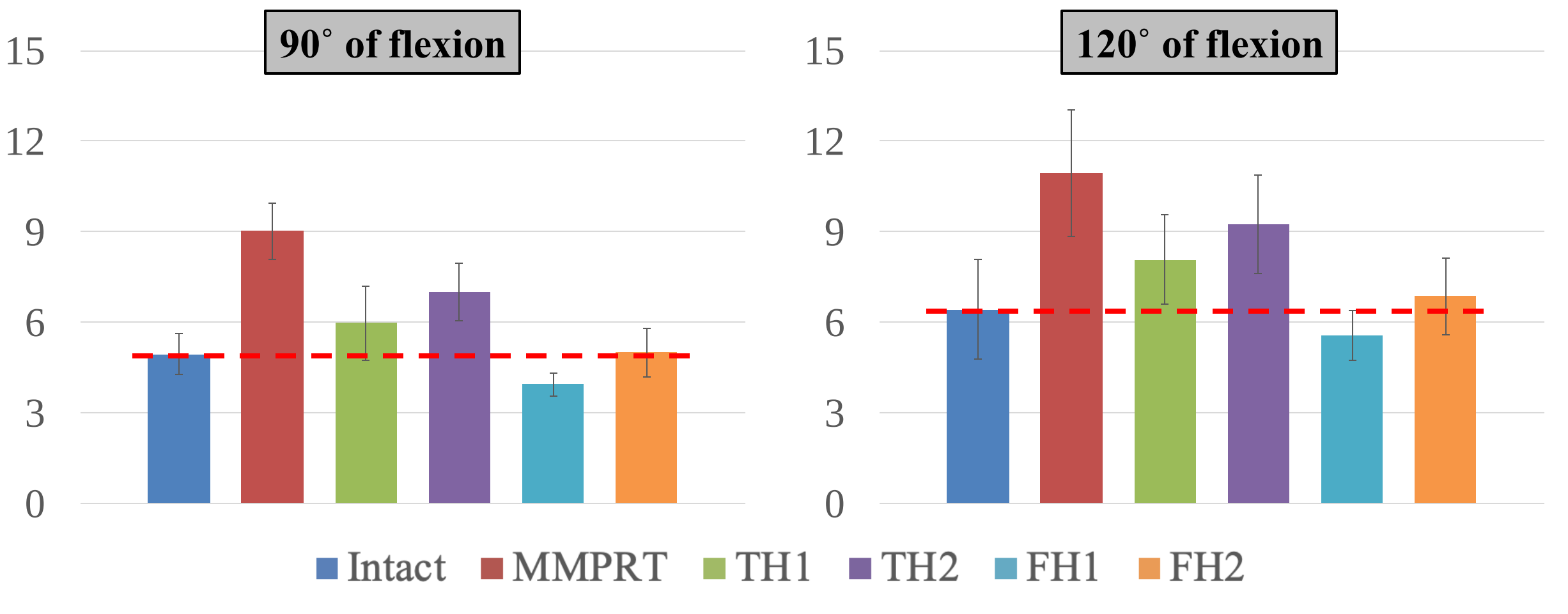


Result : Max. knee varus angle (˚)



