This article describes the poster presentation made about Shimadzu tomosynthesis.

Validity of tomosynthesis for evaluation of bone graft integration in anterior cruciate ligament reconstruction using bone-patellar tendon-bone graft —Comparison with CT images—

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1. Background

The evaluation of bone graft integration after anterior cruciate ligament (ACL) reconstruction using a bone-patellar tendon-bone (BTB) graft is important for assessment of postoperative treatment. Standard radiography is often used to evaluate bone integration, though the sensitivity and specificity of this approach is low.[1)] Computed tomography (CT) is highly sensitive and specific, and is considered effective compared to radiography.[2)] However, CT has the disadvantages of being high in cost and causing high radiation exposure.[3)]

Tomosynthesis (TS) is a technology that produces a large volume of data by obtaining several tens of tomography images in a single acquisition, which is lower cost and causes less dose than CT.[4)] Based on a literature search by the authors, no studies have yet used this technology to evaluate bone graft integration after ACL reconstruction surgery.

2. Objective

To clarify the diagnostic value of TS in the bone graft integration evaluation of bone graft after ACL reconstruction using a BTB graft.

3. Subjects and Methods

This study included 24 cases who underwent their first ACL reconstruction using a BTB graft between January and June 2017.

Surgical method:

Anatomical rectangular bone tunnel ACL reconstruction using a BTB graft.[5)] The graft was secured at the femoral side with an Endobutton, and secured at the tibial side with a Double Spike Plate (DSP) **(Fig. 1)**.

Image evaluation:

Radiography was performed 3 months after surgery simultaneously by CT and TS using a Shimadzu R/F system, and coronal plane and sagittal plane sections of 2 mm thickness were reconstructed **(Fig. 2)**.

Bone integration in the femur and tibia was evaluated by the coronal plane and sagittal plain. Bone integration was defined as partial trabecular continuity between the bone graft and bone tunnel **(Fig. 3)**. Of the image slices that showed a bone graft, the proportion of images that showed bone integration

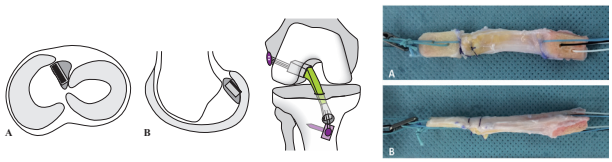


Fig.1 Anatomical Rectangular Bone Tunnel ACL Reconstruction Using BTB Graft

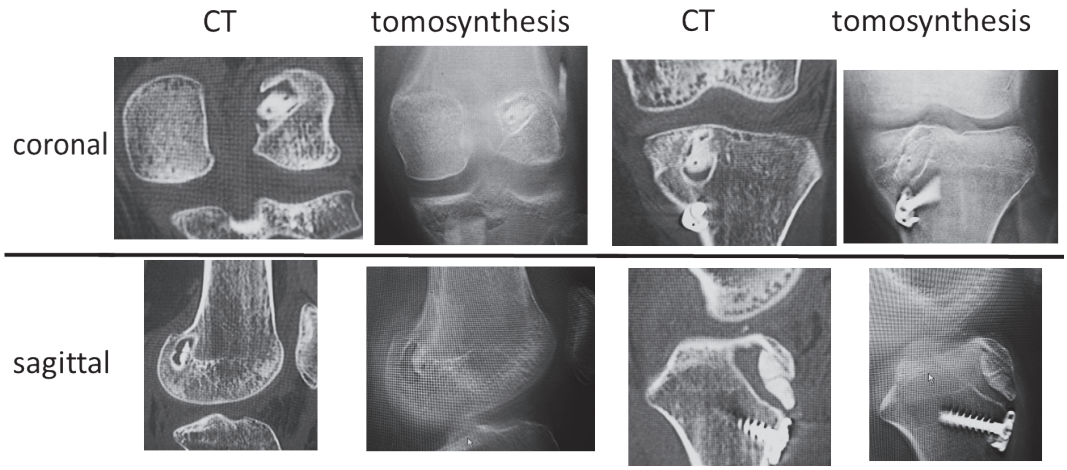


Fig.2 Comparison of CT and TS (in Coronal Plane and Sagittal Plane for Femur and Tibia)

