Department of Orthopaedic Surgery *Keio University School of Medicine*

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Nobel assessment technique of joint dynamics under weight bearing condition in ACL injured knees - an imaging study of upright computed tomography

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COI disclosure

The author has no conflict of interest to disclosure with respect to this presentation.

Introduction

- MRI is useful for diagnosis of ACL injuries.
- However, it is difficult to assess joint dynamics under weight bearing condition with MRI.
- There are reports which are X-ray assessment under weight bearing and three-dimensional kinematic analysis.

The purpose of the present study is to evaluate 3D joint dynamics of the whole leg under weight bearing condition in ACL injured knees using CT.

Methods

- A total of 18 knees joints in 9 patients with ACL-deficient knees
- 4 females and 5 males
- A mean age of 34.1 ± 12.6 yrs
- 4 fresh injury (within 3 months after injury) and 5 chronic injury

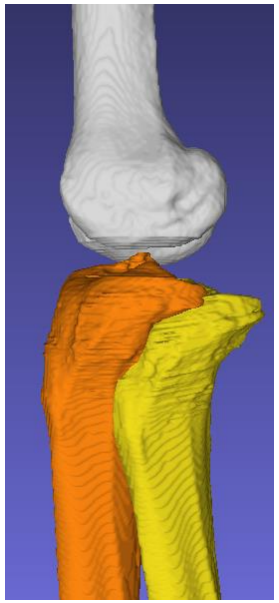
Upright CT scanner

（TSX-401R, Canon Medical System, Otawara, Japan）

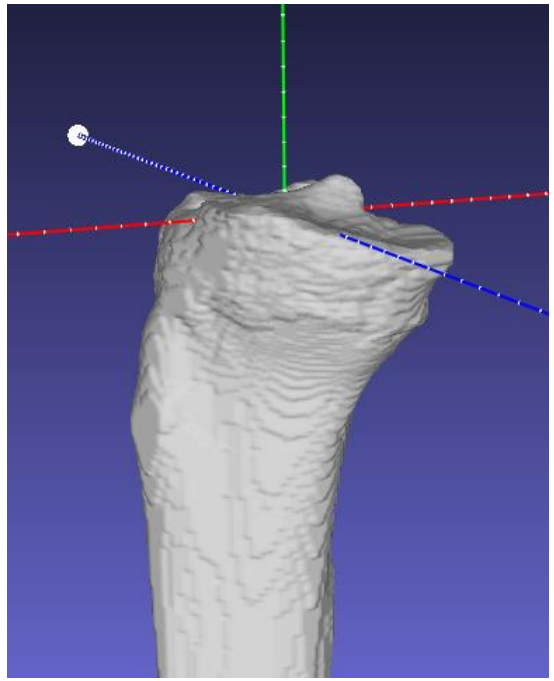
Image analysis

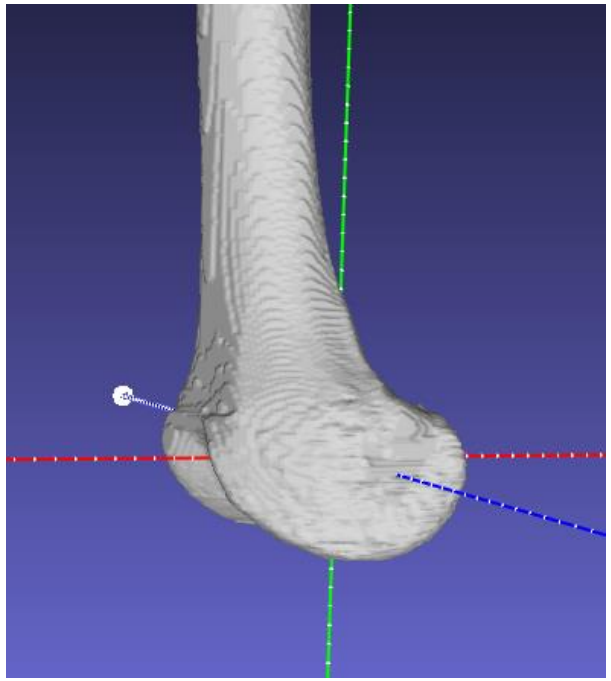
- CT DICOM date → surface model （AVIZO®）
- matching the surface date
- the triaxial positional and angular were measured

