Tibial tunnel aperture migration after anatomical rectangular tunnel ACL reconstruction using bone–patellar tendon–bone autografts

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Disclosure of conflicts of interest

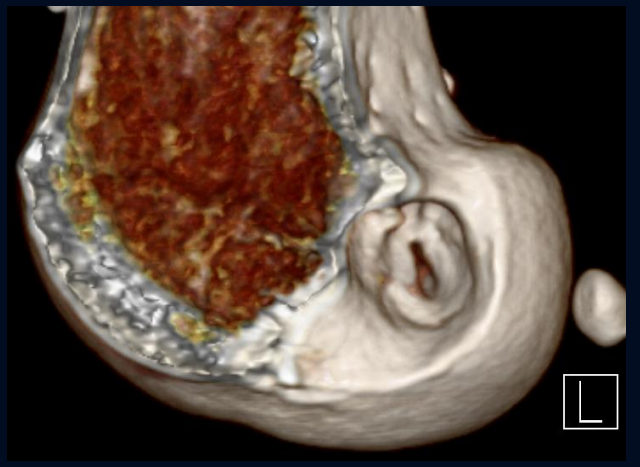
The authors have no financial conflicts of interest to disclose concerning the presentation.

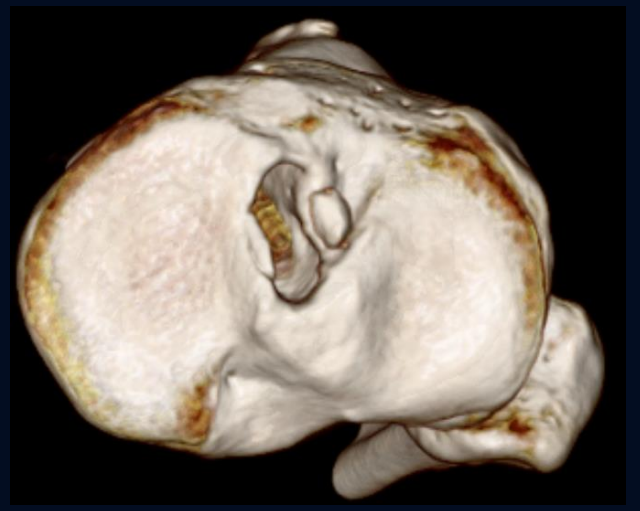
Introduction

Tunnel enlargement after ACL reconstruction (ACLR)

- ✓ Leads to instability in long term [1]
- ✓ Severely complicates revision ACLR [2]
- ✓ Many factors are related [3,4]
  - Biological factors
  - Mechanical factors
- ✓ Graft selection also affects

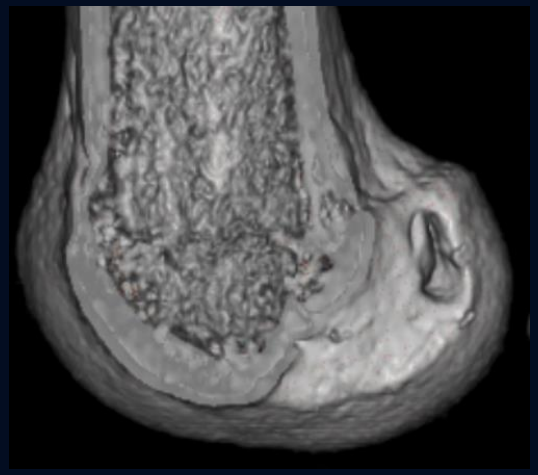
  Bone–patellar tendon–bone (BPTB)
  - Bone–ligament junction can be reproduced
  - Less enlargement compared with soft tissue [5]

