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Influence of limb position during imaging on the measurement of femoral neck anteversion angle

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Presenter：Rika Shigemoto

I have no financial relationships to disclose.

Background

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Femoral Neck Anteversion Angle; FNAA

- An anatomical index to evaluate the pathophysiology of hip and patellofemoral joint disease.
- The measurement FNAA differs depending on the measurement method of FNAA.[1, 2, 3]

- The limb position during the image capture was not explicitly described in previous studies.
- The effect of the limb position on the measurement of FNAA is not clear.

Purpose

To investigate the effect of the limb position on the measurements of FNAA.

Hypothesis

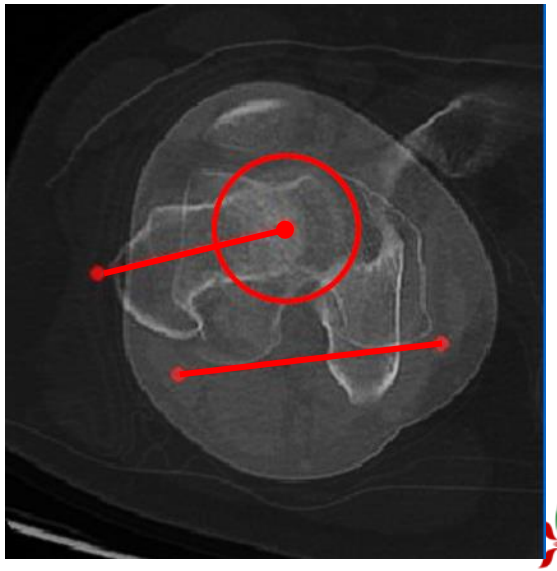
Limb position change during imaging are correlated with FNAA change.

Methods

The DICOM dates of 20 femurs of 10 patients

- 5 males and 5 females with patellar dislocation, anterior cruciate ligament injury or knee osteoarthritis
- Mean age　32.3 y.o.±19.7

- The data were imported into software (Mimics 23.0 and 3-matic 14.0).
- The angle between the line passing through the center of the femoral head and the center of the femoral neck and the tangential line to the posterior femoral condyles on axial slices was measured as FNAA.[4]



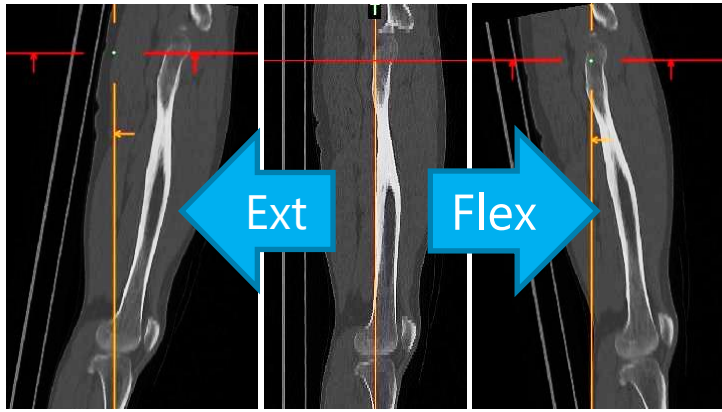
Methods

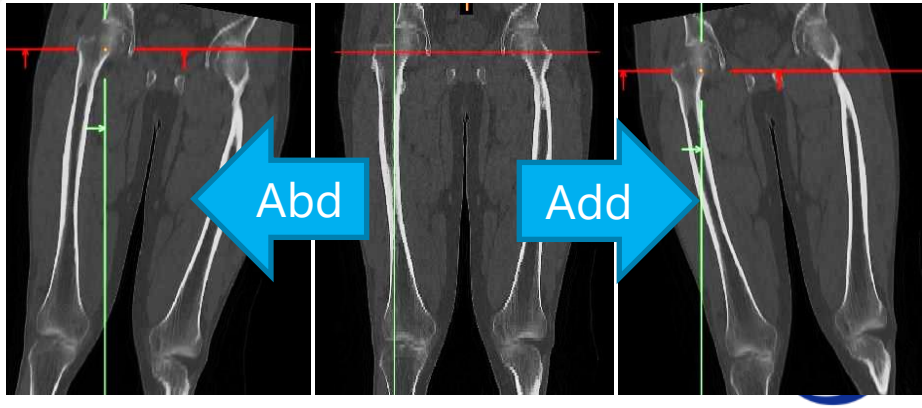
① FNAA measured using axial slices was defined as the original FNAA.
② To accurately examine the effects of the limb position on the FNAA measurement, the axial cutting plane was tilted to arbitrary directions to mimic limb position change.

