

Tomosynthesis and Motion

EDUCATION
FOR MEDICAL PROFESSIONALS

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Introduction: Motion Unsharpness

Tomosynthesis (3D) Motion Unsharpness

- Occurs at about the same frequency as conventional mammography (2D)
- Presents the same issues as 2D motion, EXCEPT that motion may go undetected

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Introduction: Motion Unsharpness

- Most common patient-related artifact*
- Motion: local/regional or involves the entire breast
- Gross or Subtle
- Repeats for motion increase radiation dose
- Potential to miss breast cancer

*Geiser et al: Challenges in Mammography; AJR:197, December 2011

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Introduction: Motion Unsharpness

2D Mammography	3D Tomosynthesis
<ul style="list-style-type: none"> • Acquisition time is brief • Captures a moment in time • One image • Technologists/radiologists adept at detecting motion • Repeats are left up to the Technologist 	<ul style="list-style-type: none"> • Longer acquisition time • Multiple image data set • Images acquired over a period of time • 3D motion occurs at about the same rate as 2D

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Introduction: Motion Unsharpness

Factors contributing to Motion Unsharpness

- Inadequate Compression
- Poor Positioning
- Exposure Time
- Patient Movement
- Heart Motion

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Tomosynthesis and Motion

3D Motion may be unrealized and unchecked

- Radiologists do not routinely review the projection dataset where motion can be confirmed or ruled-out
- Projection dataset may not be available to the radiologist (BTO)

It is up to the technologist to detect motion and repeat when advised

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Tomosynthesis and Motion

Important notes:

- We do not yet understand the full impact of 3D motion on image quality and when repeat is necessary
- Motion can occur at one point, multiple points or through-out the duration of the entire projection series
- Motion can occur at different areas of the breast, which may or may not impact breast tissue
- May affect conspicuity, sharpness of detail

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Appreciating 3D Motion

Projection Series

- The x-ray tube moves in a path parallel to the chest wall
- The resulting breast image(s) and objects should move smoothly along this same pathway
 - Medial to Lateral /Lateral to Medial
- Anterior/posterior movement of the breast images or objects indicates motion

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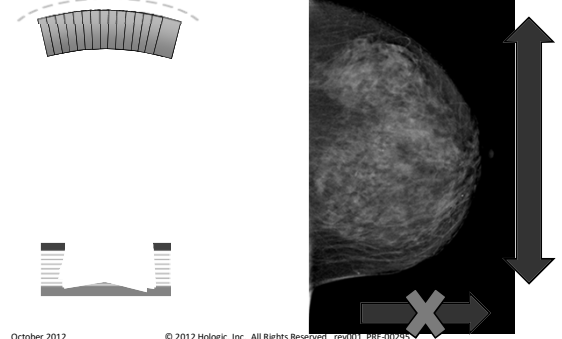
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Appreciating 3D Motion



Appreciating 3D Motion

Arc of motion of x-ray tube, showing individual exposures



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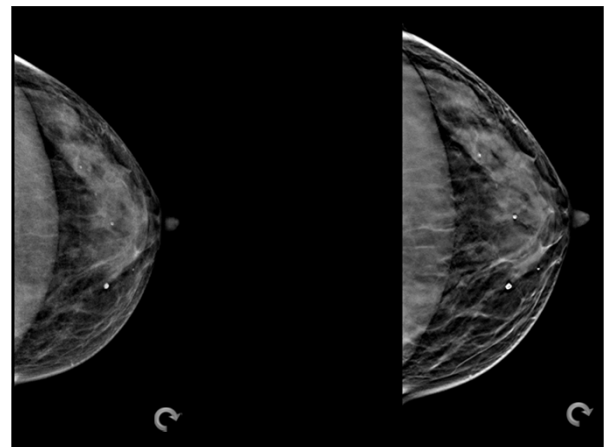
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Appreciating 3D Motion: QC Review

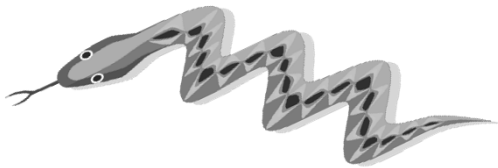
- Motion can be visible on both projection & tomosynthesis datasets
- Tomosynthesis Reconstruction
 - More difficult to detect/confirm motion on reconstruction
 - Unsharpness in the tomosynthesis dataset
 - Non-linear movement of calcifications
 - Objects or lesions look sharp in one view, but not the opposing view
- Projection Series
 - Most efficient way to detect motion
 - Review series at Selenia® Dimensions® System

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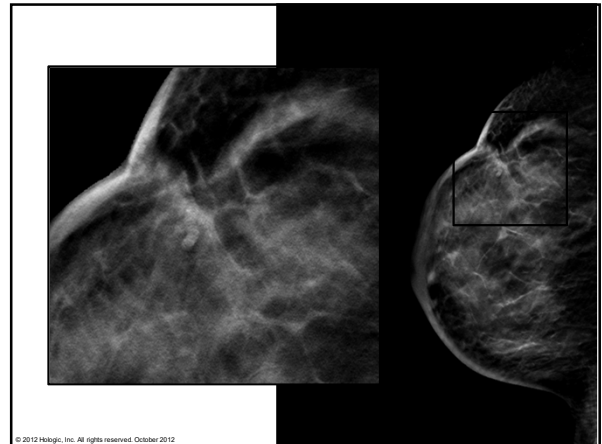
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If objects in the breast seem to wiggle and bounce anterior to posterior, consider motion



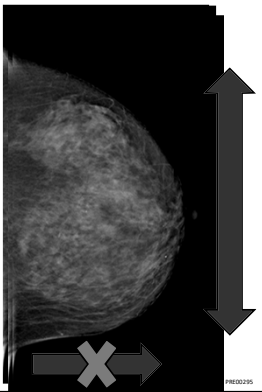
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Appreciating 3D Motion

