

Difference in the joint space of the medial knee compartment between full extension and Rosenberg weight-bearing radiographs

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Introduction

◆ **Meniscus degeneration** and **cartilage loss** play a major role in the occurrence of the knee osteoarthritis.

◆ **Minimum joint space width (mJSW)** at medial compartment

➢ *Volunteer A*

mJSW in standing 45-degree flexion posteroanterior view (**Rosenberg view**)
≠ standing extension anteroposterior view (**extension view**)

➢ *Volunteer B*

mJSW in **Rosenberg view** < **extension view**

➔ It remains unclear whether this difference is due to meniscus or cartilage.

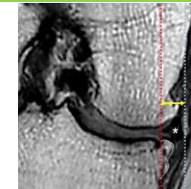
Q. Which of the two factors (**medial meniscus extrusion** or **cartilage thickness**)

had a greater effect on the difference of mJSW at the medial compartment between the **extension view** and the **Rosenberg view** ?



■ **Medial meniscus extrusion : MME** (yellow arrow)

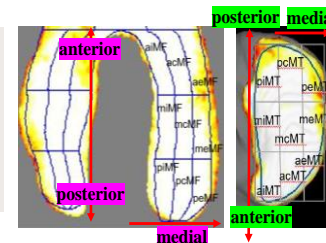
- Measured from coronal plane MRI data.
- Defined as the distance between the perpendicular line (red dotted line) from the medial margin of the tibia and the perpendicular line (blue dotted line) from the outer edge of the MM (star).



■ **Cartilage thickness**

- Automatically extracted from the MRI data and constructed in 3D with a software.
- The medial region of the femoro-tibial joint cartilage was divided into **18 subregions**, and the thickness of the cartilage in each subregion was determined automatically.

(SYNAPSE 3D, Fujifilm, Tokyo, Japan)



Discussion

◆ **MME was highly correlated with the mJSW difference**

- The normal MM moves posteriorly when the knee is flexed, but the posterior root is less mobile than the anterior horn.
- Once medial meniscus and its posterior root degenerate or are damaged, the MME increases.

Tienen et al. 2005

Ozeki et al. 2017

➔ The finding of a narrower mJSW in Rosenberg view suggests that the MM or its posterior root is degenerated or damaged.

◆ **Cartilage thickness (meMT) was correlated with the mJSW difference**

- The contact point of the medial femoral joint moved from central to posterior on the femoral side as it flexed from extension to flexion, while the tibial side remained central.

Feng et al. 2015

➔ The cartilage loss associated with OA occurs from the center of the tibial articular surface, supporting our results.

Methods

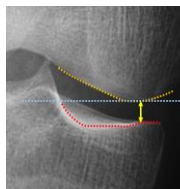
■ **Kanagawa Knee Study**

- 546 volunteers (mean age of 55 ± 14 years)
- 267 (49%) females and 279 (51%) males
- BMI (23.1 ± 3.1 kg/m²)
- Kellgren-Lawrence (KL) grade (Grade 0-1 : 94.9%, Grade 2 : 2.2%, Grade 3 : 1.3%, Grade 4 : 1.6%)
- Exclusion (History of lower limb trauma or surgery etc.)

561 participants

Exclusion
Lateral OA (5 participants)
Inappropriate radiograph (10 participants)

546 participants
(female 267, male 279)



■ **mJSW at medial compartment** (yellow arrow)

- the lowest end of the medial femoral condyle (orange dotted line)
- the anterior edge of the medial tibia (red dotted line)
- the difference subtracted mJSW in the Rosenberg view from that in the extension view was defined as "mJSW difference".

Results

● **The mJSW difference** and **cartilage thickness** was significantly correlated at 8 subregions, and the highest absolute value (meMT: middle external Medial Tibia) of the correlation coefficient was **0.248** (Fig. 3A).

● **The mJSW difference** and **MME** was also significantly correlated with the correlation coefficient of **0.547** (Fig. 3B).

➢ **MME** was significantly **higher** than that associated with cartilage thickness.

Subregion	Correlation coefficient	P-value	Subregion	Correlation coefficient	P-value
Medial femoral			Medial tibial		
peMF	0.008	0.852	peMT	0.120	**
meMF	0.009	0.829	meMT	0.248	***
aeMF	0.004	0.930	aeMT	0.078	0.068
pcMF	0.091	* 0.033	pcMT	0.090	* 0.036
mcMF	0.142	*** 9 × 10 ⁻⁴	mcMT	0.234	*** 3 × 10 ⁻³
acMF	0.059	0.168	acMT	0.000	0.991
pmMF	0.013	0.770	pmMT	0.010	0.813
miMF	0.147	*** 6 × 10 ⁻⁴	miMT	0.039	0.369
amMF	0.013	0.770	amMT	0.094	* 0.028

*p<0.05, **p<0.01, ***p<0.001

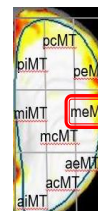
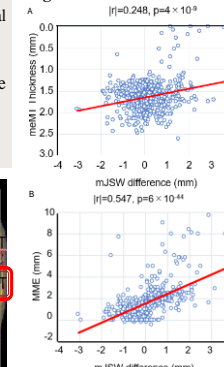


Fig. 3



Conclusion

➢ **MME had a greater effect on the difference between mJSW at medial compartment in the extension view and that in the Rosenberg view than cartilage thickness.**

➢ **Predicting MME by the radiograph is simple, inexpensive, and useful.**

✓ **Suggestion for future studies**

Clarification of the meniscus damage and degeneration using MRI (standing position) will more clearly establish the significance of the mJSW difference.

Reference

- Tienen et al. Displacement of the medial meniscus within the passive motion characteristics of the human knee joint: an RSA study in human cadaver knees. *Knee Surg Sports Traumatol Arthrosc.* 2005.
- Ozeki et al. Centralization of extruded medial meniscus delays cartilage degeneration in rats. *J Orthop Sci.* 2017.
- Feng et al. Motion of the femoral condyles in flexion and extension during a continuous lunge. *J Orthop Res.* 2015.