3D-3D registration technique

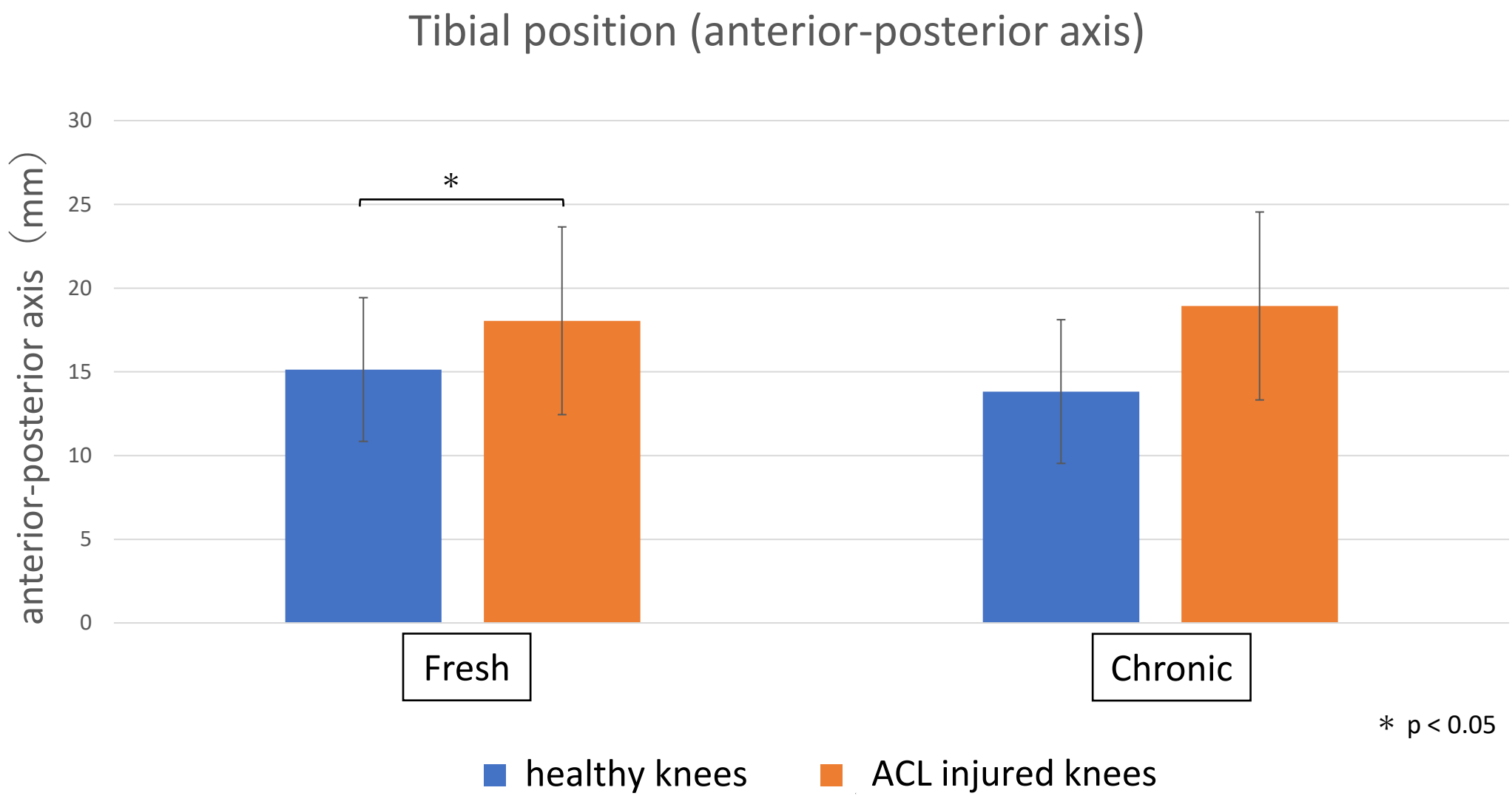


50％ weight bearing(Unaffected side)
50％ weight bearing(Affected side)





Results (under full weight bearing)



