AbstractID: 13724 Title: Using MTF to Assess the Influence of X-ray Focal Spot Blur on the Resolution of Fluoroscopic Imaging Systems

Purpose:
The resolution of x-ray fluoroscopy images is dependent on detector characteristics and x-ray focal spot penumbra blur. The purpose of this work was to investigate the influence of focal spot size and geometric magnification (M) on the modulation transfer function (MTF) of flat panel fluoroscopic imaging systems.

Method and Materials:
The MTF of was measured for two x-ray detectors, three different focal spot sizes, and M in the range 1.04 to 1.70. The MTF was measured both parallel and perpendicular to the cathode-anode direction using an angled edge device method. MTF spectra were used to calculate the noise equivalent aperture (NEA, mm^2), which is the reciprocal of the 2D integral of the 1D MTF.

Results:
There were marked changes in MTF and NEA between systems and as a function of geometric magnification for the three focal spots. Comparing the two systems, that with the larger pixel size had higher NEA for all focal spots and magnification factors. For the nominal 0.4 mm focal spot, system resolution improved with magnification up to M=1.3 and then remained unchanged for $1.3 < M \leq 1.7$. For the 0.8 mm focal spot, the system resolution was largely unchanged in the range $1.04 \leq M < 1.3$ and then decreased for $1.3 < M < 1.7$. For the 1.2 mm focal spot, the system resolution consistently decreased for all $1.04 < M \leq 1.07$. For all focal spots, resolution was better maintained in the direction parallel to the cathode-anode direction than in the orthogonal direction.

Conclusion:
Methods to assess the MTF and NEA of digital fluoroscopy systems were developed. The MTF and NEA demonstrated changes in resolution between the two detectors and three focal spot sizes, and with variable geometric magnification.