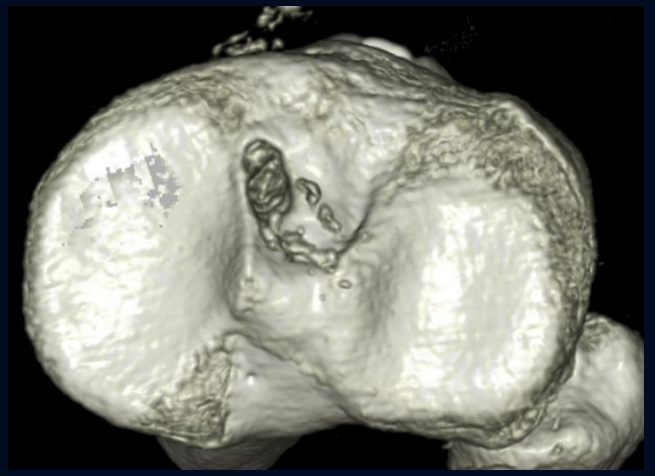




Introduction

Anatomic rectangular (ART) ACLR using BPTB autografts





Bone tunnel can be created within ACL footprint [6]

✓ Tunnels are usually 6 × 10 mm rectangular apertures

However,

ACL footprint size is different for each case [7]

Therefore, tunnel size relative to individualized ACL footprint is different

Purposes

- To investigate the morphological change of the tibial tunnel after ART ACLR using BPTB autografts

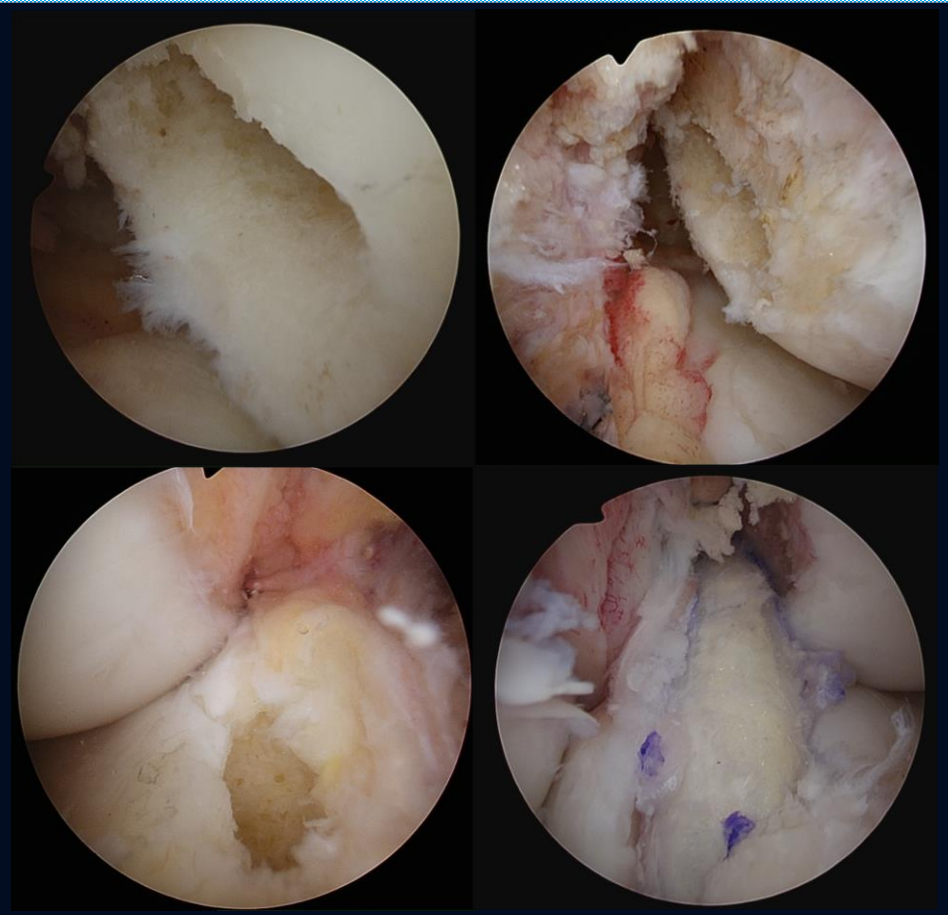
- To evaluate the correlation between tunnel size relative to the proximal tibia and tunnel enlargement

