



Dr. Eisho Kyo MD, President, Kusatsu Heart Center

Dr. Takashi Tsuji MD, Vice President, Kusatsu Heart Center

Alphenix's High Image Quality at Low Dose Supports State-of-the-Art Medical Technology at a Cardiovascular Center

With the philosophy of 'providing reliable medical care with state-of-the-art medical technology, Kusatsu Heart Center in Kusatsu, Japan, was established in March 2006 as a cardiovascular center by the late, Hideo Tamai M.D, who served as the center's first President. The center specializes in Interventional Radiology and has, therefore, installed a variety of Interventional equipment, starting with an Alphenix system (Canon Medical Systems Corporation, Japan), with the aim of providing cutting-edge medical care to patients without delay. By employing the most advanced medical technology safely, efficiently, and economically, the center helps patients return to normal life as quickly as possible. We asked Dr. Kyo, the current President of the Center, to outline the history leading up to the establishment of Kusatsu Heart Center and Dr. Tsuji, Vice President of the Center, to discuss his experience with the Alphenix Interventional X-ray system.





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*Eisho Kyo, M.D.
President of Kusatsu Heart Center*

Dr. Eisho Kyo's first meeting with Dr. Hideo Tamai

Dr. Kyo: After I graduated from university in Taiwan, I served as a Medical Intern at the Kyoto University School of Medicine, Kyoto, Japan, and then joined the Department of Cardiovascular Medicine of Shiga Adult Disease Center (now known as Shiga General Hospital), Shiga, Japan. At that time, Dr. Hideo Tamai was affiliated with the same department. He'd spent some time in the United States studying advanced catheterization techniques and had just returned to Japan after completing specialized training in percutaneous coronary intervention (PCI). At that time, the general understanding was that catheterization procedures had low success rates and were associated with many difficulties. Hence, when I first saw Dr. Tamai perform PCI, I was astonished at his procedure precision. Over time, Dr. Tamai became widely recognized as a leading expert in PCI, and he played a major role in disseminating PCI skills and techniques. I assisted him in his work and participated in many catheterization procedures.

Founding of Kusatsu Heart Center

Dr. Kyo: Ever since that time, we've been at the forefront of catheterization. Rapid advances are being made in

medical devices and techniques every day, and we need to keep up with this rapid progress in order to provide the best possible treatment options to our patients. Nevertheless, it takes a long time to replace medical equipment at a public medical institution. Moreover, after you've worked for many years at the same facility, you tend to be promoted to a higher seniority, which tends to pull you away from the clinical frontline. Dr. Tamai had the strong belief that the best medical care is only possible with the best equipment, and as a true pioneer in PCI, he decided to establish Kusatsu Heart Center as a facility providing top-level medical care to patients.

Dr. Tsuji: I met Dr. Tamai and Dr. Kyo during my residency training at the Shiga Adult Disease Center, where I learned catheterization techniques. Many patients with cardiovascular disease require urgent treatment. However, at large hospitals, they need to make appointments for echocardiography and cardiac catheterization, which makes it difficult for them to receive the required treatment immediately without delay. I agreed with Dr. Tamai and Dr. Kyo's plans to establish Kusatsu Heart Center as a facility where professionals with advanced medical skills would offer top-level medical care quickly and equally to all patients.

Dr. Kyo: In order to provide the best medical care, we need not only the right equipment but also the right medical skills and competencies.

At our center, we're trying to pass on many new medical and clinical techniques, such as PCI techniques, to other doctors and the next generation. We're also involved in improving medical techniques through clinical training programs, such as by distributing intraoperative live videos. Dr. Tamai sadly passed away in 2009, but his spirit lives on at Kusatsu Heart Center.

Initial experience with Canon Medical Systems Corporation

Dr. Kyo: When we established the Center, we installed the latest Infinix Interventional X-ray system produced by Toshiba Medical Systems Corporation (now known as Canon Medical Systems Corporation). At that time, we visited the company's manufacturing facilities and were extremely impressed by their advanced technologies.

Dr. Tsuji: In PCI, it's important to formulate a strategic plan in advance to decide how to conduct PCI based on detailed analysis of the courses and morphological characteristics of the vessels. Such plans are strongly affected by the fluoroscopic image quality. We were the first to install the multi-access C-arm system in Japan. I remember how the engineers adjusted the image quality and colors to achieve natural and easy-to-view images that allowed the blood vessels and background to be visualized in excellent harmony.

High-quality Alphenix images support smooth and accurate PCI

Dr. Tsuji: In 2018, we replaced our Infinix with the latest system, Alphenix, which offered significantly improved image processing capabilities and speed. With Alphenix, all required image data can be retained and processed as is, resulting in extremely high image quality. The system can clearly show minute blood vessels, the collateral circulation, and the location and orientation of guidewires. This allows us to perform PCI procedures more accurately and smoothly than ever before, even in challenging cases such as the treatment of chronic total occlusion (CTO), which involves extremely delicate

procedures with a precision of 1 mm or less.