・Flexion/extension and abduction/adduction angles from -20° to 20° at 5° intervals respectively

・Combination of flexion/extension and abduction/adduction angles from -10° to 10° at 5° intervals

③ FNAA was measured on each slice.
④ The amount of the angle change from the original FNAA was calculated.





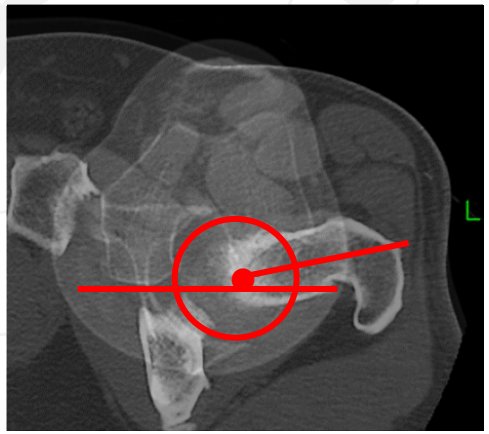
Statistical evaluation

- Spearman's rank correlation coefficient was used to examine the relationship between changes in hip flexion/extension or adduction/abduction angles and changes in FNAA.

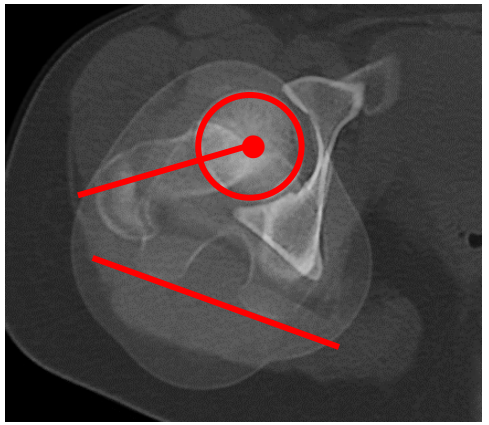