Materials and Methods

✓ Primary ACLR at our institution

✓ ART ACLR with BPTB autograft

→ 159 knees (104 female and 55 male)



Surgical procedure [8]

✓ 6 × 10 mm rectangular aperture

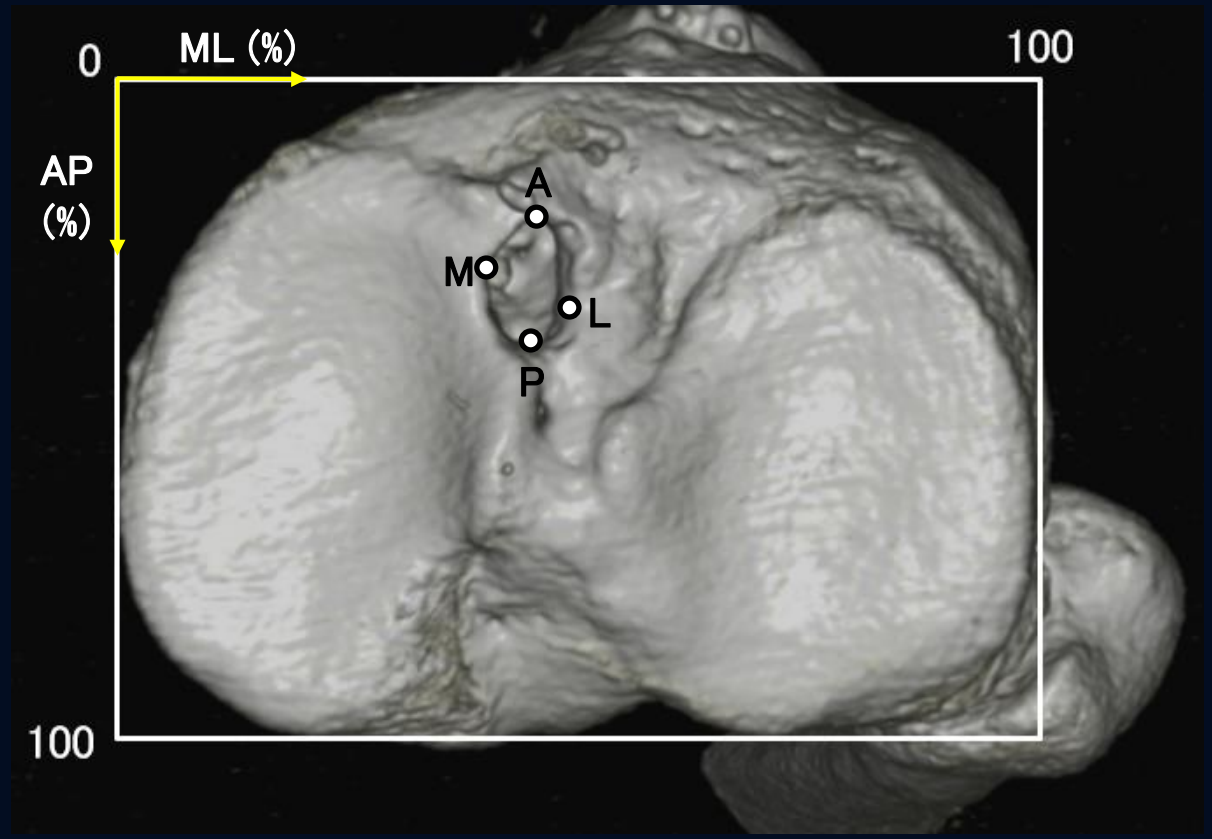
✓ Transportal method for femoral tunnel drilling

✓ Femoral fixation : Endobutton (Smith & Nephew)

✓ Tibial fixation : Double-spike plate small (Smith & Nephew)

CT evaluation

Evaluation of tibial tunnel



✓ Anteroposterior (AP) position
Anterior border (0%) ～ Posterior border (100%)

