

Utility of Slot Radiography and Epicondylar View After Implant Arthroplasties

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Aim

Since spring 2007, this hospital has used slot radiography by SONIALVISION safire mainly for radiography of the lower extremities before and after total knee arthroplasties (TKA). Conventionally, radiography was performed using CR long-view radiography cassettes (three 14 × 14-inch cassettes). However, slot radiography offers smooth, continuous images in the standing or supine posture and easily produces seamless long images for more efficient examinations. Slot radiography performs imaging using parallel motion of the FPD and an X-ray beam collimated into a slot. Due to the different geometrical positional relationship between the subject and the detector, slot radiography produces different image distortion from long-view radiography (CR). The tests we performed to compare and evaluate these methods are reported below. Special radiography techniques mastered on this system, such as the epicondylar view for rotational alignment in TKA, are discussed.

Method

1. A phantom (**Fig. 1**) was made of a low-absorbance medium sandwiched between two aluminum punched metal panels. Slot radiography and long-view radiography (CR) images of this phantom were compared.
 - 1) Punched metal panel specifications:
45 cm × 90 cm panel size, 2 mm thickness, 2 cm hole diameter, 3 cm hole pitch
 - 2) Arrangement of punched metal panels and low-absorbance medium:
Punched metal panels were placed on top of low-absorbance medium on the tabletop
 - 3) Geometrical conditions for slot radiography:
High-quality mode, frontal view, SID = 120 cm
 - 4) Geometrical conditions for computed radiography (CR):
SID = 250 cm, three 14 × 14-inch IPs
2. Method for Epicondylar View Radiography (**Fig. 2**)
 - 1) Set the tabletop horizontal. Lie the patient down and restrain. Tilt up the tabletop.
 - 2) Fluoroscopic images are quickly taken of each knee separately while rapidly adjusting the imaging angle for each knee.
 - 3) After TKA, radiography is performed after

checking accurate fluoroscopic frontal images.

- 4) Compare with CT images with respect to presurgical planning for femoral rotational alignment.
- 5) Investigate the left-right flexion gap symmetry in the knees-bent position.

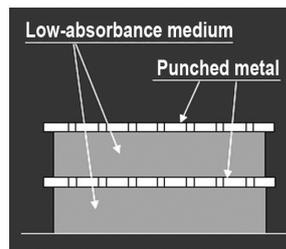
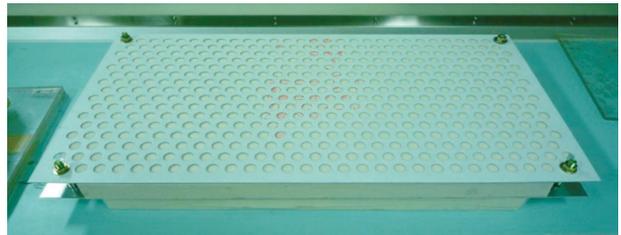


Fig. 1



Restrain supine patient and then tilt up the tabletop

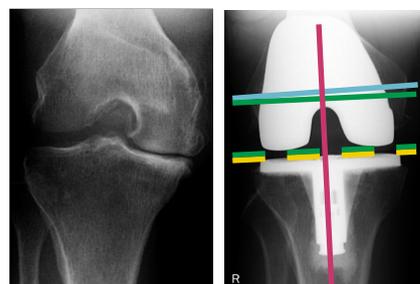


Fig. 2 Epicondylar View by SONIALVISION safire

Results

With CR long-view radiography, the holes near the center appear as single holes. The concentric images become more distorted as the distance from the center of the image increases. However, with slot radiography, almost no image distortion could be confirmed in the craniocaudal direction



and the image distortion in the R-L direction was constant along the craniocaudal axis. The full-length image of one lower limb can be seen to offer extremely low vertical and horizontal distortion compared to plain radiography (Fig. 3).

While the posteroanterior (PA) view is used for the epicondylar view with plain radiography, the anteriorposterior (AP) view is used with this system. This system is highly regarded by orthopedic

surgeons, as imaging can be performed using rapid fluoroscopy to change the angle for each leg separately. Although these images are used for rotational alignment, they are in no way inferior to X-ray CT images (Fig. 4).

The epicondylar view from the SONIALVISION safire is considered to have utility for post-TKA observations, since the strong metal artifacts occur in post-TKA CT observations.

