Purpose:
To estimate the image quality, dose saving and scatter reduction in the dual-resolution cone beam CT (CBCT) breast imaging using two different VOI scanning techniques.
Methods:
There are two different VOI scanning techniques in dual-resolution CBCT breast imaging: (1) breast-centered with a moving VOI mask technique and (2) the VOI-centered with a stationary VOI mask technique. In either case, the breast is first scanned with a low resolution detector at a lower exposure level. The VOI in the breast is then scanned with a high resolution detector at a higher exposure level through the VOI mask. The two image sets are combined together to reconstruct high resolution CT images. A bench-top experimental CBCT system with a flat panel detector and a high resolution CMOS detector was built. A paraffin cylinder with a diameter of 130 mm was used to simulate breast. A wire phantom, a 15 mm diameter paraffin cylinder with 8 vertically oriented aluminum wires of various diameters, was used to test the image quality. The wire phantom was inserted into the breast phantom 45 mm away from the center and designated as the VOI. The spatial resolution in the reconstructed images, phantom dose and scatter-to-primary ratio were measured for both scanning techniques.
Results:
For both techniques, a visual review of the reconstructed images showed that the diameter of thinnest resolvable wire is 254 μm for regular CBCT and 152 μm for dual resolution CBCT. The doses for dual-resolution CBCT can be reduced by a factor of 2 inside of the VOI and up to a factor of 6 outside the VOI. The scatter components can be reduced by a factor of 6 inside the VOI.
Conclusions:
Both scanning techniques were found to result in improved image quality, substantially reduced dose and scatter in dual-resolution CBCT.

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