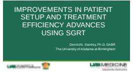

IMPROVEMENTS IN PATIENT SETUP AND TREATMENT EFFICIENCY ADVANCES USING SGRT

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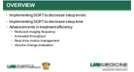
DISCLOSURES

- I have nothing to disclose.

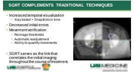


OVERVIEW

- Implementing SGRT to decrease setup errors
- Implementing SGRT to decrease setup time
- Advancements in treatment efficiency
  - Reduced imaging frequency
  - Increased throughput
  - Real-time motion management
  - Volume change evaluation

TRADITIONAL SETUP TECHNIQUES

- Visual based Clinical Setups
- Permanent or non-permanent subcutaneous marks
- X-Ray Orthogonal imaging
- Volumetric Imaging
  - Gold standard



SGRT COMPLEMENTS TRADITIONAL TECHNIQUES

- Increased temporal visualization
  - Xray based = Snapshots in time
- Decreased initial errors
- Movement verification
  - Reimage thresholds
  - Automatic readjustment
  - Ability to quantify movements
- SGRT serves as the link that correlates the initial imaging throughout the course of treatment.

CAN SGRT DECREASE INITIAL SETUP ERRORS?

- Historically, the process of positioning a patient prior to imaging verification used a set of permanent patient marks, or tattoos, placed subcutaneously.
- Surface-based imaging systems
  - Alternative method of verifying initial positioning
  - Utilizes entire skin surface
  - Non-ionizing
  - Non-invasive
  - Increased clinical efficiency

PROBLEMS WITH SUBCUTANEOUS TATTOOS

- Body habitus changes
- localized radiation induced swelling/shrinking
- Time difference between the placing of the marks and treatment
- Psychological impact of permanent marks
  - Pediatrics
  - Breast*
  - H&N
- Ink Allergies
- Religious Preferences

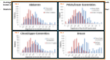
*Clow B, Allen J. Psychosocial impacts of radiation tattooing for breast cancer patients: a critical review. Can Woman Stud. 2010;28:46-52. SCOPUS

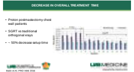
SGRT VS SUBCUTANEOUS TATTOOS

- Over a 24 month period
- 6000 individual fractions were analyzed
  - 600-900 Fxs Per Site Per Method
    - Pelvis/lower extremities
    - Abdomen
    - Chest/Upper extremities
    - Breast

D.N. Stanley, et al. "Comparison of initial patient setup accuracy between surface imaging and three point localization: A retrospective analysis." JACMP 18.6 (2017): 58-61.

DECREASE IN INITIAL SETUP SHIFTS

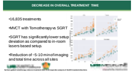




DECREASE IN OVERALL TREATMENT TIME

- Proton postmastectomy chest wall patients
- SGRT vs traditional orthogonal xrays
- ~ 50% decrease setup time

Batin et Al. PRO V6i6 2016



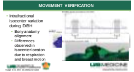
DECREASE IN OVERALL TREATMENT TIME

•16,835 treatments

•MVCT with Tomotherapy vs SGRT

•SGRT has significantly lower setup deviation as compared to in-room lasers based setup.

•Reduction of ~5-10 min of imaging and total time across all sites



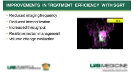
MOVEMENT VERIFICATION

- Intrafractional isocenter variation during DIBH
  - Bony anatomy alignment
  - Differences observed in isocenter location due to respiration and breast motion

MOVEMENT VERIFICATION FOR DIBH

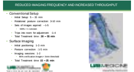
- Intrafractional isocenter variation during DIBH
  - **Stable bony anatomy ≠ stable isocenter in DIBH**
  - Unadjusted movement resulted in large dosimetric effects, primarily for the OARs
  - Failure to account for respiratory motion and breast motion resulted in statistically significant OAR dose increases
  - Movement due to inspiration and **needs continuous monitoring**

Kuegle et. Al. DOI: 10.1002/acm2.12214



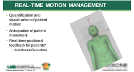
IMPROVEMENTS IN TREATMENT EFFICIENCY WITH SGRT

- Reduced imaging frequency
- Reduced immobilization
- Increased throughput
- Realtime motion management
- Volume change evaluation



REDUCED IMAGING FREQUENCY AND INCREASED THROUGHPUT

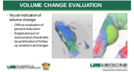
- Conventional Setup
  - Initial Setup: 5 – 15 min
  - Rotational posture correction: 3-10 min
  - Sets of images aquired: ~1-5
    - ~65% > 1 session
  - Trips into room for adjustment: 1-4
  - Total Treatment time : **30 – 55 min**
- Surface Imaging
  - Initial positioning: 1-3 min
  - Posture correction : 1-5 min
  - Imaging sessions: 1-2
    - 95% verification images < 5mm threshold
  - Total Treatment time: **15 – 25 min**



REAL-TIME MOTION MANAGEMENT

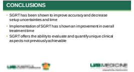
- Quantification and visualization of patient motion
- Anticipation of patient movement
- Real-time positional feedback for patients*
  - Anesthesia Reduction

*Current abstract from T. Cha et Al



VOLUME CHANGE EVALUATION

- Visual indication of volume change
  - Offline evaluation of percent reduction
  - Establishment of resimulation thresholds
  - Quantification of follow-up anatomical changes



CONCLUSIONS

- SGRT has been shown to improve accuracy and decrease setup uncertainties and time
- Implementation of SGRT has shown an improvement in overall treatment time
- SGRT offers the ability to evaluate and quantify unique clinical aspects not previously achievable

THANK YOU!