Purpose:
Digital tomosynthesis (DTS) imaging with 2D scanning patterns may help reduce the artifacts by more effectively blurring the off-fulcrum objects. In this study, the effects of various source scanning patterns on the reconstructed images are studied via simulation.

Methods:
The X-ray source was assumed to be movable following various scanning patterns. The source-to-iso-center and source-to-image distances were assumed to be 500 mm and 600 mm, respectively. Projection images were computed using an improved distance-driven algorithm. The objects studied included a Shepp-Logan phantom and a digital breast phantom constructed from segmented cone beam CT images. The X-ray absorption coefficients were taken of mono-energetic X-ray at 19 keV. The x-ray source was scanned with 1D (1D DTS) and 2D (2D DTS) patterns. The objects were reconstructed using the iterative expectation-maximization algorithm. The root-mean-squared-deviation (RSMD) was calculated to indicate the deviation in terms of CT numbers of the reconstructed image to the original phantom.

Results:
The RMSD of the reconstructed Shepp-Logan phantom was 243.3 for 1D DTS and 104.7 for 2D DTS. Visual inspection revealed reduced artifacts and better CT number accuracy with 2D DTS than 1D DTS. For the digital breast phantom, the accuracy of the reconstructed tissue structures was assessed using the CT number uniformity in the dense tissue and adipose tissue regions. The RMSD of the digital breast phantom was 113.1 for 1D DTS and 50.0 for 2D DTS. The comparison showed that the 2D DTS resulted in better accuracy in CT number uniformity.

Conclusions:
Our results demonstrated that the use of 2D source scanning patterns has the potential advantage of more effectively blurring objects in off-fulcrum planes, thus reducing the artifacts and resulting in more accurate image reconstruction.

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