

As interventional procedures become increasingly complex and advanced, there is a demand for angiography systems that reduce X-ray doses, reduce contrast medium usage, and shorten examination times. Shimadzu's latest Trinias series angiography system features various functionality for achieving minimally invasive procedures.

This article compiles some of Shimadzu's initiatives in minimally invasive treatment that have received particularly high praise.

1 Initiatives to Reduce X-Ray Doses — Low Dose Fluoroscopy Mode and SCORE RSM —

The International Commission on Radiological Protection (ICRP) poses the general principle that X-ray doses should be reduced to As Low As Reasonably Achievable (ALARA), and as seen by the increasing number of countries to establish Diagnostic Reference Levels (DRLs), awareness of X-ray dose reduction has increased substantially. In light of this, the low dose fluoroscopy mode (preset name : Low) available in Trinias series systems has been particularly well-received. This low dose fluoroscopy mode can be used irrespective of region of treatment (excluding pediatrics) and reduces X-ray doses by 44 % or more compared to normal dose fluoroscopy mode (Fig. 1). It is also provided with an ultra-low dose fluoroscopy mode (preset name: ExLow / Lowest) dedicated to catheter ablation treatment. Thanks to the motion tracking Noise Reduction technology, which is the core technology of our image processing engine named "SCORE PRO Advance", enables to minimize the afterimage even fluoroscopy at low pulse rate. Therefore, further dose reductions can be achieved by combining ultra-low dose fluoroscopy mode with low pulse rates in the arrhythmia therapy. All Trinias series models are equipped with these low dose modes as standard, and this "Minimally Invasive Treatment in Practice" section compiles various first-hand accounts from facilities that reduced doses with these low dose modes.

SCORE RSM is another Shimadzu's initiative to lower X-ray doses. SCORE RSM is a Shimadzu's proprietary imaging technique that generates a low frequency mask image from live images and performs frequency subtraction processing in real time. SCORE RSM is excellent at visualizing small contrast-enhanced vessels and devices and its dose per pulse is approx. 34 % lower than that of standard High-Speed (HS) DSA (Fig. 2). The principal advantage of SCORE RSM is a high tolerance for subject movement due to frame-by-frame processing, and some medical facilities have utilized this feature to reduce total doses on each procedure by effectively selecting between using SCORE RSM or DSA imaging. Since SCORE RSM does not require breath holding and is not affected by misregistration due to intestinal

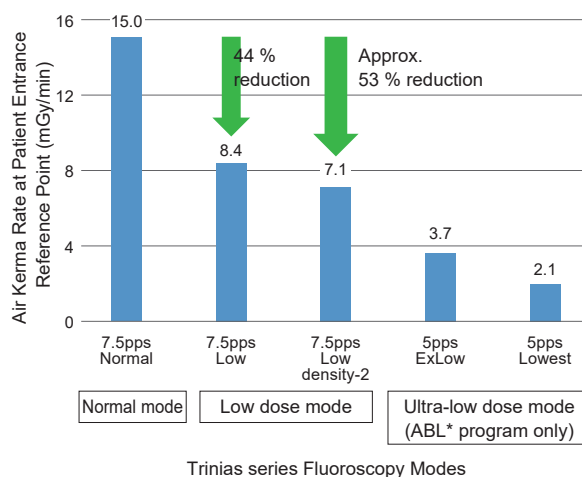


Fig. 1 Comparison of X-Ray Doses in each Fluoroscopy Mode (Cardio/ ABL* fluoroscopy program)
(FOV 6 inch, acrylic 20 cm, SID 100 cm, calculated values for 7.5 pps Low density-2)
* Dedicated program for the catheter ablation treatment in the arrhythmia therapy

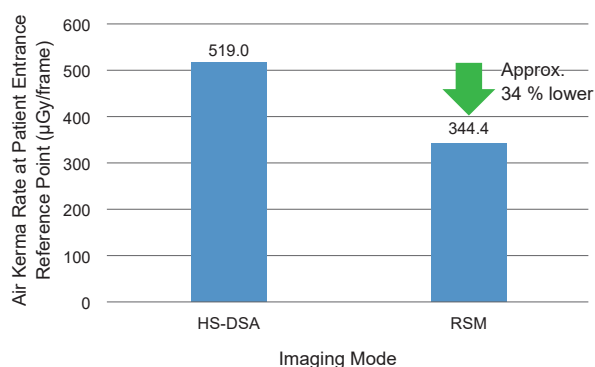


Fig. 2 X-Ray Dose Comparison between HS-DSA and SCORE RSM (FOV 8 inch, acrylic 20 cm, SID 100 cm)

movements, there are many cases of switching from DSA imaging to SCORE RSM imaging. It is highly evaluated that this can be expected to further reduce the dose.

