

Surface Guided Radiotherapy (SGRT) vs Varian RPM for deep inspiration breathhold (DIBH) breast treatments



Darina Hickey, Luke Rock, Katie Clerkin, Aisling Mohan
 Beacon Hospital, Dept of Radiation Oncology, Dublin, Ireland

Introduction

Varian RPM marker block (Fig. 1) was used in the Beacon Hospital Radiotherapy Department since 2007 to treat breast patients in deep inspiration breathhold (DIBH). Patients had permanent tattoo marks on their skin to reproduce setup. In 2019 the Beacon moved to using Align RT for patient setup and treatment in DIBH. Align RT is a surface guidance system which projects a red speckle pattern onto the patients skin (Fig. 9) and compares this to the patient position at CT sim using a user-defined region of interest (pink contour in fig.2). Both a free breathing CT (for setup) and a DIBH CT are performed. The free breathing CT body surface is used to reproduce the patients setup, removing the need for tattoos. The DIBH CT body surface is used to reproduce DIBH throughout the treatment.

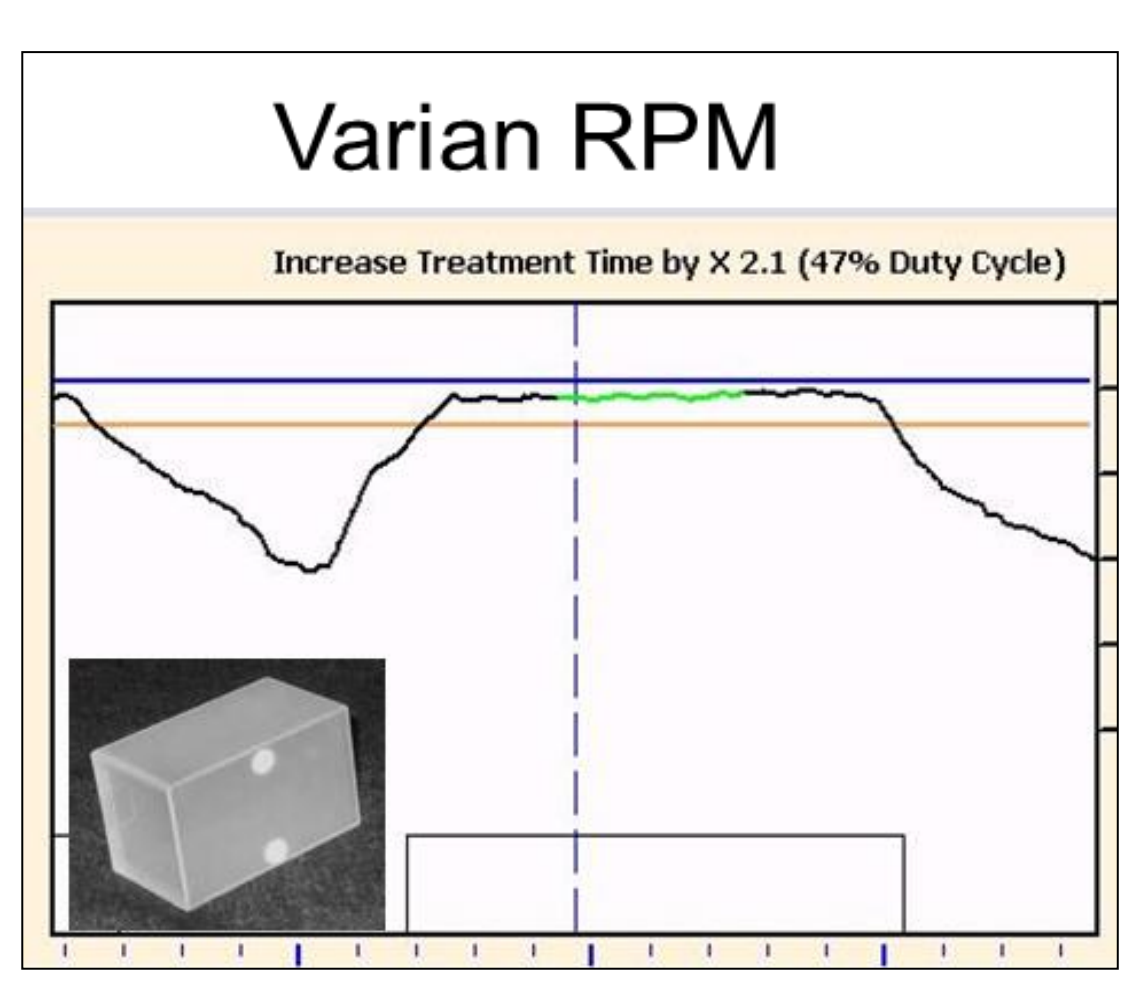


Fig. 1 Varian Real-time Position Management (RPM). Marker block placed on patients thorax to track breathing (inset).



Fig. 2 Align RT surface guided radiotherapy system. Pink shows CT sim position, green actual position.