✓ Mediolateral (ML) position
Medial border (0%) ～ Lateral border (100%)

Four points in the tibial tunnel were defined as follows

Point A : most anterior
Point P : most posterior
Point M : most medial
Point L : most lateral

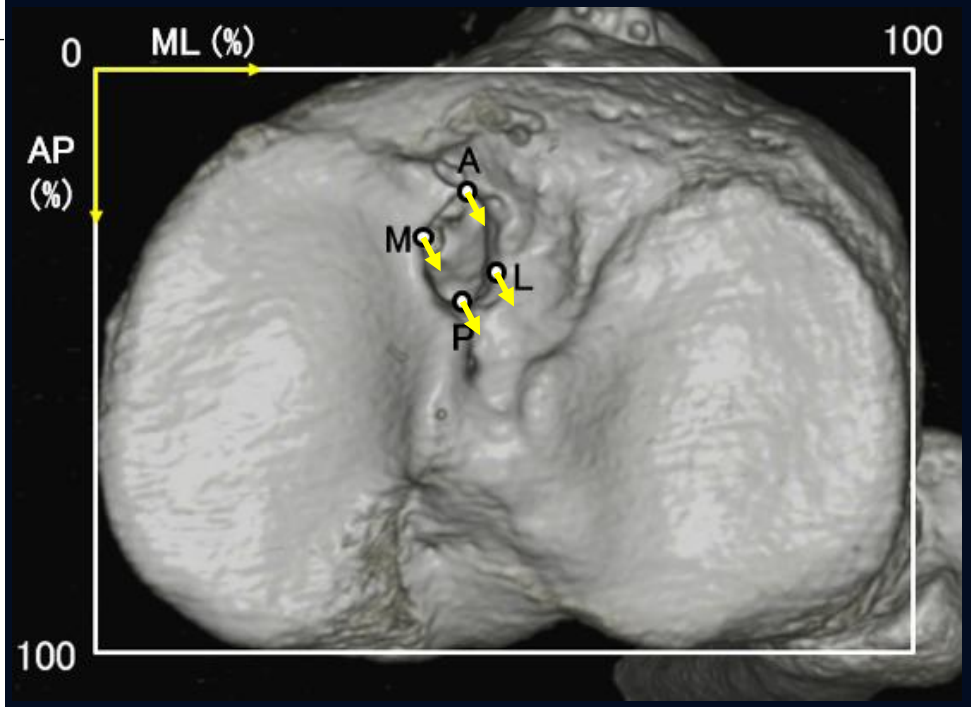
AP and ML positions were measured at each point 1 week and 1 year postoperatively

Results

AP and ML position of 4 points

		1 week	1 year	P value
Point A	AP (%)	20.6 ± 5.5	23.8 ± 5.3	**< 0.01
	ML (%)	41.1 ± 3.6	41.9 ± 3.4	**< 0.01
Point P	AP (%)	41.5 ± 6.2	44.3 ± 6.5	**< 0.01
	ML (%)	43.4 ± 3.1	44.2 ± 3.0	**< 0.01
Point M	AP (%)	26.2 ± 5.8	29.7 ± 6.0	**< 0.01
	ML (%)	37.5 ± 3.7	38.4 ± 3.1	**< 0.01
Point L	AP (%)	34.1 ± 6.7	36.4 ± 7.0	**< 0.01
	ML (%)	47.2 ± 3.0	48.5 ± 2.7	**< 0.01

Paired t-test, **P value < 0.01



All points migrated posteriorly and laterally

Results

AP and ML diameter of the tibial tunnel

	1 week	1 year	P value
AP diameter (%)	20.9 ± 3.9	20.5 ± 4.2	0.32
ML diameter (%)	9.8 ± 2.2	10.2 ± 1.9	*0.013

Paired t-test, *P value < 0.05

✓ AP diameter
Point P (AP) – Point A (AP)

✓ ML diameter
Point L (ML) – Point M (ML)

