

# The Effect on Work Efficiency of Using a General Radiography System Equipped with FPDs

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## 1. Introduction

Gunma University Hospital is situated in the northern part of Maebashi City (Showa District), a place described as “a city of water, greenery, and poetry” and also famous as the place where the poet Sakutarō Hagiwara pursued his creative activities. It is well-situated, standing in an area surrounded by greenery and the Tone River (Fig. 1). It has 715 beds and sees a daily average of 1,900 outpatients. (The highest number of patients seen in one day in 2007 was 2,400.) It has an impressive track record in the area of advanced medical treatment, and plays a central role in community healthcare (Figs. 2 and 3). Gunma University was originally founded as a new university in accordance with the National School Establishment Law of 1949, and was reestablished on 1 April 2004 as a national university corporation in accordance with the Law of National University Corporations. Regarding the university hospital, in October 2006, a new central ward was completed and various measures were implemented to create an environment capable of providing a higher level of patient-centered medical care. These included the establishment of an easy-to-understand reception and guidance system and the construction of brighter examination rooms. Also, the number of technologists in the Department of Radiology was increased, and new models of nearly all the machines used were installed. It really was a new start for us.

As part of this, in order to achieve the digitization of all our machines, we installed eight general radiography systems, four X-ray TV systems, three angiography systems, and a system equipped with a flat panel detector (FPD) as a simulator used for treatment.

We stressed image quality in our selection of equipment. Shimadzu's diagnostic imaging systems that are equipped with direct-conversion FPDs offer the highest quality. When I first saw a digital image obtained with a direct-conversion FPD, I was very impressed not only at the large view field, but also at the sharpness of the image and the lack of distortion.

We installed four Shimadzu RADspeed safire general radiography systems equipped with 17 × 17-inch direct-conversion FPDs (Figs. 4 and 5) and four

SONIALVISION safire II digital tables (Figs. 6 and 7). In this article, I will give an overview of our current setup, focusing in particular on RADspeed safire.



Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6



Fig. 7

## 2. System Overview

In the Shimadzu RADspeed safire general radiography systems equipped with direct-conversion FPDs that were installed at our hospital, 16-bit direct-conversion FPDs with a high X-ray detection capability are incorporated in the bucky stand and the supine table (Fig. 4).

General radiography is a basic examination technique that accounts for 65% (in 2007) of the diagnostic imaging performed at our hospital. We conduct as many as 400 examinations a day, and in order to reduce patient waiting time and improve work efficiency, it is important to streamline the workflow of general radiography.

The newly installed RADspeed safire is a system that streamlines workflow by, for example, acquiring examination-related information from the RIS, automatically displaying the appropriate menus, and allowing images to be viewed approximately 3 sec after exposure. Also, although it is an orthodox standing/supine system, it is equipped with a new auto-positioning function that automatically moves the X-ray tube to the position appropriate for the region of interest. More details will be given later.

## 3. Image Stability

A project to establish a PACS incorporating all systems by 2009 is underway at our hospital, and our selection of equipment reflected the prospect of filmless operation. At present, however, operation is not completely filmless, and film output is still necessary. For this reason, in addition to superior operability, the imaging processing ability to print stable high-definition images was required of the image processing system. RADspeed safire offers superior stability of image output, and in particular, achieves stability of photographic density (Figs. 8 to 11). The fact that there is little variation in density between technologists helps improve diagnostic capability, and the automation of output helps streamline the workflow (Fig. 12).

When I showed some images obtained in a demonstration to some surgeons, many of them said that they would like the system to be installed as soon as possible. Image quality can influence the outcome of surgery and so features such as the stable output of high-definition image with stable photographic density are of immeasurable benefit to both physicians and patients.