Arc of motion of x-ray tube, showing individual exposures



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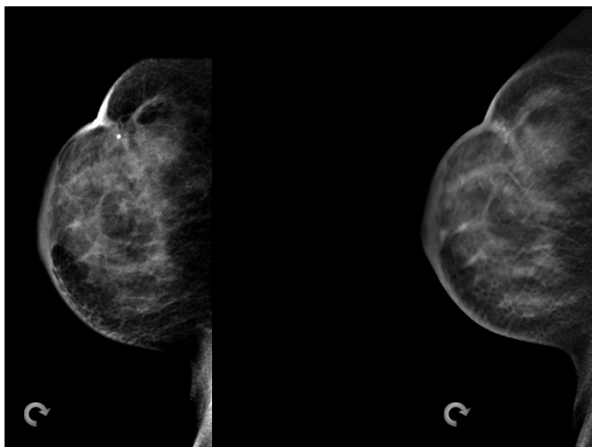
Reviewing Projection Images for Motion

- Review the Projections
 - Cine Mode
 - Moderate to fast speed



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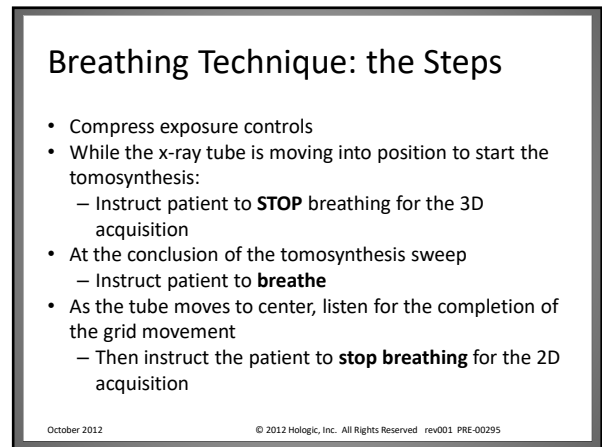
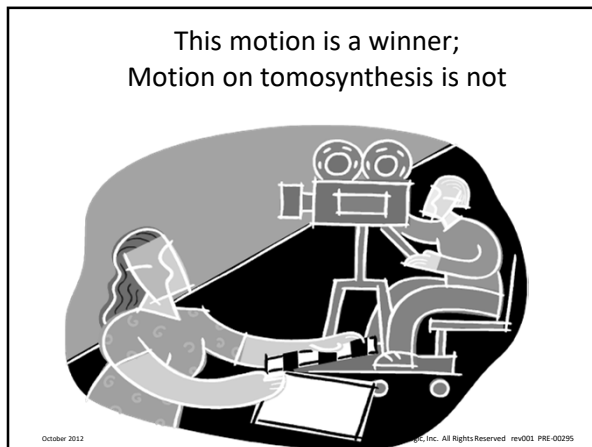
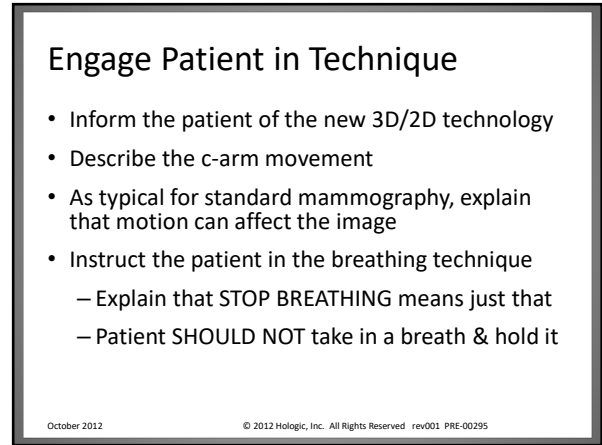
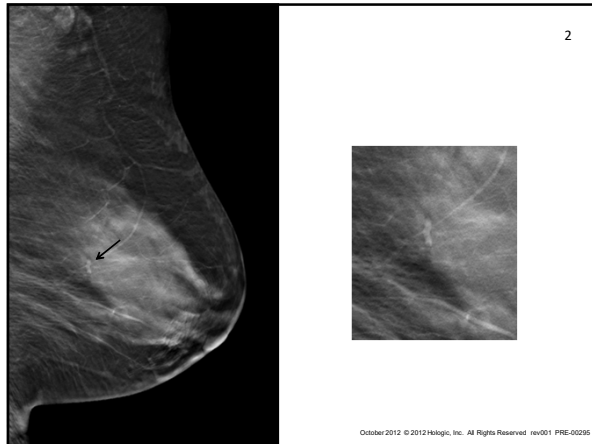


Appreciating 3D Motion: Notes

- **Chest wall**
 - Movement of the Pectoral Muscle
 - Structures that shift in and out of view
- **Inframammary fold**
 - Abdomen motion
 - Determine if it impacts the inferior and posterior breast
- **Calcification**
 - Should move in a straight line parallel to the chest wall
 - More evident with large chunky calcifications
- **Axilla**
 - Lymph Nodes shift back and forth or out of view

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Motion Repeats

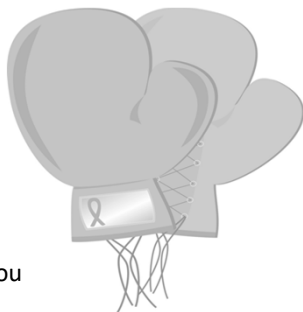
- The significance of motion unsharpness on Tomosynthesis is not yet known
- How and when to repeat an image should be directed by the supervising radiologist

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Any Questions?



Thank you

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