The Reduction of Electronic Portal Imaging as a Result of using SGRT amongst Breast Patients

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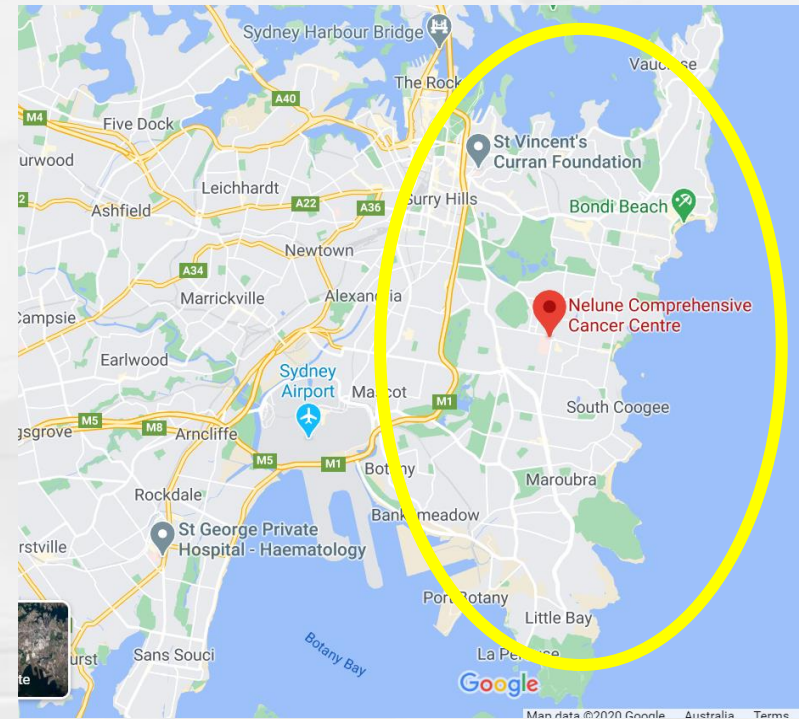
About Us:

Nelune Comprehensive Cancer Centre: Precinct of The Prince of Wales Hospital

Radiation, Medical Oncology and Haematology Services

Serves majority population of the Eastern Suburbs of Sydney

Close proximity to beaches

Google Maps, 2022

Coogee Beach (Photoscenic, 2022)

Elekta Versa HD (Coogee)
alignrt® Advance
Exactrac X-Ray

Elekta Versa HD (Bondi)

