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Using the RADspeed Pro V4 General Radiography System with FPD

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1. Introduction

The Itabashi ward of Tokyo is located in the northwestern part of metropolitan Tokyo and is bordered on the north by the Arakawa river and the neighboring Saitama prefecture beyond that. The Teikyo University Hospital is located on the banks of the Shakujii river that cuts through the southern part of the Itabashi ward from west to east. The area is famous for the various types of cherry blossoms that bloom in spring along the roads on either side of the river. Established in September 1971 in affiliation with the Teikyo University, the hospital currently has two basement floors and 19 floors above ground, with 23 diagnosis and treatment departments and 1154 beds, and includes an emergency center, and a general perinatal medical center. In addition to contributing to regional medicine, it is also designated as an advanced treatment hospital and an official medical base in the event of a disaster **(Fig. 1)**.

The total number of outpatient visits averages between 1800 and 1900 per day, with an average of 600 to 800 examined by the Department of Radiology per day. The general radiography department examines about 65 % of the patients examined by the Department of Radiology.

Fig. 1 Teikyo University Hospital

2. Background of Introducing the System

When the hospital moved to a new facility in May 2009, it transferred the existing equipment to three of the four general radiography rooms, but installed a new RADspeed safire system from Shimadzu Corporation in the fourth room. Consequently, three of the four general radiography rooms now operate using FPD systems. The remaining room uses a CR system with a bucky table.

Since the CR system is approaching its time for replacement, we were interested in evaluating the new FPD-equipped RADspeed Pro V4 general radiography system currently under development. Consequently, we visited Shimadzu to view the actual system and also confirm the development status. As a result, we were impressed not only with the high image quality, of course, but also by the easy operability and decided it was ideal as the new system we planned to introduce in our radiography room.

This article describes the features of the RADspeed Pro V4 system based on our experience using the system.

3. Using the RADspeed Pro V4 General Radiography System with FPD and its Features

3.1 Improved Workflow Due to Integrated Control Console

(1) Integrated Console

When changing exposure parameters on the previous system, it required changing settings on both the digital radiography system and the X-ray high voltage generator. However, the new system has integrated the control consoles on the digital radiography system and X-ray high voltage generator, so that operations can now be performed via one console **(Fig. 2)**. The console is operated using a touch panel screen, which allows changing exposure parameters or performing other processes more

Fig. 2

intuitively by touching the screen.

In addition, the system features a portable wireless FPD unit on the bucky table **(Fig. 3)**, which allows removing the FPD unit from the table to obtain images of extremities or patients on a stretcher who have difficulty moving onto the radiography table. In the other radiography rooms with fixed FPD units **(Fig. 4)**, a standalone wireless FPD unit or a CR unit needs to be separately installed. Consequently, the RADspeed Pro V4 provides space savings in the control room that enable a more efficient layout, as shown in **Fig. 4** and **Fig. 5**.

Fig. 3

Fig. 4   Radiography Room with Fixed FPD for Standing/Supine Positions Plus General Purpose Wireless FPD Unit

Fig. 5   Radiography Room with RADspeed Pro V4 System

The RADspeed Pro V4 also allows checking a preview image about 3 seconds after exposure, which eliminates the need to wait for image processing to finish before proceeding with the next exposure. The preview can also be checked on the monitor on the ceiling mounted X-ray tube support, as indicated below. That means the operator can go immediately to the patient and check the images there, which improves the radiography workflow.

(2) Examination Information Display Monitor
By including an optional examination information display monitor in the examination room, as shown in **Fig. 6**, the RADspeed Pro V4 allows viewing images, exposure parameters, or other information in both the control and examination rooms, which eliminates the need to go to the control room for various tasks, as required with previous models.
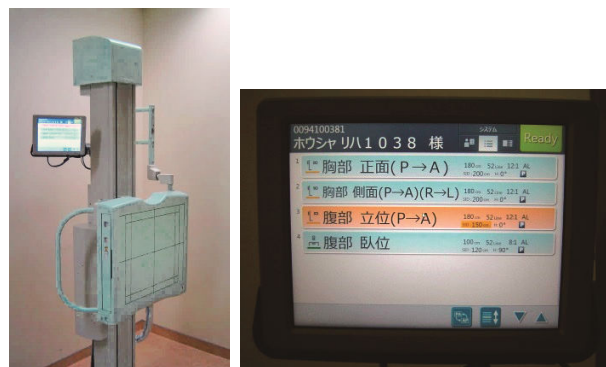

Fig. 6   Bucky Stand and Examination Information Display Monitor

The examination room information display monitor allows viewing patient information and images, selecting or resequencing protocols, or specifying or changing failed exposures.

The ability to select or change the order of protocols from the examination room is especially convenient when performing the next exposure while observing the patient status (such as when changing the sequence to perform exposure in the frontal standing abdominal position, rather than the lateral chest position, after finishing an exposure in the frontal chest position, as shown in **Fig. 6**).

Before examinations, the monitor can be used to confirm patient information and identity more easily, which is helpful for avoiding incidents and accidents.