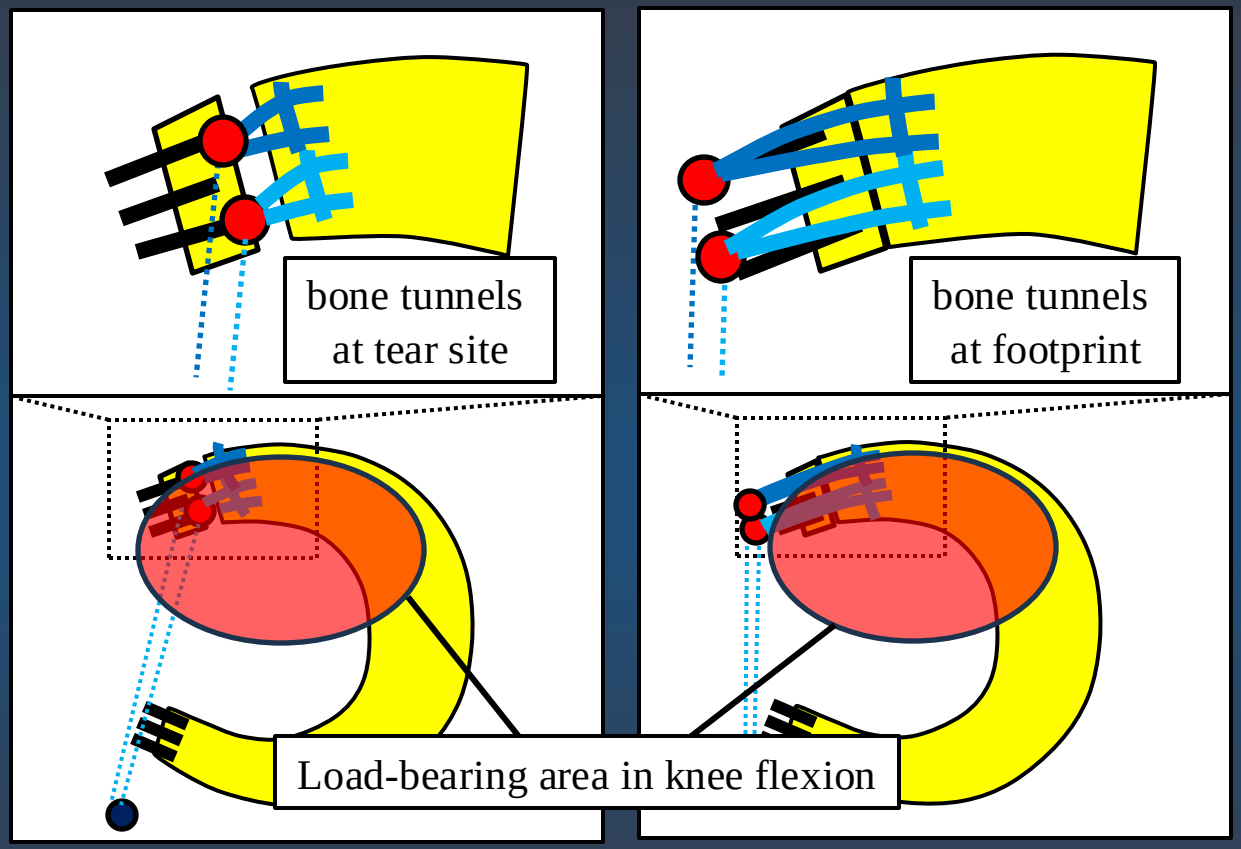
Knee varus angles increased in MMPRT and were restored by TPR in FH groups.

Result : Max. knee varus angle (˚)



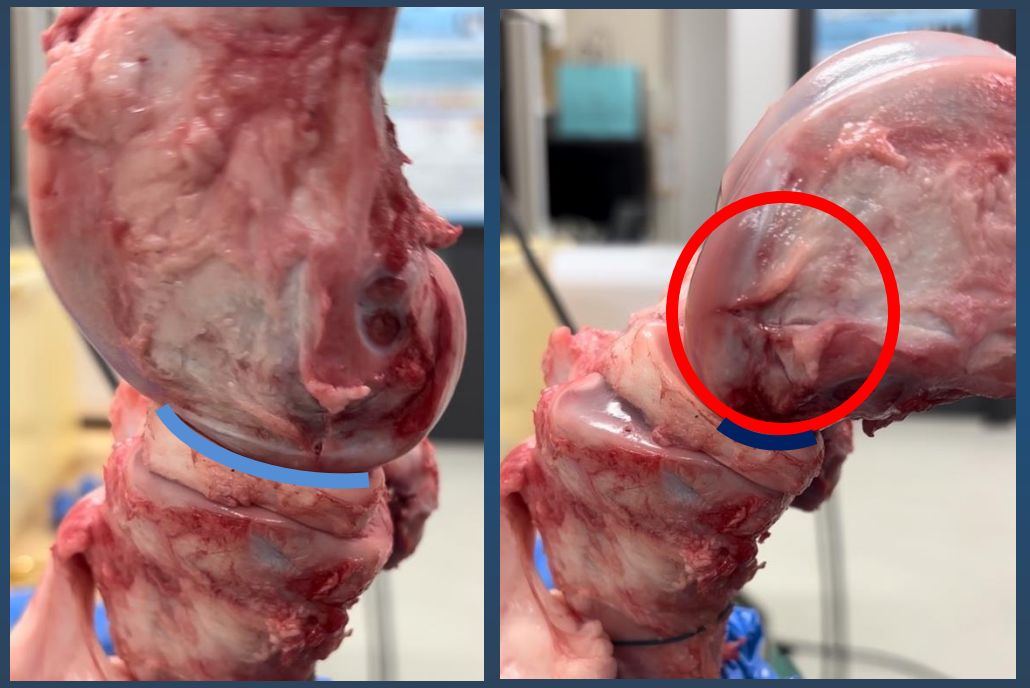
Knee varus angles in FH1 group tended to show over-constraint.