Results

- Original FNAA

  Mean **17.6°** ±15.3

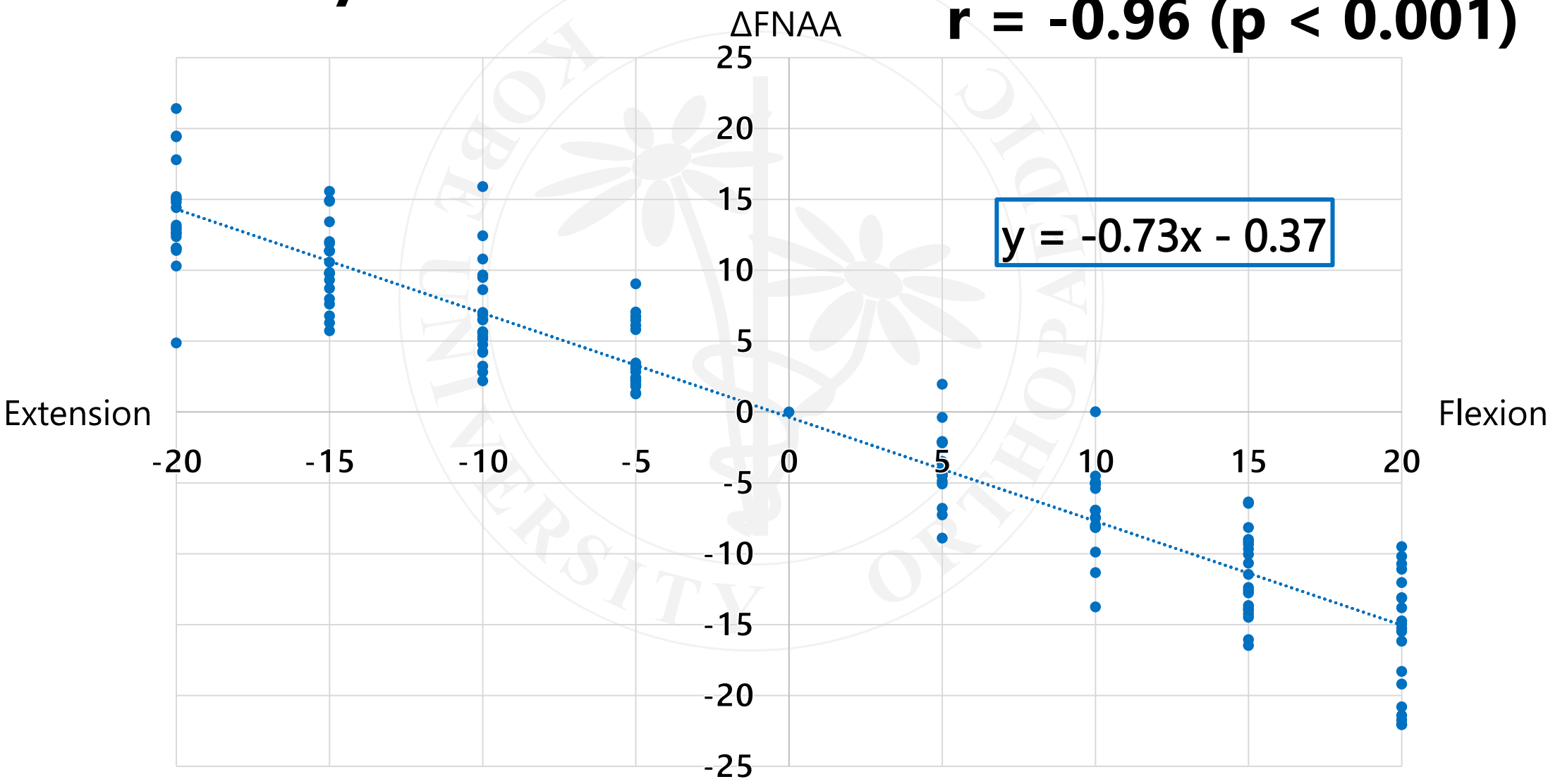


Minimum -13.5°

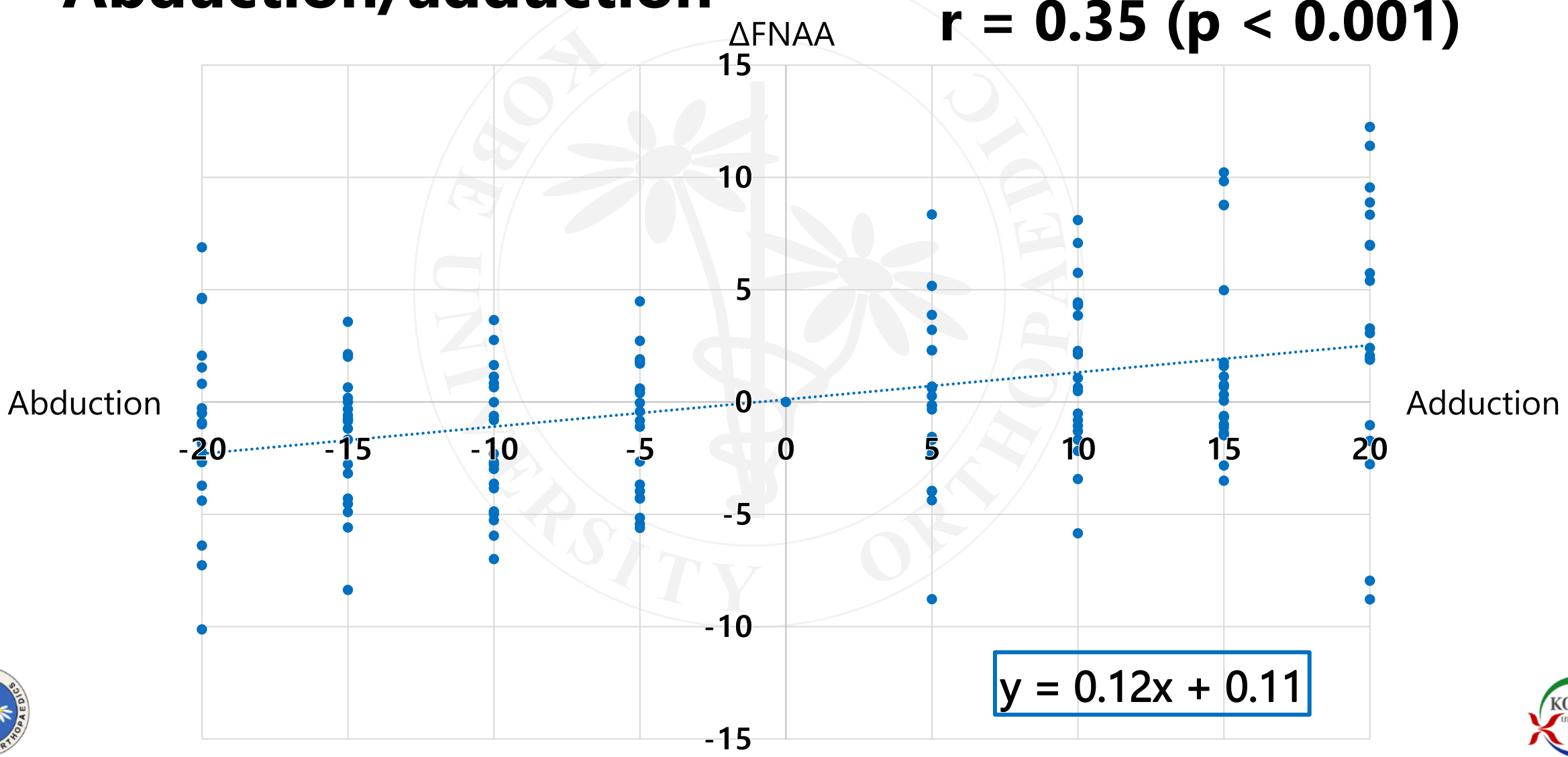


Maximum 40.7°

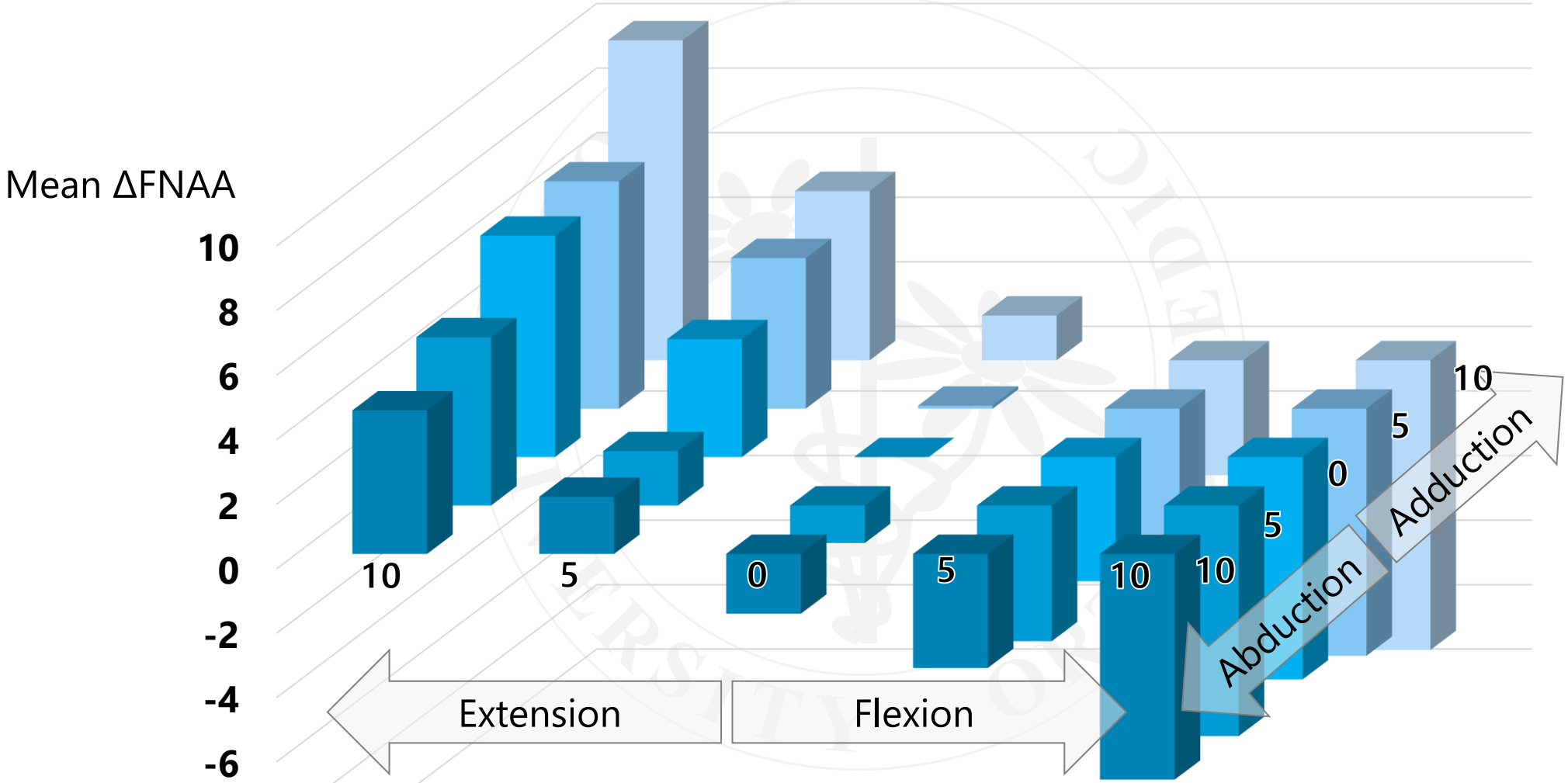
Scatter plot and linear approximation ①
~ Extension/flexion ~