Methods and Materials

An audit was performed to ensure that tattooless SGRT technique was comparable to tattoo and RPM technique.

Ten 2 field breast patients treated with Varian RPM in 2018 randomly selected for comparison with the first ten patients treated with Align RT. The audit was repeated in 2020.

The immobilization remained the same between the 2018, 2019 and 2020 cohorts (Fig.3). Daily MV imaging was performed for all patients.

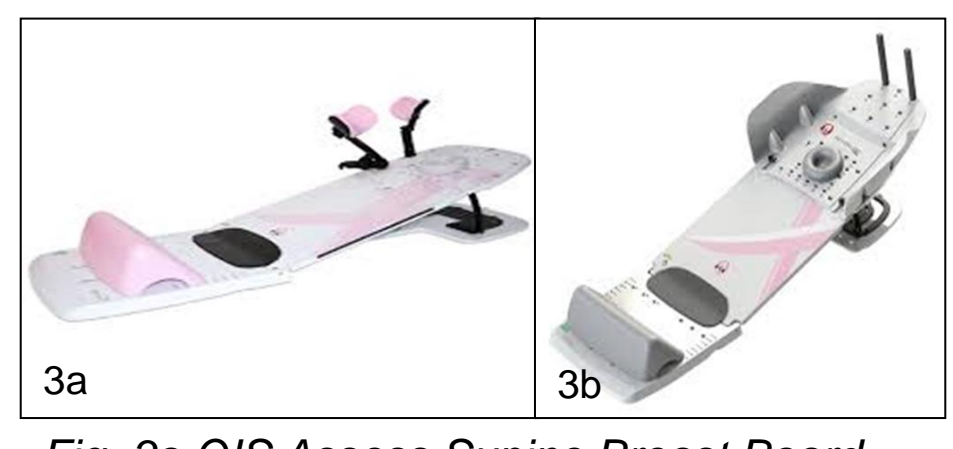


Fig. 3a OIS Assess Supine Breast Board
 Fig. 3b OIS Armshuttle Elite (used with vac bag for 3 field breast treatments).

Varian RPM	Align RT
marker block as surrogate for motion	patient skin surface
Tattoos	Tattooless
10 years experience 10 patients 2018	audit first 10 patients audit 10 patients at 1 year

Comparison

- Magnitude of shifts
- Repeated analysis 1 year later
- Total treatment time
- Number of re-setups for 2 & 3 field treatments

Results

Magnitude of shifts

- SGRT - peak shifted towards 0.0cm imaging shift in three directions.
- SGRT - increased frequency of (0.2cm) – (-0.2cm) imaging shifts in three directions. This is less pronounced but maintained for SGRT & 1 year, Fig 4.
- SGRT - more reliable for setup