Mechanical Effect in Different tunnel locations



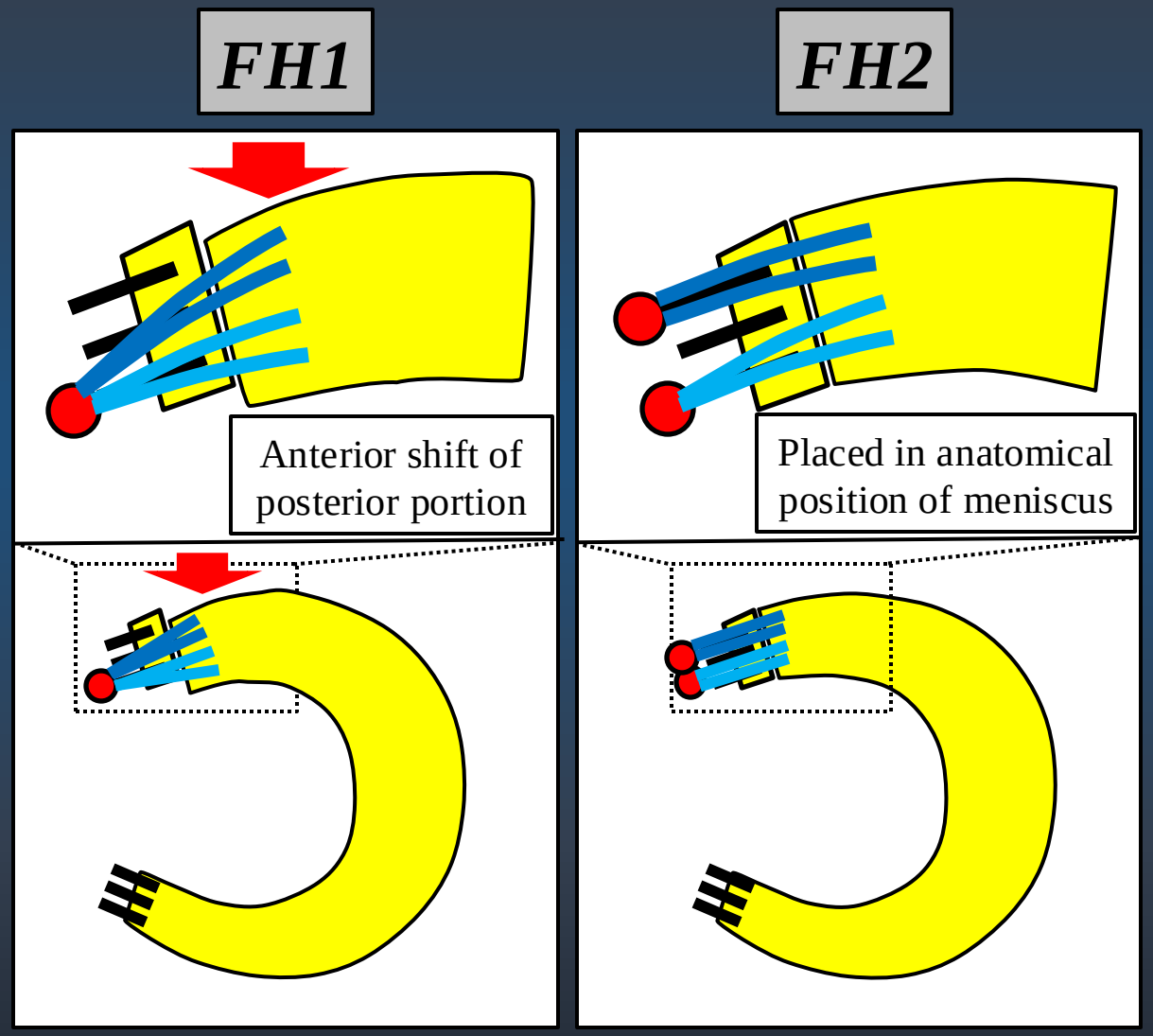
Extension

Flexion



Insufficient restration of meniscus function was observed in TH groups, especially in knee flexion because tibio-femoral compressive load was applied to the posterior portion of the meniscus.

Mechanical Effect in Different tunnel numbers



- Pulling the posterior portion of the meniscus through anterior single tunnel may cause anterior shifting.
- The posterior portion of the meniscus can be placed in anatomical position by using double tunnel.

Double tunnels might have superior effect in restoring the meniscal function !

Conclusion

Creating double bone tunnels at the anatomical attachment site might provide sufficient restoration of meniscal function to the intact level in TPR for MMPRT.

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