Scatter plot and linear approximation ②
~ Abduction/adduction ~



ΔFNAA when changing by combining hip flexion/extension and adduction/abduction



➢ Mean maximum difference of FNAA measurements **21.0°** ±4.9

Discussion

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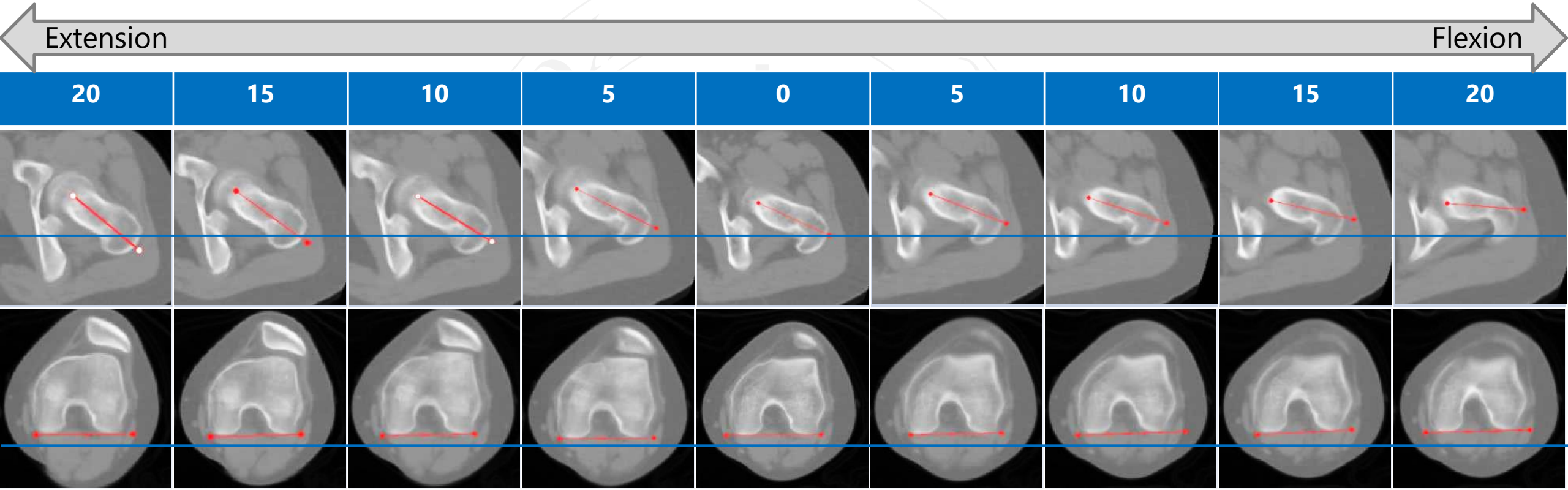
Relationship between hip flexion/extension and FNAA



