

The Philips logo is displayed in a bold, blue, sans-serif font within a white rounded rectangular box.The word "Healthcare" is written in a white, sans-serif font on a dark blue background.The words "Zenition Series" are written in a white, sans-serif font on a dark blue background.

Who/Where

Dr. Shohei Iwabu, chief clinician, Orthopedics Department, Saiseikai Utsunomiya Hospital, Japan

Challenge

Improving image quality, dose efficiency and positioning flexibility for minimally invasive orthopedic procedures.

Equipment

Philips Zenition 70 mobile C-arm with Flat Detector technology and Unify workflow

Results

The Zenition 70 produces high quality images from small hands to large trunk anatomy, while delivering less dose than previous mobile C-arms. It allows space for the surgeon even during horizontal projections and can be moved with relative ease.

Usefulness of Philips Zenition 70 in orthopedics

Saiseikai Utsunomiya Hospital and the Philips Zenition experience

Importance of X-ray fluoroscopy in orthopedic surgery

The field of minimally invasive procedures is currently being explored with great enthusiasm by many medical professionals with the aim of reducing the burden of surgery on patients. In the field of orthopedics where physicians often deal with bone injuries, there are many situations where this reduction can be achieved by using X-ray fluoroscopy. However, X-ray fluoroscopy, is a double-edged sword. The invasive nature of radiation exposure affects both the patient and the healthcare provider. When using X-ray fluoroscopy during surgery, there is always the issue of how to obtain the maximum amount of information, while applying the lowest possible radiation exposure.

The mobile C-arm has long been an indispensable tool in orthopedic surgery.

"Today, it is no exaggeration to say that the performance of the mobile C-arm is as important as the skill of the surgeon in determining the quality of the surgery," says Dr. Shohei Iwabu, chief clinician, Orthopedics Department at Saiseikai Utsunomiya Hospital, Japan.

"With this importance in mind, we chose to update our mobile C-arm to a Philips Zenition 70," says Dr. Iwabu. "When selecting this model, our main priority was its suitability for orthopedic surgery. The features we sought were: high image quality at low X-ray dose, easy handling, maneuverability, good responsiveness, a well-balanced C-arm, versatility and quick start-up."



Photo 1: The small X-ray tube tank allows space for the surgeon during horizontal projections



Photo 2: Zenition C-arm position on caudal side to free up space for anesthesiology staff

Need for a dedicated orthopedic imaging solution

The hospital used five mobile C-arms in its operating room, all of which had drawbacks for orthopedic surgery:

- The oldest C-arm was a relatively high-powered, easy to maneuver system, but was marked for replacement due to its significant deterioration in image quality.
- Two relatively new systems are high-power, high-performance, high-resolution models, used to support cardiac surgery. However, they pose many problems when used for orthopedic surgery. Their large main unit and control tower make them difficult to position in the small OR. Their huge X-ray tank takes up the entire surgical field during horizontal imaging, making it difficult for the surgeon to find somewhere to stand. The lag between pressing the footswitch and capturing the image results in timing errors. Orthopedic surgeons also find the long start-up and shut down time on these systems very frustrating.
- Another new analog system is the most popular among orthopedic staff for several reasons: the main unit, control tower and X-ray tube tank are small and easy to maneuver. There is a short interval between pressing the footswitch and the display of images, and it has quick start-up and shut down times. However, its low power output makes it somewhat difficult to image trunk anatomy. The C-arm is poorly balanced and swings freely when unlocked, and images cannot be recorded.
- The remaining mobile C-arm is an older, smaller, high-definition model for hand surgery, but image quality has been worsening and the arm can no longer be fixed in place.

Zenition 70 meets all the requirements for orthopedics

The new mobile C-arm had to provide image quality high enough for use in both hand surgery and spine and pelvic procedures. "The only C-arm that met all of our requirements was the Zenition 70," says Dr. Iwabu. "Although it is high-powered, it has a small X-ray tube tank, so there is still enough space for the surgeon, even during horizontal projections (Photo 1)."

Easy to handle and position

Dr. Iwabu: "The Zenition 70 has a well-balanced arm that can be moved with relative ease during fracture surgeries requiring frequent changes in imaging projections. It is easy to handle and doesn't move out of position even when it is not fixed in place. Even with a wireless footswitch, the C-arm is very responsive, so that we never get the timing wrong."

