

New multipurpose fluoroscopy system Zexira i9: New functions to ensure high image quality at low exposure dose



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There is currently great interest in the phenomenon known as digital transformation (DX), which refers to the radical changes in society resulting from the widespread adoption of digital technologies. The field of radiology, which has a history extending back more than 100 years, is no exception to this trend. The Zexira i9 digital RF system is the direct result of Canon Medical Systems Corporation's efforts to develop an ideal RF system based on the latest digital technology.

The Zexira i9 system that entered service at Tokyo Women's Medical University Yachiyo Medical Center in August 2021 supports advanced acute care in the southern Tokatsu region of Chiba, Japan, which includes Yachiyo City, Ichikawa City, and Funabashi City. The medical center offers a wide range of examinations and procedures employing their Zexira i9, including gastrointestinal angiography as well as drainage and fistulography in the fields of gastroenterology and surgery, myelography and nerve root blocks in the field of orthopedics, bowel repositioning and voiding cystourethrography in the fields of pediatrics and pediatric surgery, and ureteral catheterization in the field of urology. We conducted interviews with Mr. Michio Nakayama (Chief, Radiologic Technologist, Imaging Exam Room, Department of Medical Technology) and asked him to share his clinical experience with the Zexira i9 installed at his medical center.



Figure 1: From left: Yuri Yoshino (Radiologic Technologist), Michio Nakayama (Chief, Radiologic Technologist, Imaging Exam Room, Department of Medical Technology, Kei Imanishi (Physician), Yuriko Demura (Radiologic Technologist), and Nobuyuki Kawai (Chief Radiologic Technologist)

Improved visualization during procedures while minimizing exposure dose

Zexira i9 features outstanding fluoroscopic image quality achieved using a 43 × 43 cm FPD manufactured by Canon Inc. and a newly developed image processing unit. Mr. Nakayama notes, "With a conventional system, we sometimes need to perform radiography if we can't see sufficient detail in the fluoroscopic image. This means an increase in the exposure dose to the patient. So improved fluoroscopic image quality is really important in clinical practice."

Zexira i9 provides excellent image quality while minimizing radiation exposure, allowing both diagnostic examinations and therapeutic procedures to be performed at low exposure dose. Mr. Nakayama states, "Images with excellent contrast enhancement can be obtained at low exposure dose. In particular, the ability to visualize low-contrast areas is truly outstanding. The tip of the needle can be observed very clearly while performing procedures. And the fact that we can avoid having to perform radiography further reduces the exposure dose to the patient."

i-fluoro The field of view (FOV) can be moved without repositioning the patient table or the imaging system.

Zexira i9 is provided with the new i-fluoro function. With i-fluoro, the FOV in magnified display can be moved without the need to physically reposition the patient table or the

imaging system (X-ray tube assembly and FPD). Within an initially set 43 cm range, the magnified FOV can be displayed and freely moved to any desired position. The FOV can be moved more safely because there is no need to reposition the patient table or the imaging system during procedures such as needle puncture or drainage. Mr. Nakayama states, "Repositioning the imaging system or the patient table in order to move the field of view during an invasive procedure is risky, and it's also stressful to the surgeon. In addition, the vibration caused by mechanical movement of the table may cause the patient to feel anxious or frightened. The ability to move the FOV without physically repositioning the patient table or the imaging system is a major benefit in actual clinical use."

Flexible examinations performed with i-fluoro

The FPD can be moved over a wide range up to 9 cm from the end of the table when the multipurpose patient table is installed in Zexira i9, providing an extensive radiography range of 205 cm in the head-to-foot direction. By using i-fluoro in combination to move the FOV, fluoroscopy can be performed over a wide range, including areas near the end of the table. This greatly increases the amount of freedom in positioning, reducing the burden on both the operator and the patient during procedures. Mr. Nakayama also states, "Urological contrast examinations are often performed with the patient in the lithotomy position. Because the field of view can easily be moved to the end of the table in Zexira i9, we can perform fluoroscopy with much less effort. It minimizes the need to reposition the patient. This also helps to reduce patient stress and discomfort."

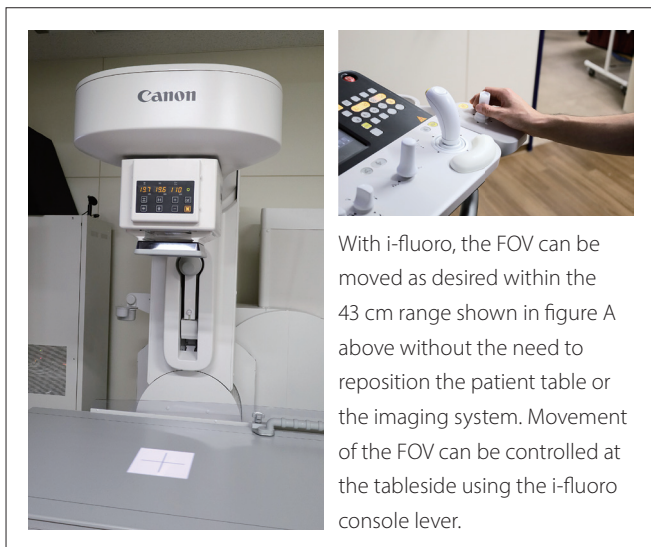


Figure 2: Moving the FOV with i-fluoro in Zexira i9



Figure 3: The FOV can be moved to a position 9 cm from the end of the table.