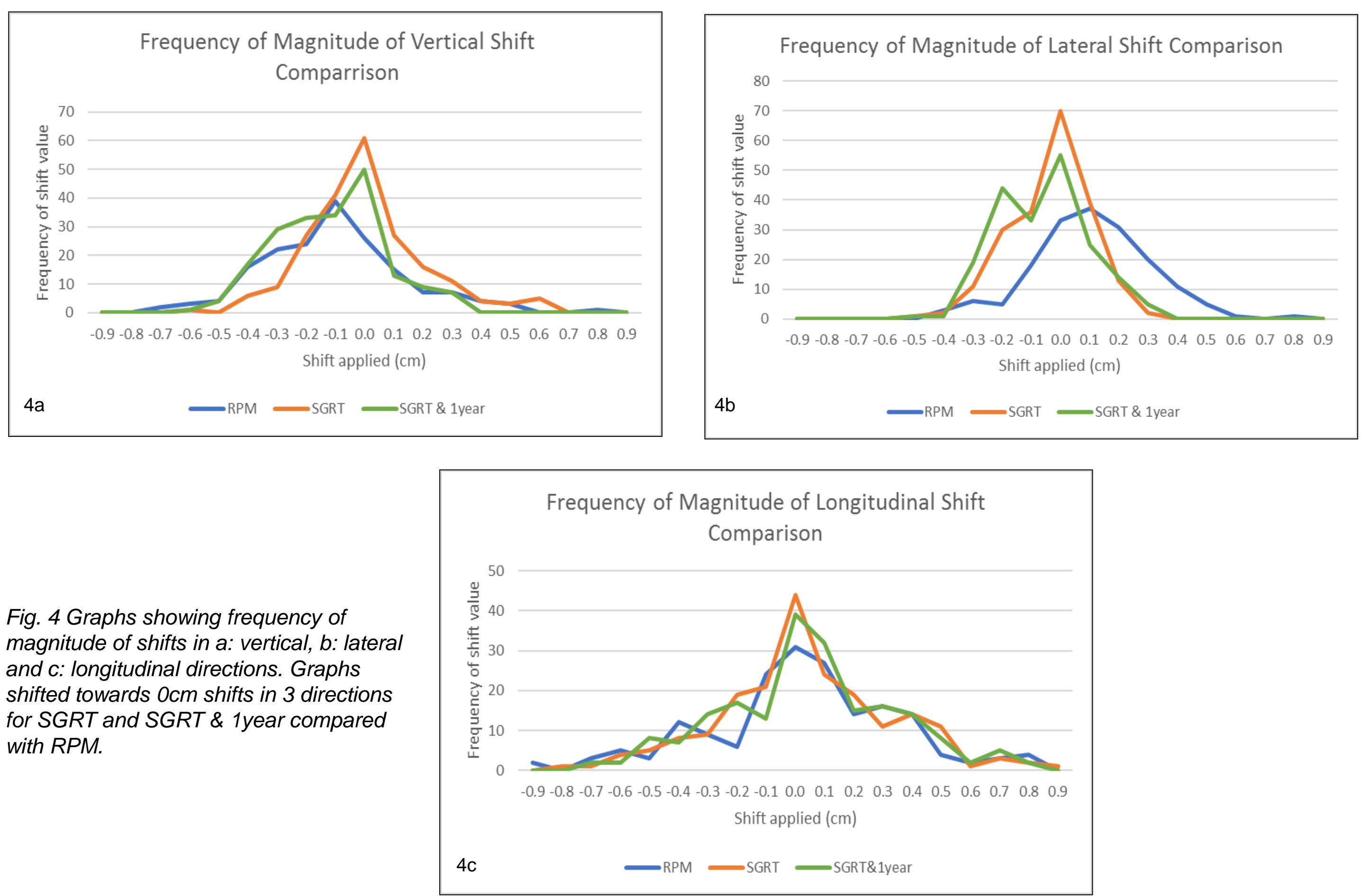


Fig. 4 Graphs showing frequency of magnitude of shifts in a: vertical, b: lateral and c: longitudinal directions. Graphs shifted towards 0cm shifts in 3 directions for SGRT and SGRT & 1year compared with RPM.

Number of re-setups

- Unchanged for 2 field breasts
- Intrafraction monitoring has not revealed patient motion during treatment
- Fig. 6 shows a significant decrease in re-setups for 3 field treatments with SGRT. Use of the arm ROI in Align RT has yielded better supraclavicular setup (Fig. 7).

