Comparing search strategy in breast tomosynthesis and 2D mammogram: an eye tracking study.

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Breast cancer screening (mammography) has typically involved search of 2D x-rays of the breast. A new modality, breast tomosynthesis (BT) allows visualization of a series of slices through the breast, reducing occlusion from overlapping tissue. BT appears to improve performance but, because it is new, little is known about best search strategies and nothing is known about eye movements during BT search. We compared eye movements for eleven radiologist examining eight BT and 2D cases. Four cases in each modality contained abnormalities. Each showed only one breast. Observers marked suspicious masses with mouseclicks. Eye-position in X/Y space was recorded at 1000Hz and co-registered with slice/depth plane as radiologists scrolled through BT images, allowing a 3D representation of eye position. As in previous work, BT hit rate for masses was higher than for 2D cases. BT false alarm rate was lower. However, BT search durations were much longer (75s) than 2D (43s). Tomosynthesis produced longer fixations and less distance travelled per unit of time by the eyes. Our lab has shown that, when searching through volumetric images of the chest, radiologists typically adopt one of two distinct strategies. “Drillers” scroll quickly through depth while keeping XY eye position relatively constant. “Scanners” carefully search each XY depth plane before scrolling more slowly in Z (Drew et al., 2013). Mammographers in the current study appear to be predominantly drillers. However, there was some variability in how consistently they used this strategy and how often they made large scanning eye-movements in the XY plane. The current study is a first step towards assessing the effectiveness of different search strategies in tomosynthesis.