Purpose: To extend the exposure dynamic range of the MAF using its variable gain so that objects with a wide range of differences in attenuation can be visualized.

Methods: A phantom with low, medium, and high attenuating regions was constructed by placing two low-contrast vascular stents and a dense steel screw as test objects on a three-step-wedge assembly of aluminum and copper plates. The phantom was imaged with a standard FPD which has a fixed dynamic range and with the high-resolution MAF at two different gain settings of its light image intensifier with constant x-ray technique parameters.

Results: The stents and screw-threads could not be visualized in all three step regions in the FPD image. For the MAF, although we could visualize the stents and screw in the low-attenuating step at low MAF gain, we could not see well the part of the image in the high-attenuating region. By increasing the gain 14 times, however, we were easily able to visualize the objects in the high-attenuating region although part of the image in the low-attenuating region was then saturated. In the high-attenuating region, the signal-to-noise ratio and contrast-to-noise ratio for the screw increased from 3.5 to 4.1 and from 6.3 to 7.1, respectively, as the gain was increased. Normalized pixel values for line profiles in the image of a stent in the high-attenuating region at low gain closely follows the same profile in the high-gain image, however, with substantially more noise fluctuations due to increased contribution of instrumentation noise.

Conclusions:Although not possible for the FPD, different gains can be used for the MAF to visualize an object's details and improve the signal-to-noise ratio under conditions of large differences in background attenuation without changing the x-ray technique parameters.