Minimally Invasive Procedures in Practice

—Further Evolution of SCORE™ PRO Advance—

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Since its release in 2015, the SCORE PRO Advance image processing engine employed in the Trinias™ angiography systems. In a recent trend to pursue minimally invasive procedures, Shimadzu updated the image processing engine to meet customer expectations for manufacturers to achieve even higher image quality and lower exposure dose levels.

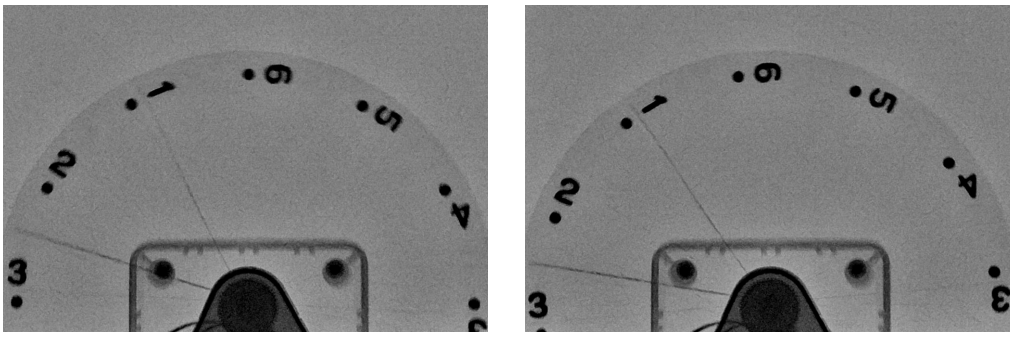
1 SCORE PRO Advance Features

In fluoroscopy, SCORE PRO Advance identifies catheters, guide wires, and other linear structures in the body by extracting their pattern and using matching technology among different image frames to reduce only random noise patterns without causing contrast deterioration or afterimage from structure movement.

For radiography, noting that linear structures in images are typically blood vessels filled with contrast media, visibility can be improved by enhancing only blood vessels and devices in images without enhancing dotted noise.

2 Description of Improvements

2.1 Conventionally, the X-ray pulse width for fluoroscopy was 8 to 13 msec (which varied depending on the X-ray parameters specified based on the object thickness). That could result in blurring if the device moved too much during X-ray exposure, which could cause decreased visibility of the guide wire tip or other features. To solve that problem, X-ray parameter settings were optimized and the pulse width was shortened to within 5 to 10 msec. The shorter pulse width decreases blurring caused by movement and provides more stable contrast between structures in different frames **(Fig. 1)**.

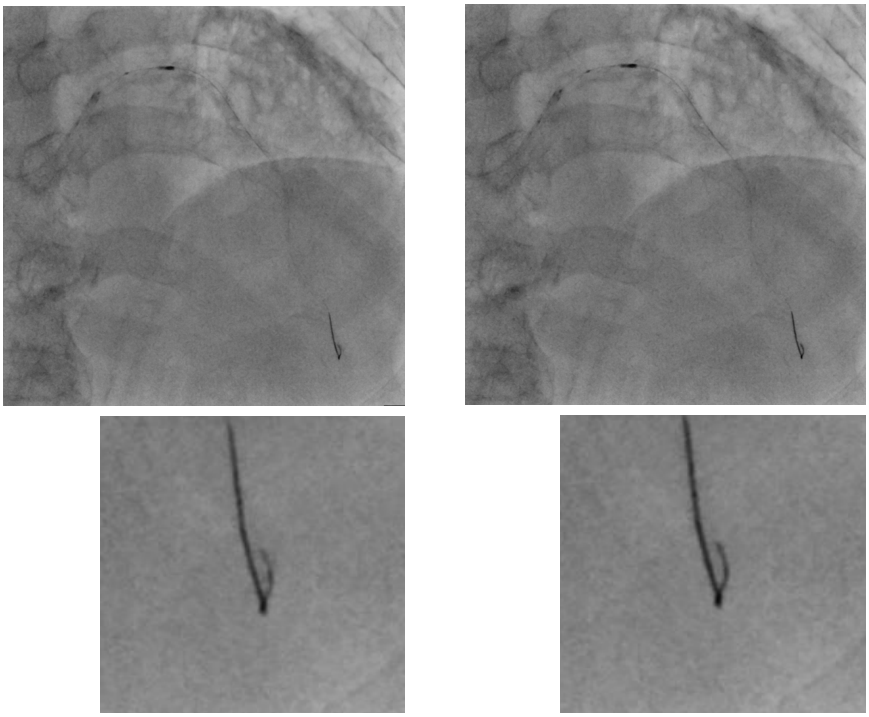


Before improvement　　After improvement

Fig. 1 Blurring due to movement was further reduced after improvements

2.2 The accuracy of matching linear structures in the body during fluoroscopy was improved to further reduce afterimage of devices and other moving objects. In addition, improvements to background graininess increased the contrast-to-noise ratio (CNR) by about 10 %* in Low mode.

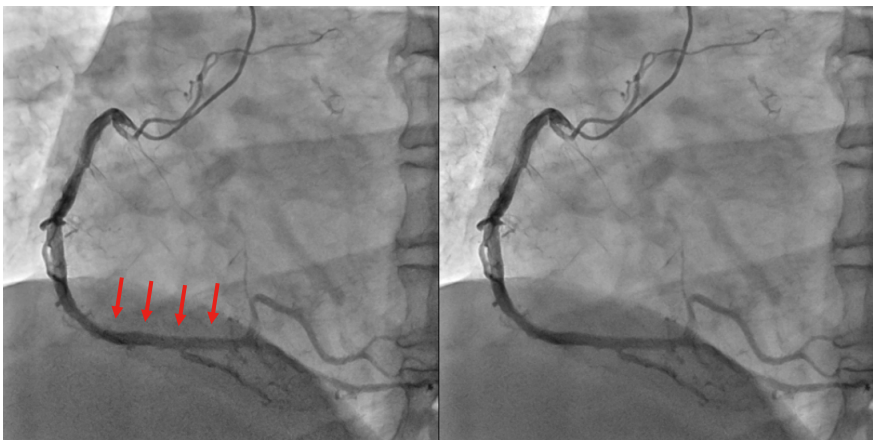
2.3 For fluoroscopy, in addition to an overall improvement in image quality, such as improved visibility and image sharpness of guide wire tips or catheter tips before injecting contrast media, which previously were sometimes difficult to see **(Fig. 2)**, an entrance dose rate for a 20 cm acrylic phantom was reduced by about 10 % * at the patient entrance reference point which had been defined as "IVR point".



Before improvement　　After improvement

Fig. 2 Improved guide wire visibility

2.4 For radiography as well, increased matching accuracy and background graininess improvements similar to fluoroscopy reduced noise and improved blood vessel visibility without changing exposure dose levels. The improvements were especially effective for blood vessels overlapped by the spine, diaphragm, or other objects in thicker parts of the body **(Fig. 3)**.



Before improvement　　After improvement

Fig. 3 Noise reduction also improved the visibility of blood vessels obscured by the diaphragm

3 Final Comments

Finally, we express our deep appreciation to all the physicians, radiological technologists, and other hospital personnel that helped with development. We will continue our research and development work in the future as well in an effort to contribute to minimally invasive procedures.

* This comparison is with our previous models.