Mosaiq 2.64

Nelune Comprehensive Cancer Centre- Radiation Oncology

Elekta Infinity (Tamarama)
alignrt® Advance

AlignRT Clinical September 2020

Monaco HD

Raystation 11B
RayStation

CT Simulation Toshiba Acquilion CT
simrt™
ABC3

SimRT Clinical June 2022

Fig 1. Macromedics Breastboard

Fig 2a. Transverse slice of a Breast plan
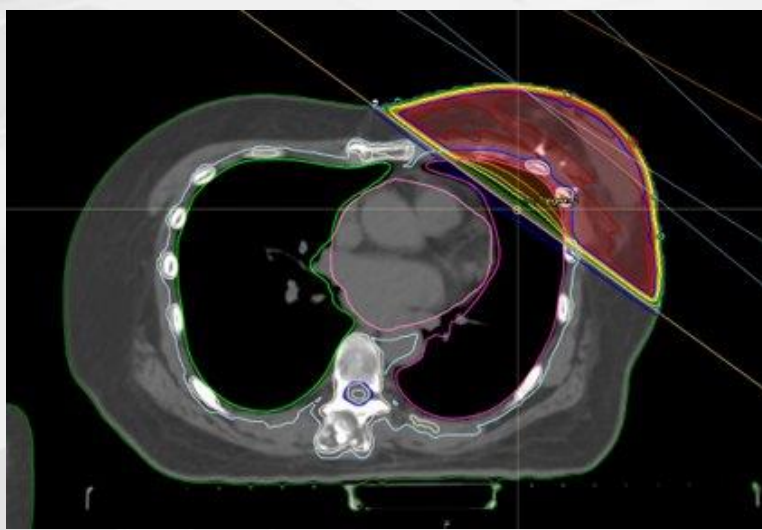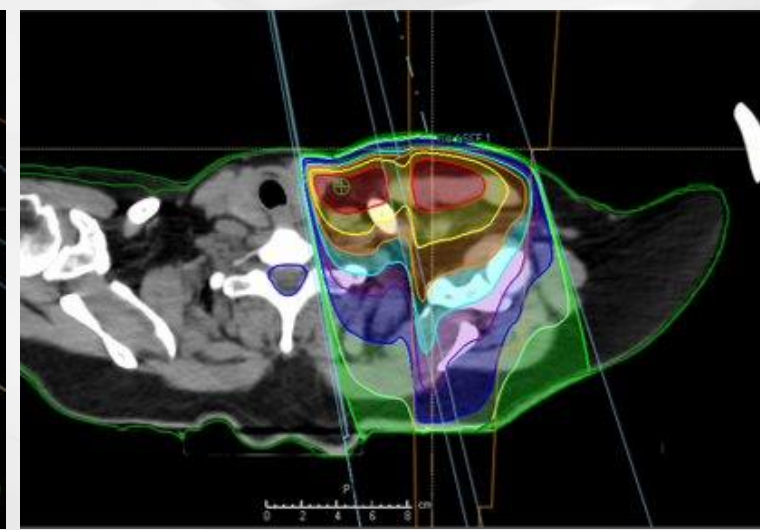

Fig 2b. Transverse slice of Supraclavicular plan

Breast Technique at NCCC

- Whole Breast Field Tangents with field in field segments

- Rarely VMAT or IMRT

- Supine on Breastboard

- Fractionation varies between 15/16 to 25 fractions.

- 3 /4 Field Monoisocentric Technique for Regional Lymph Nodes (LN)
  - Head turned away

- Pendulous breast patients: Bra cup worn

- IMC nodes: Mostly partially wide tangents less often electron beam match

- DIBH patients: Free-Breathing and Breath-hold CT scan.

Fig 3. Civco Bra-Cup

Breast Pre-treatment Imaging Protocol

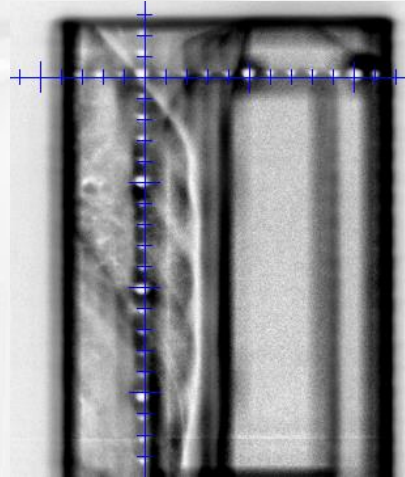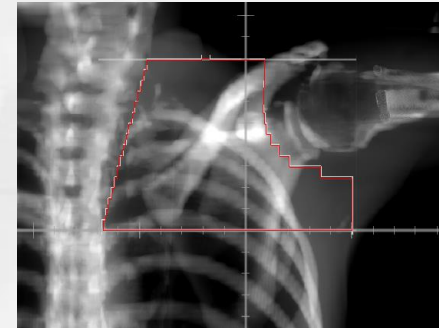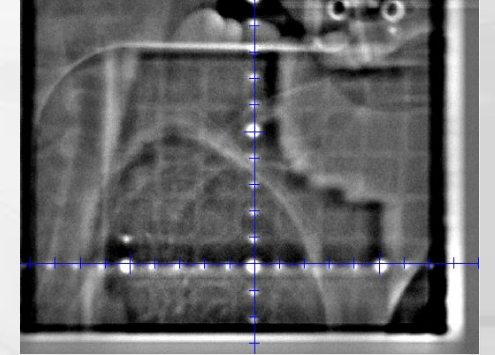Fig. 4a Tangent DRR   Fig. 4b Tangent EPI   Fig. 5a SCF DRR   Fig. 5b SCF EPI

- Pre-treatment MV EPI of Tangent Field plus MV EPI of Nodal Field (Anterior Oblique SCF or PA Axilla Field) on 1st and 2nd fractions then weekly EPIs

- Action level is 0.5cm

- If discrepancy ≥ 0.5cm, then adjust, capture new SGRT surface, treat and repeat pre-treatment EPIs on a daily basis until two consecutive fractions of EPIs are within 0.5cm.