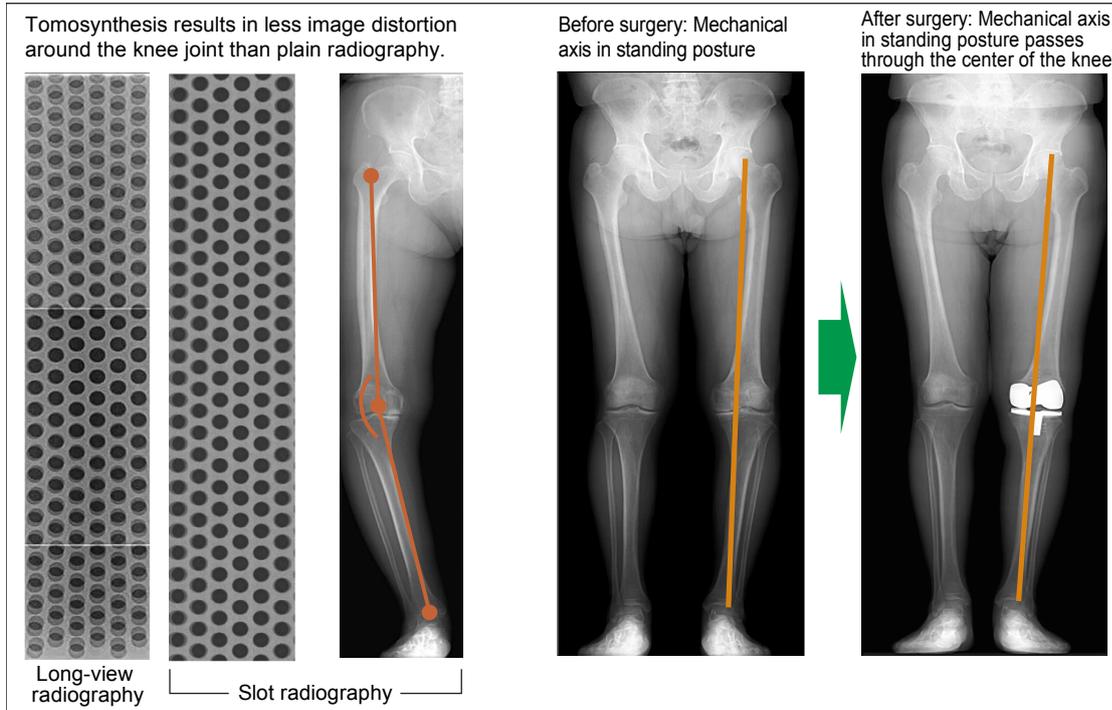


Fig. 3

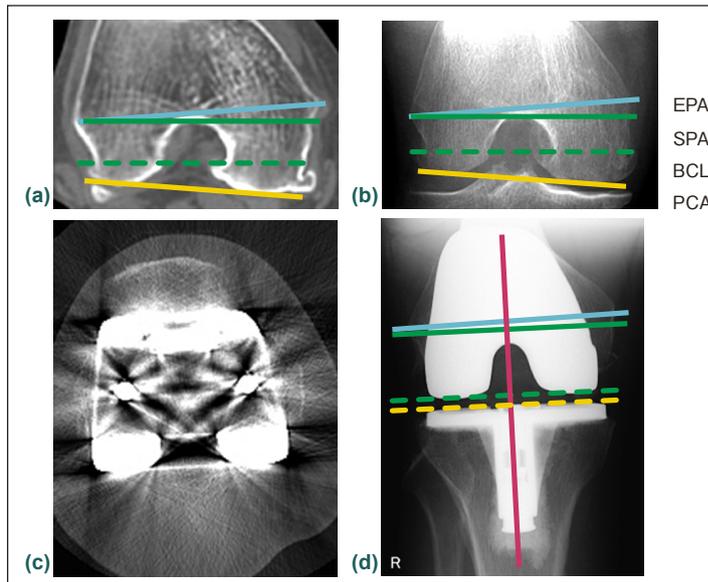


Fig. 4 Comparison of Femoral Rotational Alignment (before and after surgery)

Before surgery: (a) X-ray CT, (b) SONIALVISION safire
After surgery: (a) X-ray CT, (b) SONIALVISION safire

Discussion

Distortion affects CR long-view radiography, as the vertical and horizontal angles from the focal point increase toward the corners of a long cassette. Slot radiography produces little distortion, however, as the slit moves parallel to the imaged object and

the image is back-projected to the height of the surface of the object.

In addition to this slot radiography, we introduced other radiography methods that are safer and more convenient than conventional plain radiography, such as the epicondylar view used for measurements for femoral rotational alignment before and after total knee arthroplasty (TKA) surgery.