**ML diameter enlarged significantly,
while AP diameter did NOT**

→ The following correlation was evaluated

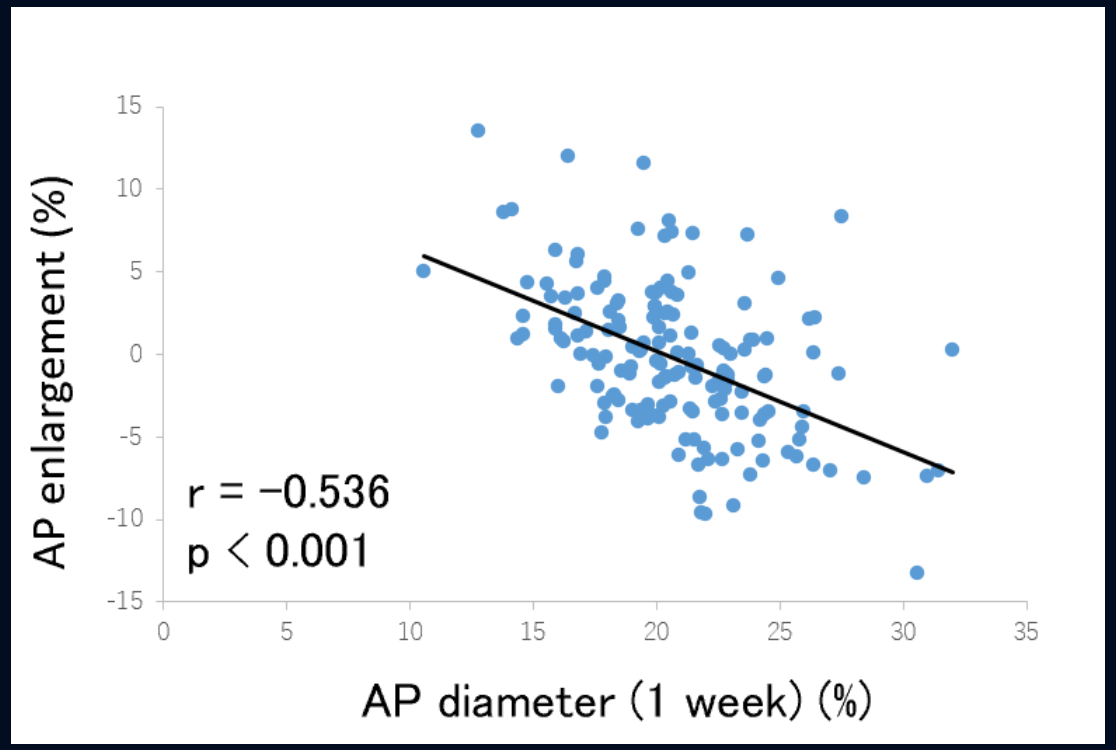
✓ AP enlargement and AP diameter 1 week postoperatively
✓ ML enlargement and ML diameter 1 week postoperatively