- Since SGRT became clinical, less unscheduled, repeat EPIs were noticed…

Aim

- Primary: To quantify how significantly SGRT has reduced the number of repeat EPIs compared to tattoo-based setups amongst breast patients.

- Secondary: To determine whether if there are differences in the number of repeat EPIs amongst chestwall patients, breast-conserving surgery patients or patients wearing the Civco breast Cup.

What are the
advantages of
less
repeat imaging?

The advantages of less repeat imaging:

- Less dose – Adhering to ALARA Principle
    - Imaging dose is low compared to treatment but ideal to minimise dose for long term surviving patients
    - Especially younger patients

- Less time patient is on the couch
    - Less likely to move –reduce chance of intrafraction motion
    - Increases efficiency of the busy linac schedule

- Reduce patient anxiety – noticing extra amount of EPIs

- Reduce Occupational Health & Safety (OHS) Risk issue when attaching reticle onto gantry head for staff and patients

- Saves department resources on image storage and increase longevity of imaging panel

Pre-SGRT vs SGRT Cohort

Pre-SGRT Patients

- Anterior and Lateral tattoos for iso alignment

- Relied Setup photos and written instructions to reproduce arm and chin position

- Intra-fraction monitoring limited to patient compliance and checking audio-visual monitors

- DIBH patients: Spirometry based ABC3

SGRT Patients

- AlignRT Advance used for:

  - Tattooless Isocentre placement using breast/chestwall surface+Real Time Deltas (RTD)

  - Reproduce arm and chin position (Fig. 6)