Fig. 8

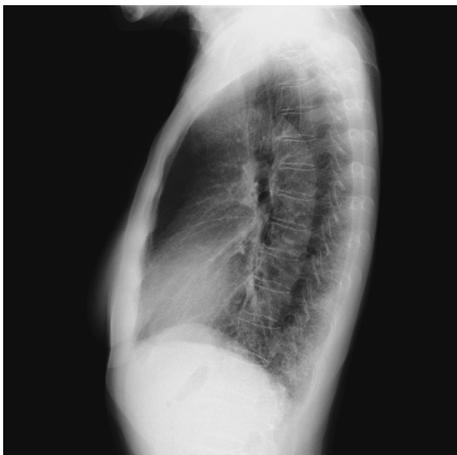


Fig. 9



Fig. 10



Fig. 11

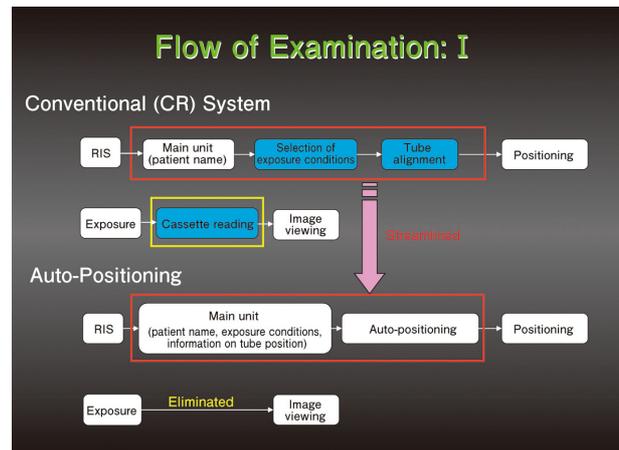


Fig. 12

## 4. System Operability

The RADspeed safire systems that we installed at our hospital use a touch panel and a dial-type operating method to attain superior operability.

Regarding the workflow, when an examination order is received from the RIS, the appropriate menus are automatically displayed, and the exposure conditions and exposure field size are automatically set, making for smooth, stress-free operation. In the imaging of multiple regions, the menu for the next step is displayed automatically after each exposure, and so only a minimum number of operations are required.

## 5. Immediacy

Images can be displayed approximately 3 sec after exposure. This means that the necessity of repeating exposure due to patient movement or accessories can be identified quickly, which is an important advantage as it helps reduce the patient immobilization time and the total examination time. The exposure cycle is only 8 sec long and so a good, stress-free workflow can be attained even when imaging multiple regions.

## 6. Auto-Positioning Function

**Figs. 13 and 14** show the auto-positioning ranges of devices and the flow of examinations performed with auto-positioning. **Figs. 15 to 17** show the results of evaluation of the operability, efficiency, and safety.

RADspeed safire's auto-positioning function is very effective for improving the workflow. It is easy to operate, and makes it possible to go from the standing position to the supine position in approx. 15 sec. The object distance can be changed, oblique radiography can be executed, and the equipment can be moved to the parking position by simple remote control operations. It is also possible to care for the patient while moving the equipment. These features make the system easy for female technologists with little physical strength to use.

Another advantage of the auto-positioning function is that it allows a large examination room to be used efficiently with a single X-ray tube, as opposed to a two-tube system. The X-ray tube can also be moved efficiently when, for example, performing radiography on stretcher-borne patients. One other significant advantage is that, because the position of the X-ray tube is coordinated even during oblique radiography in the standing or supine position, it is not necessary to have the patient move in order to confirm the location of the center. Regarding safety, features that make this a patient-friendly and user-friendly system include the following:

1. If there is a danger of contact during movement of the X-ray tube, the system can be stopped immediately by simply stopping remote control operation.
2. Because the same single X-ray tube can be moved to either the standing or supine position, there is no danger of another X-ray tube hitting the patient or technologist, as there is with a two-tube system.
3. As there is only one X-ray tube, there is no danger of selecting the wrong one.