2 Initiatives to Reduce Contrast Medium Use — SCORE Chase —

Shimadzu has been also engaged in developing functions that reduce contrast medium use.

One of these initiatives is SCORE Chase, an application that generates long-view images of the lower extremities (Fig. 3). SCORE Chase can generate long-view images and allow observation of the entire lower extremities from a single contrast injection image acquisition. Long-view images can be created both by panning catheter table lateral and longitudinal direction and SCORE Chase is also suitable for patients with joint mobility issues. By combining SCORE Chase with the ability of SCORE RSM to tolerate patient movement, unsuccessful acquisitions and repeated acquisitions can be avoided and ineffectual use of contrast media can be reduced. A long-view image is also generated automatically as soon as the acquisition is complete, allowing for easy overall comparison of blood flow features before and after treatment and hence shorter examination times.



Fig. 3 RSM Long-View Image with SCORE Chase

3 Initiatives to Shorten Examination Times — Shimadzu's Proprietary Procedure Support Functions —

SMART Access function of the C-arm positioner was developed for shorter examination times and has been well-received. Shimadzu's proprietary C-arm axle structure enables Transversal movement that accommodates a radial approach with a single-plane and frontal C-arm of bi-plane system. This SMART Access function has received high praise for enabling the trouble-free implementation of all steps from patient entry, to C-arm positioning, diagnosis, and treatment in sites where space is at a premium. SMART Touch is a customizable touch panel mountable at the bedside that can be used to change the fluoroscopy or radiography program, select applications, and perform image operations during procedure. SMART Touch is well evaluated as providing the stress-free operation because the required functions can be customized for each procedure and operator.

Another area of development is imaging that combines SCORE RSM with precessional C-arm movement. SCORE RSM precessional imaging allows images to be acquired from multiple directions in a single contrast injection image acquisition. Furthermore, by selecting a frame with well-separated blood vessels from the acquired images and transmitting the angle information of that frame to the C-arm, the optimum angle can be reproduced quickly. (Fig. 4). This can even be performed at a single touch and has been highly praised for facilitating speedy progress during procedures.

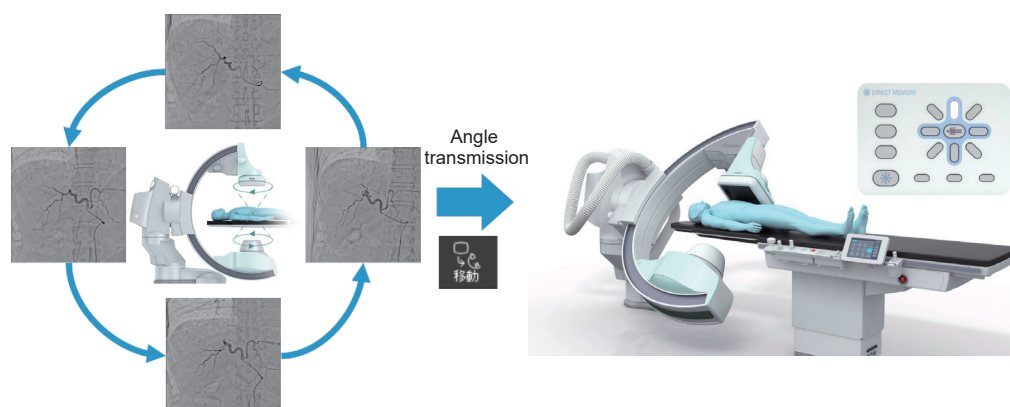


Fig. 4 Precessional Imaging and Angle Transmission

4 Final Comments

Shimadzu has ceaselessly pursued the development of image-guided applications for real-time performance and proprietary procedure-support functions aimed at minimally invasive treatments. Going forward, Shimadzu will continue to collect feedback from all parties engaged in interventional procedures and endeavor to make interventions even less invasive.