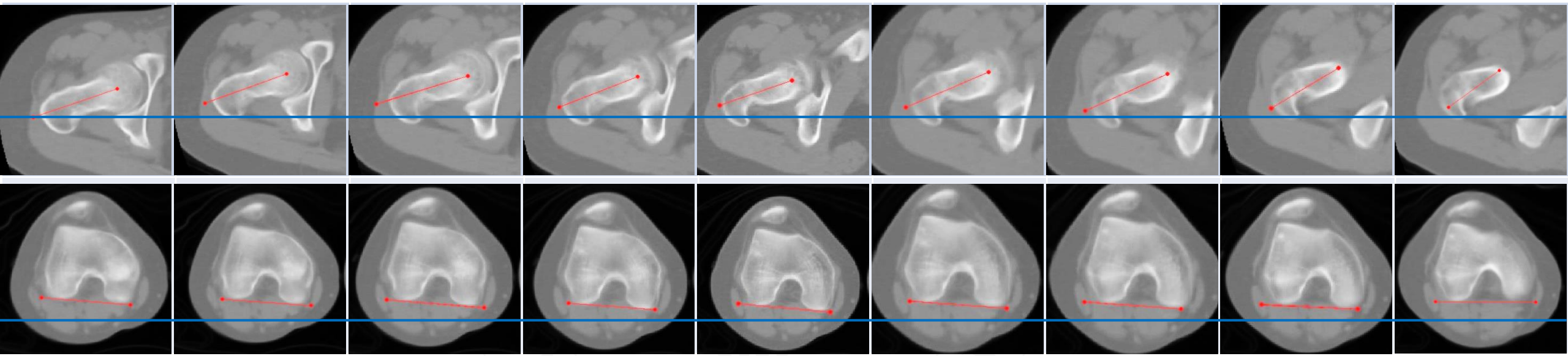
- The angle between the neck axis and the ground changes.
- The angle between the PCA and the ground remains almost unchanged.

⇒Neck-shaft angle affects FNAA measurement.

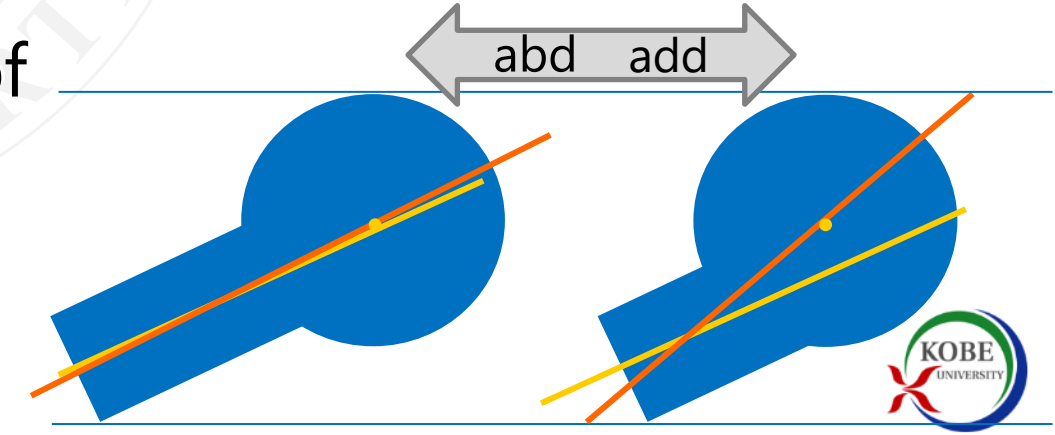
Relationship between hip abduction/adduction and FNAA

abduction ⟵ ⟶ adduction

20	15	10	5	0	5	10	15	20



- When the cervical axis and the center of the femoral head do not coincide, the cervical axis tends to change with adduction.



Conclusion

- The FNAA changed in association with the change in cutting direction of the axial slice.
  ⇒The measured value can differ depending on the limb position.

- This trend was particularly pronounced in the flexion-extension direction, with a 1° change in hip flexion angle resulting in a 0.73° change in FNAA.

References

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