  - Constant Intrafraction monitoring of patient's surface

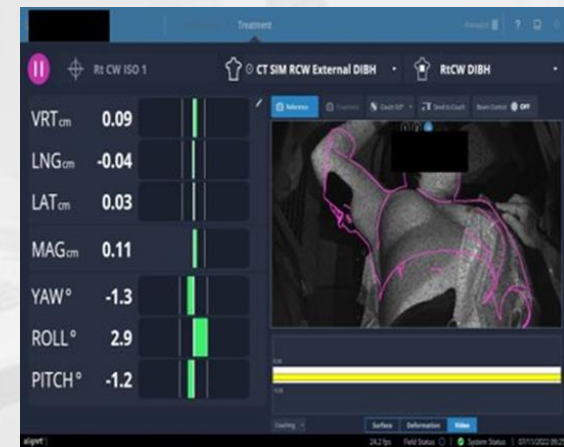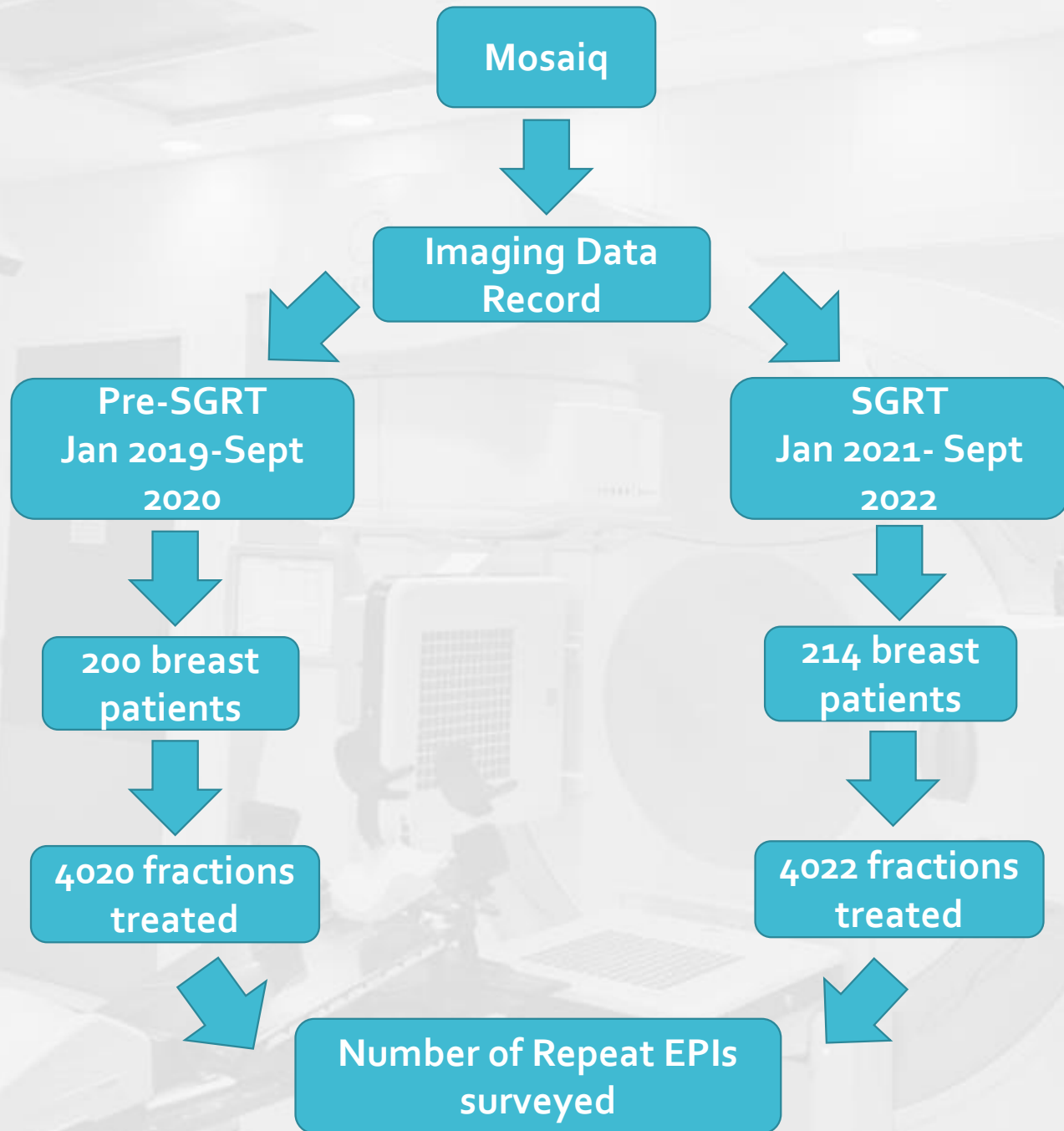 - DIBH: Real Time Coaching (RTC)

Fig 6. Patient contour used to reproduce arm and chin position

Study Design- Data Collection

Mosaiq

↓

Imaging Data Record

Pre-SGRT
Jan 2019-Sept 2020

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200 breast patients

↓

4020 fractions treated

SGRT
Jan 2021- Sept 2022

↓

214 breast patients

↓

4022 fractions treated

Number of Repeat EPIs surveyed

Study Method

- Inclusions in study:

  - Sex: Female
  - Age range: >18 years of age
  - Disease status: New Diagnosed breast cancer or diagnosed with recurrent breast cancer
  - Treatment history: Patients who received breast-conserving surgery or mastectomy and received breast radiation therapy either in free-breathing or Deep Inspiration Breath-hold (DIBH)
  - Breast patients who were required to wear a 'Civco' bra cup for their radiation therapy

- Exclusions from study:

