An Introduction to QA & Safety Applications of Surface Imaging

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Education Topic Specific Guided Tours

- Wednesday, Therapy: Surface Image Guided Radiotherapy Monitoring Systems:
  - 10:15am – Noon (No check in after 10:30am), Room 201B
  - First come first served!
Disclosures

- I receive royalties and licensing fees for computer-aided diagnosis technology through The University of Chicago.
- I am co-Chair of “TG-302: Surface Image Guided RT” but this presentation does not represent any AAPM guidelines.
Outline

- Introduce surface imaging (SI) & its clinical applications
- Motivate QA & safety applications of SI
Surface Imaging Basics

- Non-invasive, optical 3D imaging modality
- Registers real-time patient surface to a *reference surface* (CT-simulation vs camera-acquired)
- Registration can be limited to region-of-interest (ROI)
- Compares registered translations/rotations to a user-defined *threshold* to alert the therapy team and/or hold the beam
Surface Imaging Basics

3D Surface from CT data

‘Entire’ ROI

‘Breast’ ROI
Surface Imaging: Clinical Applications

- Initial patient positioning:
  - 3D modality
  - No radiation dose
  - Real-time feedback over a large field-of-view

- Intra-fraction monitoring:
  - Voluntary deep-inspiration breath-hold (DIBH) for whole-breast radiotherapy (WBRT)
  - Frameless SRS
WBRT DIBH: INTRA-FRACTION MONITORING
Additional Benefits of Surface Imaging

- Treatment Quality:
  - Efficiency?

- Safety Checks:
  - Correct immobilization?
  - Correct isocenter treated?
Quality Improvement: SI to ↑ Efficiency

- Reduce filming frequency
- Increase throughput

The University of Chicago Medicine WBRT

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<tr>
<th></th>
<th>Before AlignRT</th>
<th>After AlignRT</th>
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<tbody>
<tr>
<td>% of Patients with shifts &lt; 1cm</td>
<td>64%</td>
<td>92%</td>
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<tr>
<td>% of Patients with shifts &lt; 1cm; total time &lt; 30mins</td>
<td>44%</td>
<td>72%</td>
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Voluntary DIBH Breast Case: SI on Fraction 1

Pitch problem caused by changed in breath-hold pattern or positioning?
Voluntary DIBH Breast Case: Films on Fraction 1

AP kV

LAT kV

DRR/Med MV port
Voluntary DIBH Breast Case: CT scan comparison
Voluntary DIBH Breast Case: CT scan comparison
Voluntary DIBH Breast Case: Sl on Fraction 2

Pitch resolved!
Learning Objectives

1) Introduce surface imaging as a quality improvement tool
2) Review current quality improvement applications of surface imaging
3) Discuss potential future quality improvement applications of surface imaging
Speakers

- Alonso Gutierrez, PhD, Miami Cancer Institute
- Hui Zhao, PhD, Univ. of Utah
- David Wiant, PhD, Cone Health Cancer Center
- Laura Padilla, PhD, Virginia Commonwealth Univ.
- Mike Tallhamer, MS, Centura Health
Acknowledgements

- Colleagues:
  - Steven Chmura, M.D., Ph.D.
  - Yasmin Hasan, M.D.
  - Maxine Washington, M.D.
  - Therapy & dosimetry team

- TG–302 members