3.2 Collimator Includes Soft X-Ray Cut Filter

To reduce exposure dose levels, the RADspeed Pro V4 includes an auto-filter function that automatically selects filters for each radiography protocol. The function usually specifies the 0.3 mm Cu filter for the chest and abdomen, the 0.2 mm Cu filter for the vertebral body, and the 0.1 mm Cu filter for the extremities. This filters out low-energy components

to reduce the skin surface dose. However, though the function is effective in reducing exposure dose, compared to not using a filter, it lengthens the exposure times for radiography using the phototimer. In particular, the 0.3 mm Cu filter for the chest and abdomen can cause problems with blurring in the lateral view due to patient movement. Therefore, after discussing it with the manufacturer, we decided to change the filter to a 0.1 mm Cu filter. Being able to change parameters separately for each radiography protocol in this way is also an advantage of the system.

3.3 Auto-Positioning

The auto-positioning function included on our system is operated by a remote controller **(Fig. 7)** that is linked to the radiography protocol, so that the tube automatically moves to prespecified positions. Compared to manually moving the tube as we did on previous single-tube systems, this significantly improves workflow efficiency, requiring only a press of a button to move the tube. (Previous systems also allowed manually moving the tube to a prespecified standing or supine position, where an electromagnetic lock was engaged to center the bucky with the exposure field, but it also required manually disengaging the lock, so it required considerable effort.)

Fig. 7

When we were introducing the system, we also considered introducing a two-tube system, which was already used in other radiography rooms, but due to the short movement range of the tube, we decided a single-tube system would be adequate. Compared to the two-tube systems used in other radiography rooms, the system allows moving the tube while observing the patient status, which means the movement can be immediately stopped by releasing the button if there is any danger of the tube hitting the patient. Consequently, examinations can be performed by one person without looking away from the patient.

Other buttons on the remote controller can be used

to specify up to four tube positions, regardless of the radiography protocol. That means when switching from standing to supine positions, the tube can be moved to a prespecified position that is out of the way of the patient and technologist. This has helped ensure examinations are performed more safely.

3.4 Auto-Stitching Radiography

Auto-stitching radiography, used to obtain images of the entire spine or entire lower extremities, can be performed by automatically moving the imaging unit synchronously with the tube swivel movement. After exposure, the images are automatically stitched together to obtain long images with no discontinuities easily, in the same manner as the RADspeed safire. Compared to long view radiography we previously performed using CR, this eliminates the need to read images after radiography and allows using widths up to 17 inches. Therefore, both lower extremities can be exposed at the same time. (When left and right extremities could not be imaged with a single exposure with CR, each extremity was exposed separately.)

To include the bottom of the feet in full length images, as requested by the orthopedic surgery department at our hospital, we have patients stand on platform about 10 cm tall **(Fig. 8)**. The maximum 160 cm height provides plenty of room even for full lower extremity radiography of tall patients. Compared to CR, this provides a significant improvement in workflow efficiency. However, unlike the RADspeed safire, the RADspeed Pro V4 cannot capture serial images by holding down the exposure button. Therefore, we must wait for the system ready-up state each time the tube is swiveled, which increases the overall radiography time somewhat. Consequently, there is a greater risk of patients moving, so the system requires immobilizing patients more securely
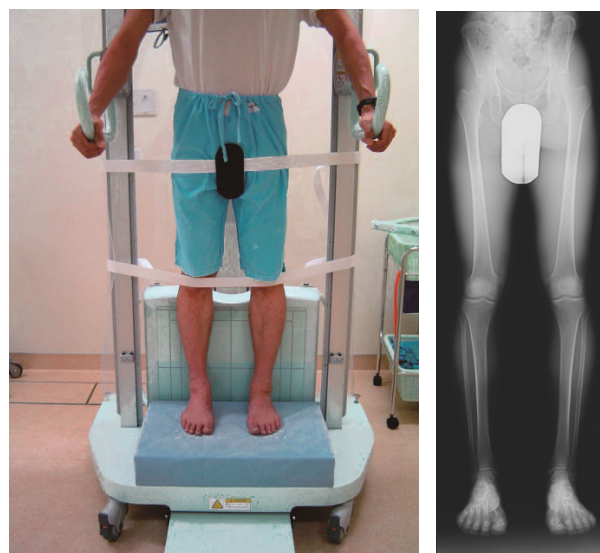

Fig. 8

than with the RADspeed safire.

For images after exposure, the system includes an additional correction process that lessens the darkness differences in the background caused by different exposure conditions, which is efficient in cases where there are prominent differences in patient body thickness between thin and thick areas. This enables us to provide more natural images.

4. Summary

When introducing the RADspeed Pro V4 general radiography system equipped with FPDs, we were concerned whether a single-tube system, which was the same as our pervious system, would really improve our radiography workflow. However, after actually using the system, we feel that the variety of useful functions of the V4 system allow an efficient use of our cramped control room.

Also, by being involved at an early stage of development, we were able to contribute suggestions and feedback for the system, such as adding a highlight marker mode or by discussing many changes to settings, such as a simplified standard setting method for left-right markers. Consequently, we have been able to use the system more efficiently in actual practice. We hope Shimadzu will continue to actively listen to the views and requests of users and develop improved versions that are even more patient- and user-friendly.

References

Toshiaki Nakamura, et al.: Development of "RADspeed Pro V4" X-Ray System with Multi-Purpose FPD, Shimadzu Review, Vol. 70, Nos. 1 and 2, 2013