  - Patients who wore the "Chabner bra" for treatment
  - Patients who received IMRT or VMAT radiation therapy and required a pre-treatment Cone-Beam Computed Tomography (CBCT) for treatment verification
  - Patients who received Bi-lateral breast treatments
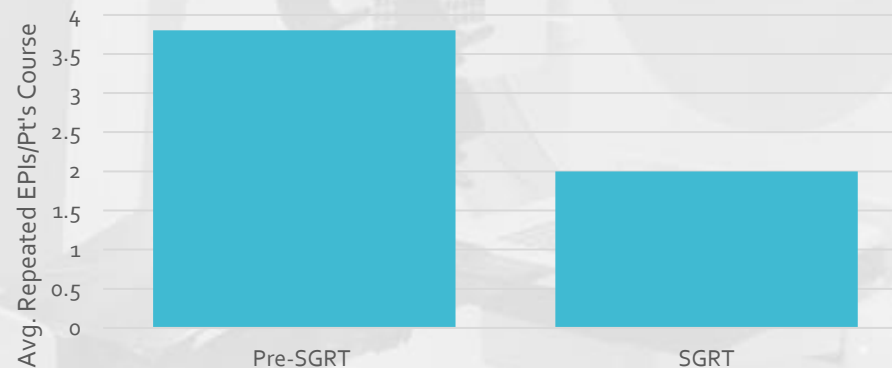
Results

Results

Summary of Repeated EPIs amongst all patients

	Pre-SGRT	SGRT	SGRT Benefit
Patients	200	214	
Fractions Delivered	4020	4022	
Repeated EPIs	757	433	
Avg. Repeated EPIs/Pt's Course	3.8	2	-1.8 (-47.4%)

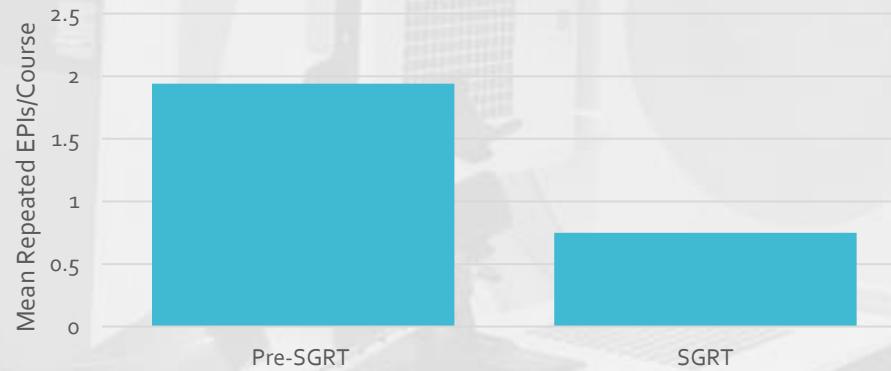'Avg. Repeated EPIs/Pt's Course amongst all breast patients'

Results

- Welch's unpaired t-test was used due to patients being independent of each other between the two samples.

- There was an extreme significant difference in the number of repeat EPIs between pre-SGRT patients and SGRT patients ($p < 0.0001$)

Results

Repeated EPIs amongst 2 Field TANGENT BREAST Patients WITHOUT Bra-Cup			
	Pre-SGRT	SGRT	SGRT Benefit
Patients	107	100	
Repeated EPIs	208	75	
Avg. Repeated EPIs/Pt's Course	1.9	0.75	-1.15 (-61.9%)

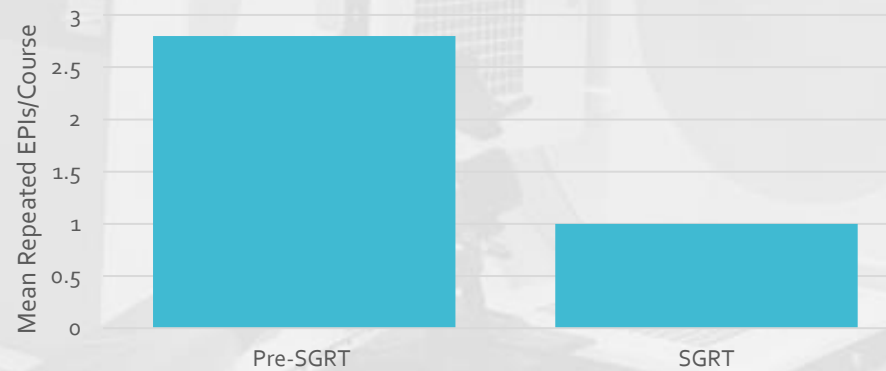'Mean Repeated EPIs/Course' amongst non-bra breast patients

