AbstractID: 10577 Title: Effects of voxel size on visibility of microcalcifications in cone beam breast CT

Purpose:
To investigate the effects of voxel size on the visibility of simulated microcalcifications (MCs) in cone bream breast CT.

Method and materials:
Calcium carbonate grains (ranging from 140-150 to 200-212 µm), were used to simulate MCs. 25 MCs from same size group were arranged into a 5 × 5 cluster and embedded at the center of a 15 mm diameter paraffin rod. Rods with MCs from various size groups were constructed and scanned with a bench top experimental CBCT system. A CCD detector (C4742-56-12ER, Hamamatsu Photonics K.K) operated in 2×2 binning mode was used to acquire 300 projection images with a pixel size of 48 µm over 360°. Imaging geometry was configured with a magnification factor of 1.16 to result in a voxel size of 42 µm to match the spatial resolution limit. The acquired images were further binned into image sets of larger pixels (96, 144, 192, 240 and 288 µm). The image sets were then reconstructed with Feldkamp's backprojection algorithm using a ramp filter. The reconstructed image sets were reviewed by 6 readers independently. The visibility, computed as the ratio of visible MCs and averaged over all readers, was plotted as the function of voxel size to quantify the effects of voxel size on the visibility of MCs.

Results:
Based on the visibility versus voxel size plot, 90% visibility was achieved for 200 – 212, 180 – 200, 160 – 180, 150 – 160 and 140 – 150 µm calcifications at a voxel size of 249, 249, 206, 166 and 125 µm, respectively. The visibility versus voxel size plot may be used to determine the minimum pixel size required to achieve a specific visibility level for MCs of certain sizes.

Conclusions:
We have demonstrated that the minimum voxel size required to achieve a specific visibility level decreased with the MC size.