High-definition imaging fine-tuned for extremities

"The high power output provides good images of the spine and pelvis in patients who have a sturdy build (Image 1)," says Dr. Iwabu. "Even for hand surgery, the C-arm allows us to obtain images comparable to those taken with previous specialized, high-definition mobile C-arm systems (Image 2)." The orthopedic staff have worked with Philips engineers to fine-tune the imaging settings to acquire images tailored to the patient's hands. Dr. Iwabu adds, "The laser sighting device is particularly effective for surgery on small areas."

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Image 1: Zenition's high power output provides good images of the spine and pelvis in large patients



Image 2: Zenition 70 images of the hand are comparable to those taken with previous high-definition mobile C-arm systems

Case Study

This patient was a 69-year-old woman with a right olecranon fracture sustained when she fell off her bicycle and landed on her elbow (Image 3).

The patient was placed on her side with her arm on a radiolucent support. The fracture site was opened via a dorsal entry. After revision with bone forceps, Kirschner wires were inserted and fixed intramedullary through the olecranon tip. A tension band was added and clamped (Image 4).

The surgery lasted 1 hour and 22 minutes. The total fluoroscopy time was 25 seconds and the total fluoroscopy dose was 0.620 mGy.

Fluoroscopy was used during surgery to check the status of repair and the position of the Kirschner wires (Image 5). The main unit was installed on the caudal side instead of the cranial side in order to secure space for anesthesiology staff (Photo 2). The mobile C-arm was rotated to obtain a lateral image, and the X-ray tube was placed on the cranial side (Photo 3). Because the X-ray tube tank is small, it was easy to obtain a medial image even with this set-up.

Dr. Iwabu concludes, "The Zenition 70 is an easy-to-use C-arm with a rugged, robust frame and high-performance imaging capabilities. As a mobile C-arm used in orthopedic surgery, it is highly versatile and serves as a reliable partner than can fully function in any situation."



Image 3: Zenition 70 images of olecranon fracture sustained on elbow



Image 4: Zenition 70 images of clamped tension band



Image 5: Zenition 70 image to check status of repair and position of Kirschner wires

The hospital uses operating rooms in sequence as they become free in order to complete surgeries in a shorter period of time, and the mobile C-arm has to be moved accordingly. "Both the body and Mobile View Station of the Zenition 70 are sturdy and solid, yet compact. Although the device is weighty, it moves smoothly, meaning even our healthcare workers who are less physically strong have no trouble moving it," says Dr. Iwabu. "It is also quick to shut down and start-up when moved around, which makes things less stressful for us. Sometimes we also use smaller operating rooms. With the Zenition 70, there is no need to compete for space when performing implant surgeries that require a large number of surgical instruments."

Easy to operate

Dr. Iwabu is also satisfied with the ease of operation, although this was lowest on the list of priorities. "Operation is simple and straightforward, and I feel confident asking anyone to operate it on the spot, including processing images using the touch screen and changing the imaging perspective. Saving and transferring images is likewise straightforward and easy. The wireless remote control is also useful."

Sufficient image quality with reduced radiation exposure

Finally, the most important thing for the hospital was to reduce the amount of radiation exposure, while ensuring sufficient image quality. "The Zenition 70's range of imaging technologies enable it to produce high quality images from small hands to large trunk anatomy, while delivering a smaller dose than previous models. This also helps to reduce the total irradiation time," says Dr. Iwabu.



Photo 3: Zenition C-arm rotated to obtain lateral image, with X-ray tube on cranial side

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Key features of Zenition 70

- Compact fourth generation flat detector visualizes complex structures with exceptional clarity and dose control
- Engineered for continuous imaging with enhanced heat management to support longer and complex procedures
- In a user study¹ the touch control and navigational aids of Unify workflow reduced miscommunication by almost half
- The Zenition user interface is so easy, it scored in the top 12% for best system usability¹.

¹ Results obtained during user tests performed in November 2013 by Use-Lab GmbH, an independent company. The tests involved 30 USA based clinicians (15 physicians teamed up with 15 nurses or X-ray technicians), who performed simulated procedures in a simulated OR environment. None of them had worked with a Philips C-arm or with each other before.

These results are specific to this institution. Results in other case studies and institutions may vary.