Results

Repeated EPIs amongst 2 Field TANGENT BREAST Patients WITH Bra-Cup			
	Pre-SGRT	SGRT	SGRT Benefit
Patients	33	39	
Repeated EPIs	91	40	
Avg. Repeated EPIs/Pt's Course	2.8	1.0	-1.8 (-72%)

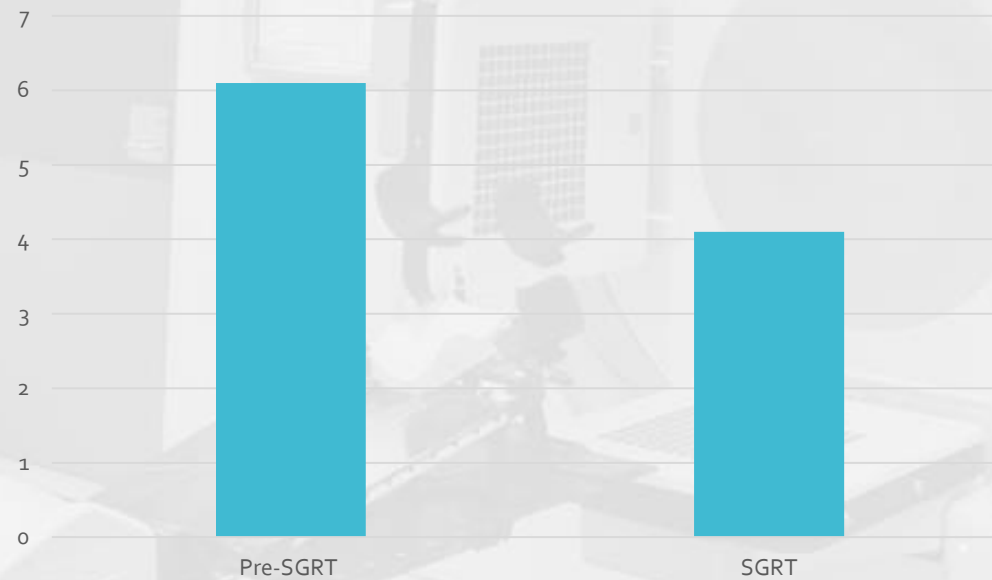'Mean Repeated EPIs/Course' amongst Breast patients with Bra-cup

Results

Repeated EPIs amongst CHESTWALL Patients

	Pre-SGRT	SGRT	SGRT Benefit
Patients	33	45	
Repeated EPIs	204	184	
Avg. Repeated EPIs/Pt's Course	6.1	4.1	-2.0 (-32.8%)

Mean Repeated EPIs/Course

Results

Repeated EPIs amongst FB Patients (Breast/Chestwall)			
	Pre-SGRT	SGRT	SGRT Benefit
Patients	154	119	
Repeated EPIs	539	229	
Avg. Repeated EPIs/Pt's Course	3.5	1.9	-1.6 (-45.7%)

'Average EPIs amongst FB Patients'
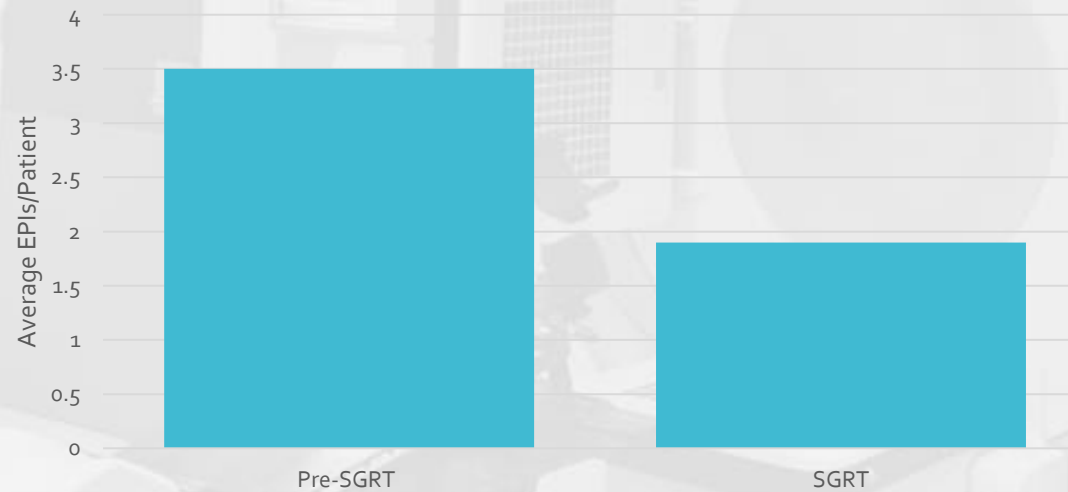
Results