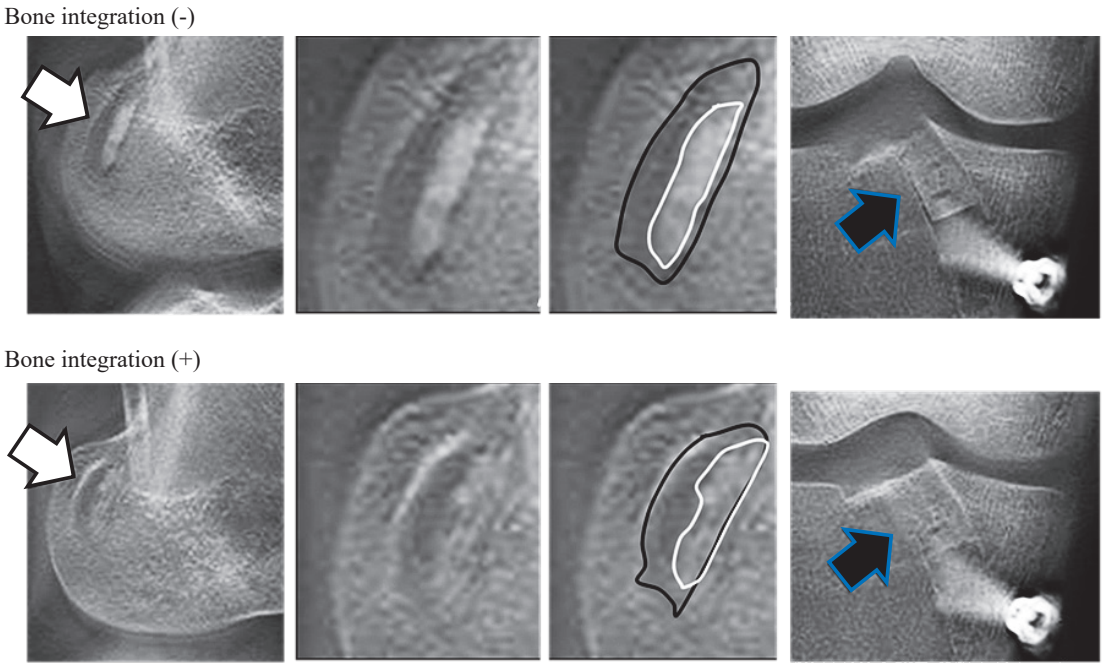


Fig.3 Non-Bone Integration (Top) and Bone Integration (Bottom) Shown by TS

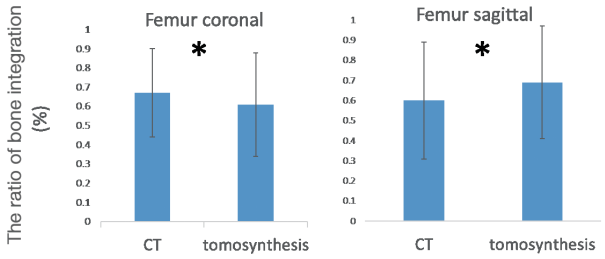
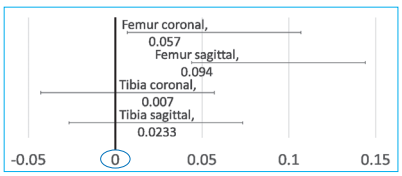


Fig.4 Comparison of Bone Integration Evaluated Using CT and TS (in Coronal Plane and Sagittal Plane of Femur)



ICC (Femur)

	coronal	sagittal
CT	0.81	0.92
tomosynthesis	0.82	0.76

ICC (Tibia)

	coronal	sagittal
CT	0.74	0.96
tomosynthesis	0.73	0.89

Fig.5 Confidence Interval of Difference between CT and TS (Left), and Inter-Rater Difference (ICC) (Right)

was determined (number of slices showing bone integration/number of slices showing a bone graft), and this proportion was compared at the femur and tibia sites for CT and TS. All images were evaluated by two specialists of orthopedic surgery. The proportion of images showing bone integration was compared at each part, and the confidence interval for the difference between CT and TS was determined using the mean of values obtained from the two specialists. The inter-rater difference (intraclass correlation coefficient [ICC]) was also investigated.

4. Results

CT and TS of 24 cases were investigated retrospectively. Comparing the proportion of CT and TS images showing bone integration revealed CT and TS confidence intervals overlapped when examining coronal and sagittal plane images of the tibia. There was a significant difference between CT and TS for the femur, but the difference was small **(Fig. 4)**, and assuming a non-inferiority margin of 0.1 (10 % examination error) caused the CT and TS confidence intervals to overlap and the results to be equivalent. ICC exceeded 0.7 when using either method of examination **(Fig. 5)**.

5. Discussion

After assuming a non-inferiority margin of 0.1 (10 % examination error), the results suggested that TS was not inferior to CT in the evaluation of bone integration after ACL reconstruction surgery using a BTB graft. The advantages of TS are (1) short examination times, (2) low cost of examination compared to CT, (3) few metal artifacts,[6] (4) low dose compared to CT,[7] and (5) also low cost in terms of hospital facilities.

The limitations of this study were the (1) small number of cases, and (2) no established method for evaluating bone integration using TS. We plan to continue this study and increase the number of cases to a suitable number for this investigation.

TS may be considered a useful diagnostic tool for the evaluation of bone integration after ACL reconstruction with a BTB graft.

References

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