KEY POINTS

- ✓ The exposure reduction mechanism allows procedures to be performed at low exposure dose.
- ✓ Safer examinations and higher examination efficiency are achieved by employing image processing techniques which ensure high image quality while minimizing exposure dose.

<Pulsed fluoroscopy>

The grid-controlled X-ray tube enables pulsed fluoroscopy with a short wave head and tail. Nine frame rates are available (1, 2, 3, 5, 7.5, 10, 15, 20, and 30 fps). With regard to pulsed fluoroscopy, Mr. Nakayama comments, "A frame rate of 10 fps has been newly added between 15 fps (for clearer visualization of movement) and 7.5 fps (for lower exposure dose). At 10 fps, procedures can be performed with clearer visualization at a relatively low exposure dose. With more available choices at lower frame rates, we can set the optimal frame rate according to the specific clinical requirements, such as prioritizing low exposure dose in pediatric procedures and so on."



Figure 4: Console for controlling various functions in the examination room

<Digital brightness adjustment>

In fluoroscopy, image brightness was previously adjusted using a function known as "automatic brightness control" (ABC), in which the brightness was controlled automatically according to the level of X-ray output. However, in Zexira i9, a function known as "digital brightness adjustment" is used to digitally control the image brightness without changing the fluoroscopy dose rate. In digital brightness adjustment, luminosity and contrast are adjusted by image processing to increase the brightness for improved visualization. With regard to fluoroscopy dose modes, the fluoroscopy dose rate can be set to Normal (100%), Mid (50%), or Low (35%) while maintaining a consistent level of image brightness thanks to digital brightness adjustment. Mr. Nakayama also notes, "It's possible for us to increase the screen brightness when the operator needs a brighter FOV. In some cases, acceptable visualization can be achieved using the digital brightness adjustment function, allowing the procedure to be completed without the need to perform radiography."

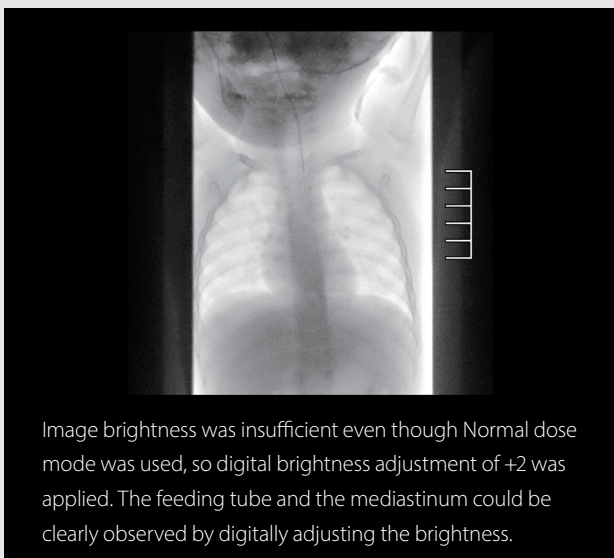
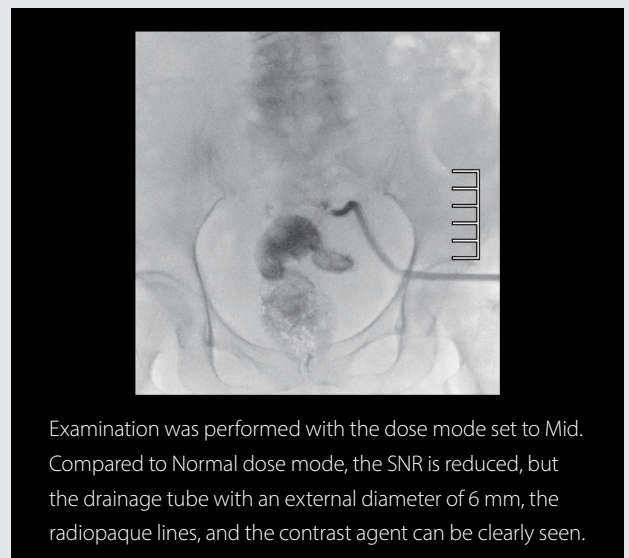


Image brightness was insufficient even though Normal dose mode was used, so digital brightness adjustment of +2 was applied. The feeding tube and the mediastinum could be clearly observed by digitally adjusting the brightness.

Figure 5: Placement of a feeding tube in a pediatric patient observed in an upper gastrointestinal contrast examination.



Examination was performed with the dose mode set to Mid. Compared to Normal dose mode, the SNR is reduced, but the drainage tube with an external diameter of 6 mm, the radiopaque lines, and the contrast agent can be clearly seen.

Figure 6: Contrast imaging during drainage of an abscess associated with rectal perforation.

Looking forward to the future of digital RF systems

In the future, Tokyo Women's Medical University Yachiyo Medical Center expects to further expand the range of clinical applications of Zexira i9 because it is an extremely flexible fluoroscopy system that can support a wide variety of examinations and procedures. Mr. Nakayama comments, "Zexira i9 expands what we can do far beyond the limits of conventional fluoroscopy systems. I look forward to having more opportunities for users like us to share our know-how with each other in the future." The new wave of X-ray fluoroscopy brought about by Zexira i9 is steadily growing.

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* The contents of this report include the personal opinions of the interviewees based on their clinical experience and knowledge.

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