Lower dose exposure thanks to higher image processing speed

Dr. Tsuji: The image processing functions of Alphenix have been updated to allow the required data to be obtained, while reducing noise. So, clear images can be obtained without increasing the radiation dose, leading to substantial dose reduction. In addition, while we used a radiography mode which has a higher dose than fluoroscopy for the recording purpose in the past, Alphenix allows us to record fluoroscopic images using fluoroscopic acquisition functions (F-Rec and F-Store) thanks to remarkable improvements in image quality even in low-dose fluoroscopic

mode. In many cases, fluoroscopic acquisition can take the place of radiographic imaging, resulting in a further reduction in radiation dose. The F-Store function allows images to be recorded retrospectively for up to 60 seconds before the end of fluoroscopy. That means that we don't need to interrupt what we are doing in order to perform radiographic imaging. This further increases the efficiency of PCI procedures. In addition, when the dose mapping function known as the Dose Tracking System (DTS) is used, the exposure dose on the patient's skin surface can be displayed in colors. We can monitor exposure levels during the procedure and change angles accordingly, which is effective for preventing exposure hot spots.





Kusatsu Heart Center

Upgrading to Alphenix allows fine adjustment of fluoroscopy and radiography settings

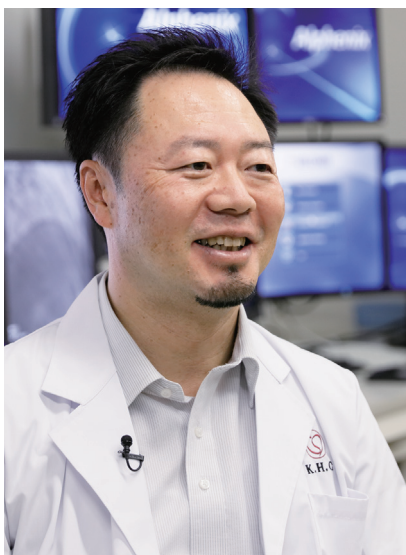
Dr. Tsuji: With Alphenix, we can acquire fluoroscopic images with virtually no image lag, even in low-rate pulsed fluoroscopy. Therefore, we can reduce the pulse rate from 15 fps to 7.5 fps, resulting in further dose reduction. Also, in January 2021, we upgraded the X-ray tube of our Alphenix, enabling us to use a narrower pulse width at 7.5 fps. Using a shorter pulse width is the same as setting a faster shutter speed

on a camera, and the moving heart can be observed clearly without the image blurring. Furthermore, since the pulse width is shorter, higher-quality and sharper images can be obtained by increasing the maximum current per pulse without changing the total radiation dose. In other words, a clearer image quality can be resulted in without dose increase. Such parameters, as well as other fluoroscopic and radiographic settings, can be used in suitable cases. Even when the X-ray beam passes through the patient

nearly transversely, we can obtain very clear fluoroscopic images - far superior to anything we'd seen before. The greater freedom in setting the angle of the X-ray beam makes it much easier to perform therapeutic procedures.

Impression of Canon Medical Systems

Dr. Tsuji: Previously, we'd been using an interventional X-ray system produced by an overseas manufacturer. This was because Japanese manufacturers were offering X-ray tubes with



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Takafumi Tsuji M.D,
Vice President
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lower output than those from overseas manufacturers. However, after using an interventional X-ray system from Canon Medical, we realized that it's not simply a matter of high X-ray output. Canon Medical employs a variety of approaches to achieve better image quality. Faster image processing allows the data from the image sensor to be processed instantly during imaging, and innovative new technologies mean the pulse width can be shortened. I'm very impressed by Canon Medical's outstanding development capabilities, which enable improvement of image quality using a variety of approaches. I also appreciate our collaborative partnership, in which we communicate and interact closely with the company. For example, before we conduct intra-operative live demonstrations, Canon Medical engineers come to our center and check the system. We appreciate their strong support and friendly attitude, such as listening carefully to users' requests and promptly incorporating these requests into new developments and upgrades.

Expectations for the future Interventional X-ray systems

Dr. Tsuji: The Alphenix Biplane system supports imaging at different angles from two directions. However, the blood vessels and heart are three-dimensional structures, and

blood vessels (in particular) need to be viewed from the most suitable angles along their courses. Currently, we take information from images acquired at different angles and CT images and integrate this information to create 3D images in our minds towards understand the courses of the vessels. We look forward to the development of AI-driven technologies that can automatically identify the most suitable viewing angles. To do so, it will be essential to integrate infor-

mation from various modalities, such as CT and intravascular ultrasound (IVUS). When AI makes it easier for us to understand the condition of the heart and blood vessels by integrating information from multiple modalities, with automatic vessel tracking and confirmation of the wire position in CT images, the success rate of PCI will be further improved, and procedures will be performed in less time. This will lead to better medical care and outcomes for our patients. //



President, Hideo Tamai M.D.
 Dr. Hideo Tamai was a founder of Kusatsu Heart Center. He had impacted the Japanese and international interventional cardiology fields as a key contributor and pioneer in PCI treatment. Since 2001, he has hosted The Complex Catheter Therapeutics (CCT) which has garnered and attracted a worldwide captive audience. He played an important role as both an operator and organizer to the CCT, and was key in making it thrive as a successful international meeting which it continues to be to this day. He has provided many lectures and live cases, not only in Japan, but also at overseas academic conferences and disseminated PCI treatment techniques to the world. In 2009, he had passed away and will be truly be missed.