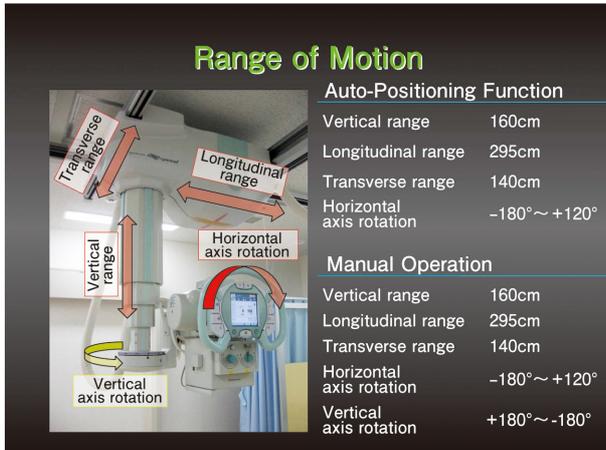


Fig. 13

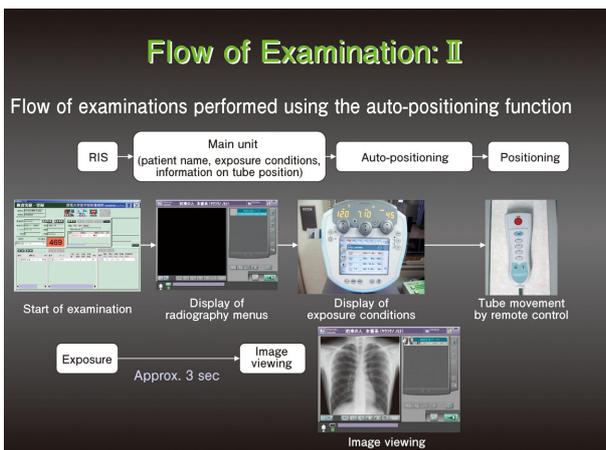


Fig. 14

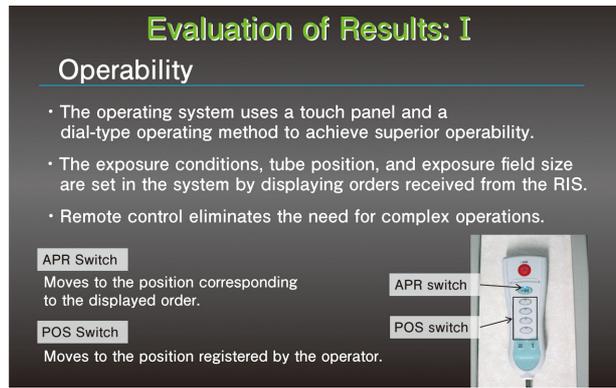


Fig. 15

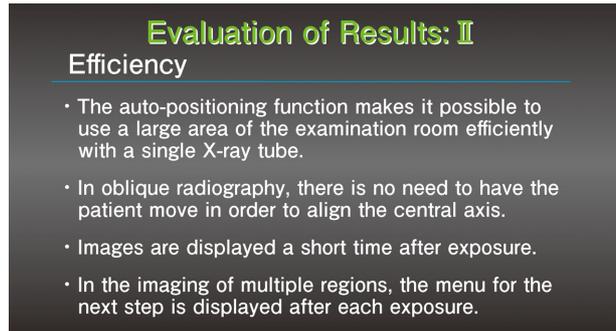


Fig. 16

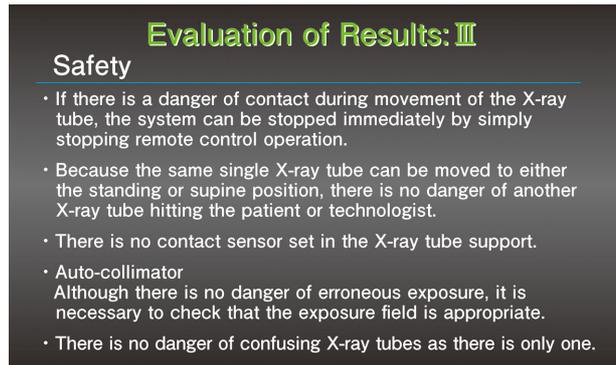


Fig. 17

## 7. Increased Efficiency Achieved by Installation in Same Room as Digital Table

At our hospital, out of the four RADspeed safire systems and the four SONIALVISION safire II systems that we installed, we have set up one of each system in the same room, which we use as an abdominal radiography room that can respond flexibly to orders for thoracoabdominal examinations. This further increases the efficiency of examinations and operation (Figs. 18 and 19).

