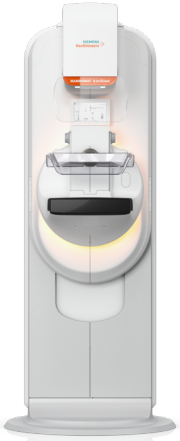
Scientific Publication • Women's Health • DBT

Focal spot motion in digital breast tomosynthesis and its effect on spatial resolution



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Background

Digital breast tomosynthesis (DBT) has become standard practice; however, the acquisition method of DBT between vendors is far from standardized. Currently, there are three commercially available DBT tube motion techniques: (1) continuous motion, (2) step-and-shoot, and (3) continuous motion with flying focal spot. Each of these methods represents a trade-off between total acquisition time and focal spot blur.

Purpose

The aim of the study was to characterize the increase in effective focal spot size in DBT relative to standard 2D projections and assess the influence of this increase on spatial resolution using the modulation transfer function (MTF).

Methods

Focal spot size was measured for both a 2D acquisition and the 0° DBT projection using a 10 µm slit phantom. Imaging techniques were set to those used for a 2, 4, and 8 cm thick breast of 50/50 adipose/fat composition. MTF curves were measured using a copper edge phantom both at the breast support plane and 4 cm above the breast support.

Results

The effective focal spot size increase from 2D to DBT increased with breast thickness for all systems. The continuous motion systems showed the greatest increase in effective focal spot size with percent increases of 101% to 462% depending on unit and breast thickness. The flying focal spot system showed the smallest increase in effective focal spot size in DBT acquisitions, being 3%, 21%, and 25% for a 2, 4, and 8 cm thick breast, respectively. The step-and-shoot and flying focal spot systems showed no degradation in MTF curves due to increasing effective focal spot size in DBT acquisitions, while the continuous motion systems showed a reduction in the frequency at which the MTF curve reached 50% of 26%-45%.

Conclusion:

Both step-and-shoot and flying focal spot systems minimized effective focal spot size increase in DBT acquisitions compared to continuous tube motion systems.

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