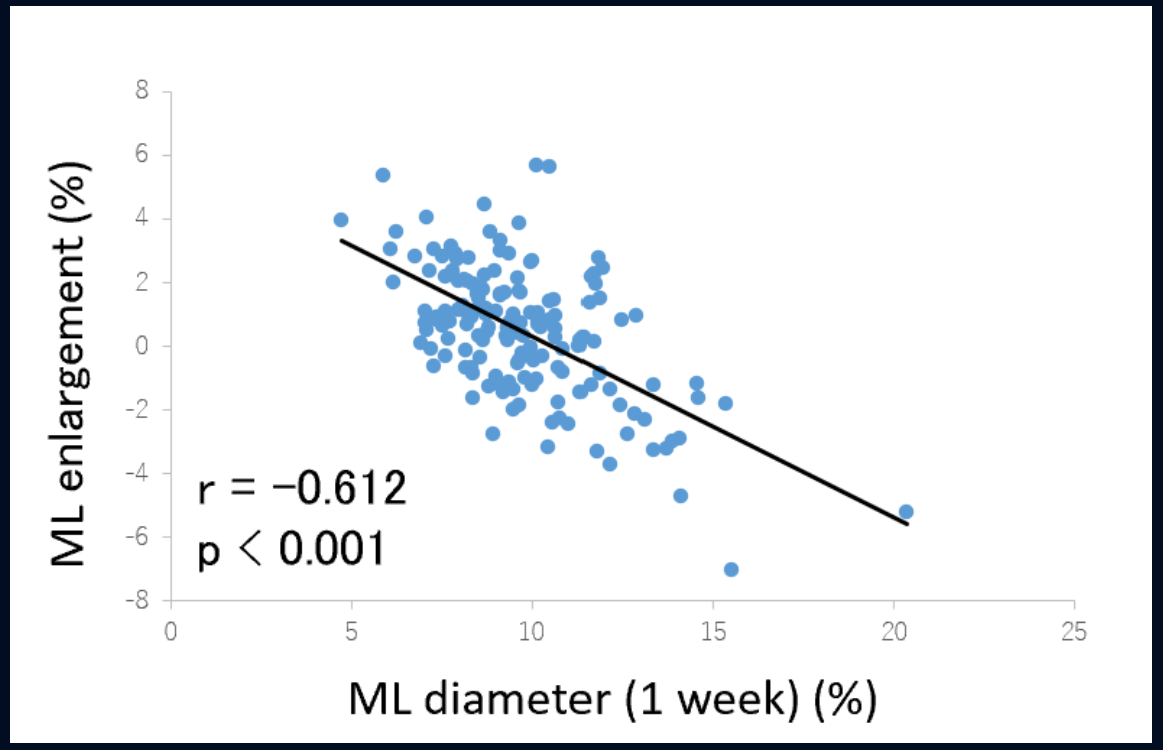
✓ AP enlargement
AP diameter (1 year – 1 week)

✓ ML enlargement
ML diameter (1 year – 1 week)

Results

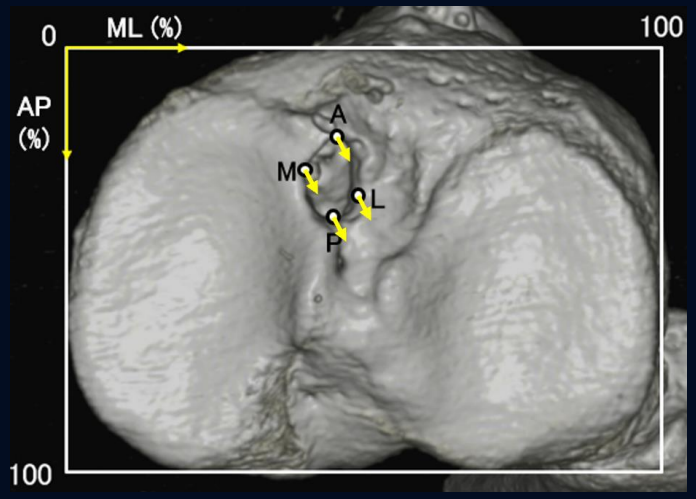
Correlation between tunnel enlargement and tunnel diameter





Negative correlation was found
between tunnel enlargement and initial tunnel diameter

Discussion



✓ The graft was pulled posteriorly and laterally
→ Migration in the same direction [9,10]

✓ Similar results for migration after ART ACLR [10,11]

Enlargement only laterally, not posteriorly in this sudy

✓ New bone ingrowth where stress was not applied [9]

Limitation

✓ Retrospective study

✓ Only tunnel aperture was measured to evaluate tunnel enlargement

✓ Other factors were not assessed regarding tunnel enlargement

✓ CT images were only acquired at two time points

✓ Follow-up period was short

Conclusions

In ART ACL reconstruction using BPTB autografts

The tibial tunnel migrated laterally and enlarged in the ML plane, while it migrated posteriorly but did not enlarge in the AP plane.

Negative correlations were found between tunnel enlargement and tunnel diameter relative to the tibia in both the AP and ML planes.

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