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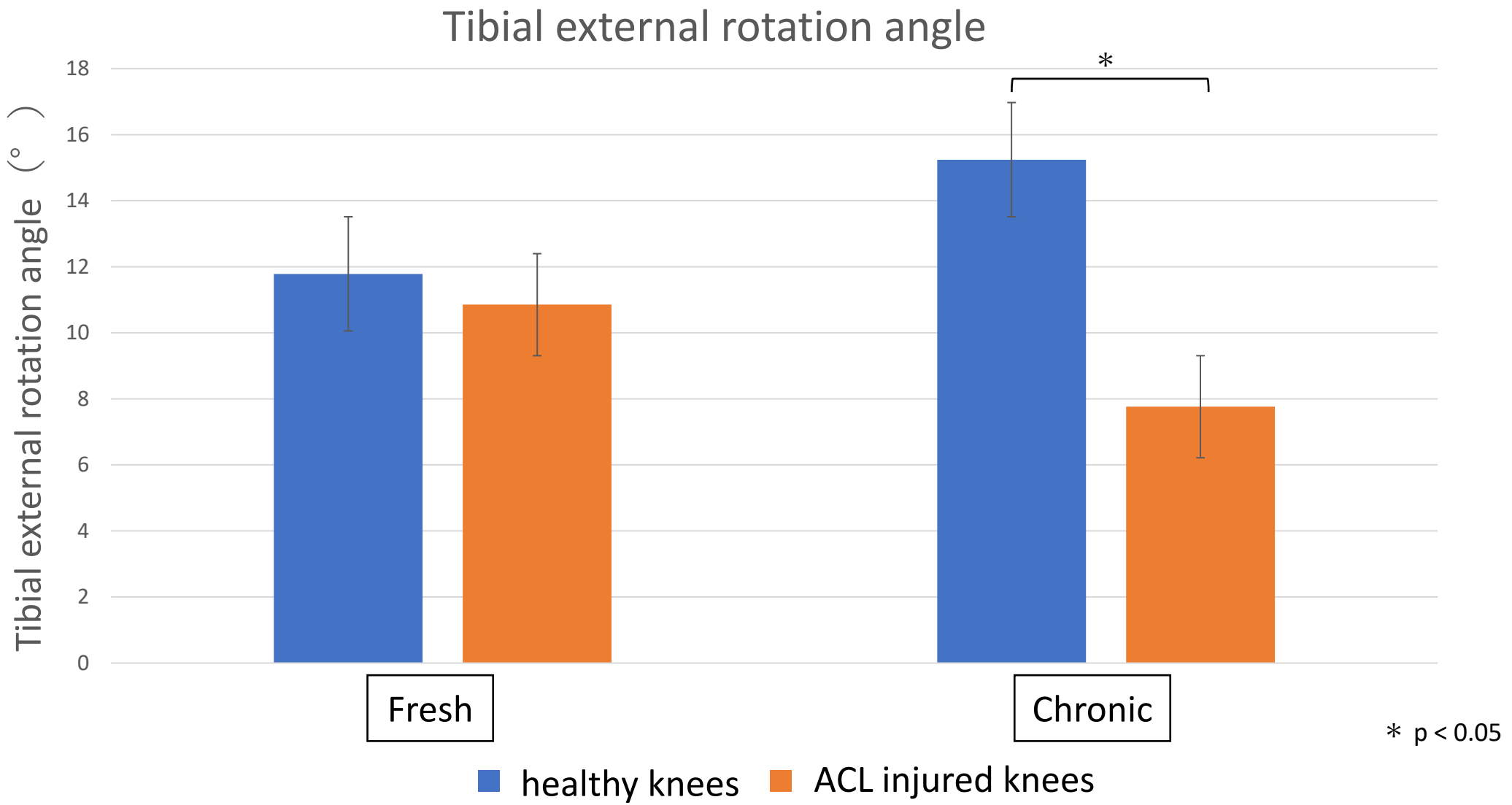

Discussion

- According to previous literatures (using MRI), anterior translation and internal rotation of the tibia

ACL-deficient knees > healthy knees

- Screw home movement (knee external rotation in 0-15° of knee flexion)

ACL-deficient knees < healthy knees

(Morishige Y, et al. Skeletal Radiology 2021)

Present study

- Using novel upright CT
- Knee dynamics “under weight bearing condition”.
- It suggests that chronic ACL injured knees will lead to “rotational changes”.

Limitation

- Influential factors to the knee alignment under weight bearing

  -the difference of bone morphology (e.g. tibial slope)

  -the complication of unstable meniscus injury

Conclusion

- The present study was done to evaluate 3D joint dynamics of the whole leg under weight bearing condition in ACL injury knees using upright CT.

- It suggests that chronic ACL injured knees would lead to rotational changes with anterior translation of the tibia, while fresh ACL injured knees would have anterior translation of the tibia without rotational abnormality.

References

- Oki S, et al. The relationship between the morphological axis and the kinematic axis of the proximal radius. Surgical and Radiologic Anatomy. 2018;41(4), 423-429
- Morishige Y, et al. Four-dimensional computed tomographic analysis of screw home movement in patients with anterior cruciate ligament deficient knee - a 3D-3D registration technique. Skeletal Radiology. 2021;51(8), 1679-1685