Repeated EPIs amongst DIBH Patients (Breast/Chestwall)

	Pre-SGRT	SGRT	SGRT Benefit
Patients	46	95	
Repeated EPIs	218	204	
Avg. Repeated EPIs/Pt's Course	4.7	2.1	-2.6 (-55.3%)

'Average EPIs/Patient amongst DIBH patients'
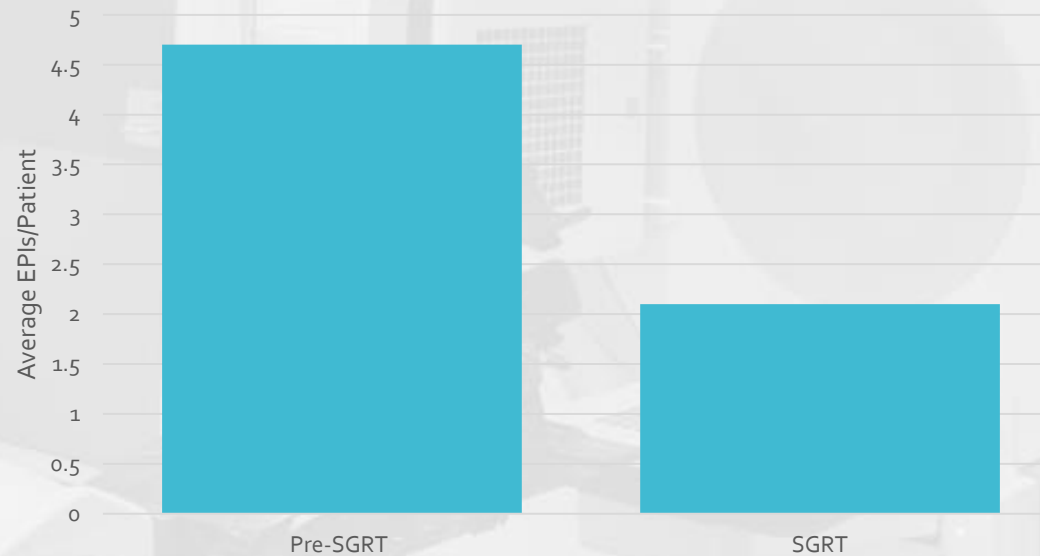
Discussion

- Most significant reduction in repeat EPI's amongst patients who wore bra-cups (-72%).
  - SGRT tracks whole breast surface instead of relying on tattoo marks which are subject movement of skin.
  - More reliable tool to setup larger breast patients.

- SGRT more effective in reducing repeat EPIs amongst breast patients compared to chestwall patients.
  - Breast surface has more dynamic topography than chestwall, allowing a more accurate match for SGRT.

- Notable decline in repeat EPIs amongst DIBH patients (-55.3%).
  - As patients breathe into their breath-hold position, their postural position usually change.
  - SGRT is a more accurate tool to correct for patient's postural changes when in BH during setup.

Conclusion

- SGRT technology has led to significantly more consistent setups and long term reduction in the amount of repeat EPIs amongst breast patients.

- SGRT is a more accurate tool which complements our breast EPI protocol to align the patient to the isocentre more accurately without tattoos nor additional ionising radiation.

Thank you

Questions?

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