At first, we planned to install the SONIALVISION safire II system in a specialized X-ray TV room, but in response to a suggestion from Shimadzu that this system was suitable for abdominal examinations, we conducted an investigation that involved inspection of actual use. As a result, we concluded that the aspects described below made this system ideal for abdominal examinations. Also, in the course of our investigation, it was judged that installing RADspeed safire in the same room would make it possible to respond to orders for thoracoabdominal examinations, and that this promised

to improve examination efficiency. It was decided, then, that one of each of the two systems would be installed in the same abdominal examination room.

1. SONIALVISION safire II is equipped with a 17 × 17-inch, distortion-free, wide-angle FPD.
2. Table inclination allows radiography in both the standing and supine positions without having to move the patient.
3. Image processing is suitable for abdominal images.
4. Fluoroscopy can be used to check the position and the state of air before executing radiography.

Since we started using this setup, the way that the SONIALVISION safire II allows the bed to be lowered to give easy access to the many patients and caregivers at this hospital who have difficulty walking and the way that it allows radiography to be executed in both the standing and supine positions without having to move the patient have contributed to improved throughput. Regarding general operation, because this setup can be used as a backup when the schedule for the chest examination rooms and specialized X-ray TV rooms is full and because variations in examination orders can be handled flexibly, it has been possible to use the examination rooms more efficiently than was originally anticipated.

## 8. Summary

Since installing the RADspeed safire general radiography system that is equipped with a direct-conversion FPD, its superior operability has helped improve workflow and increase throughput to a level much greater than that achieved with a standard CR system. Regarding image quality, because this system produces a stable output of high-definition images obtained with the direct-conversion method, it has contributed to an increase in diagnostic capability.

This system promises to contribute greatly to improvements in the quality of the examinations that are performed as a medical service subject to increasing demands.



Fig. 18

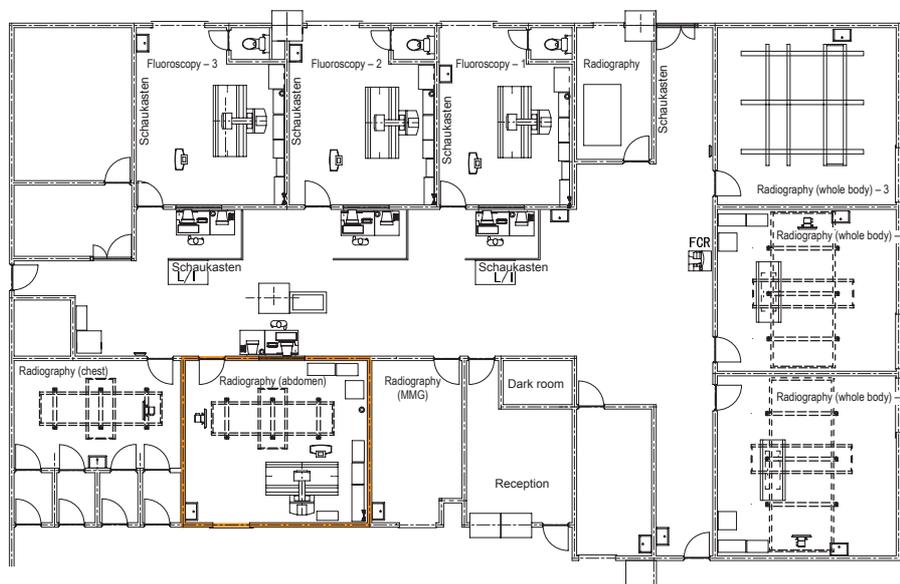


Fig. 19