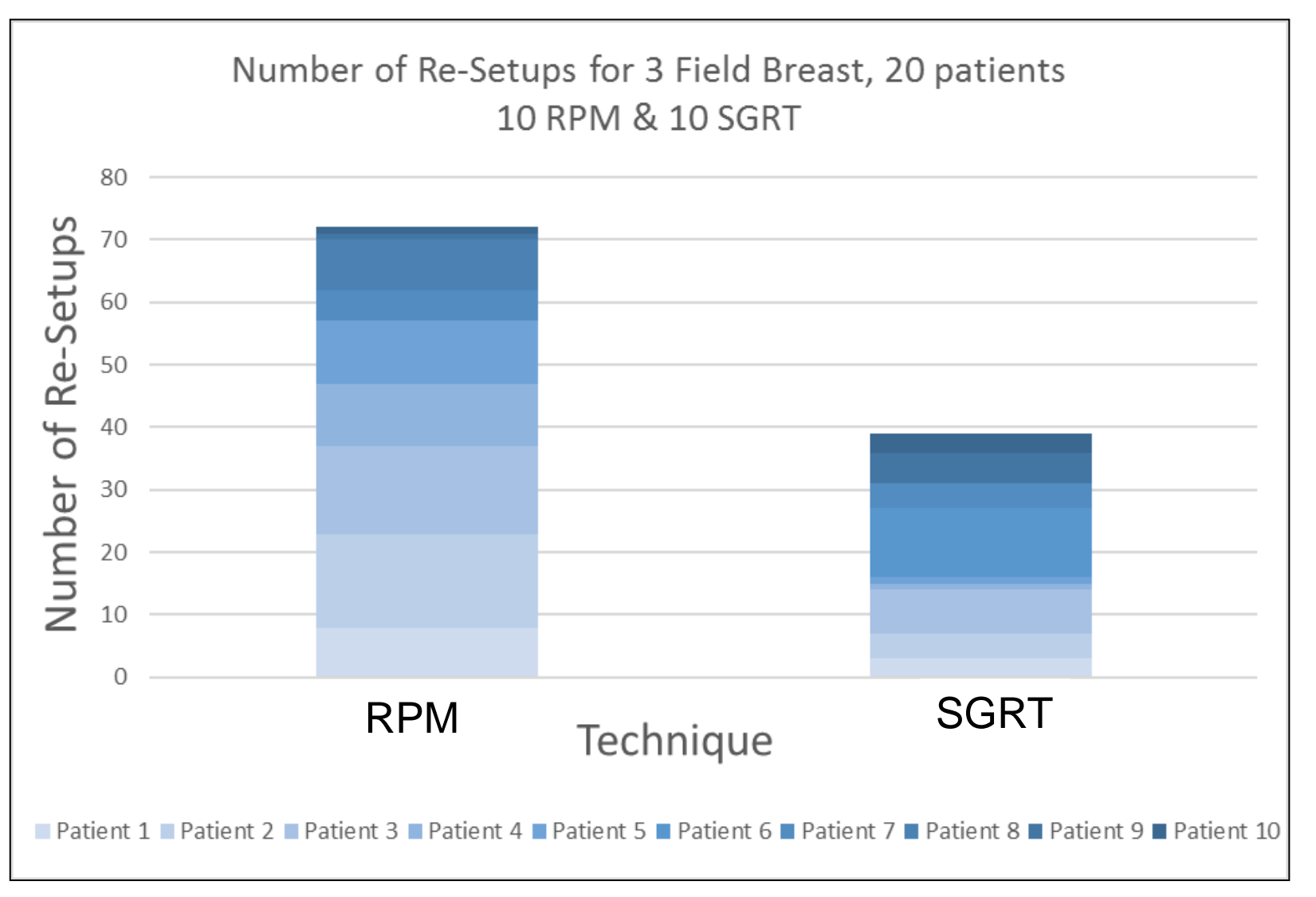


Fig. 6 Number of Re-Setups for 3 Field Breast treatments; 10 patients RPM & 10 patients SGRT

Additional Advantages of Align RT

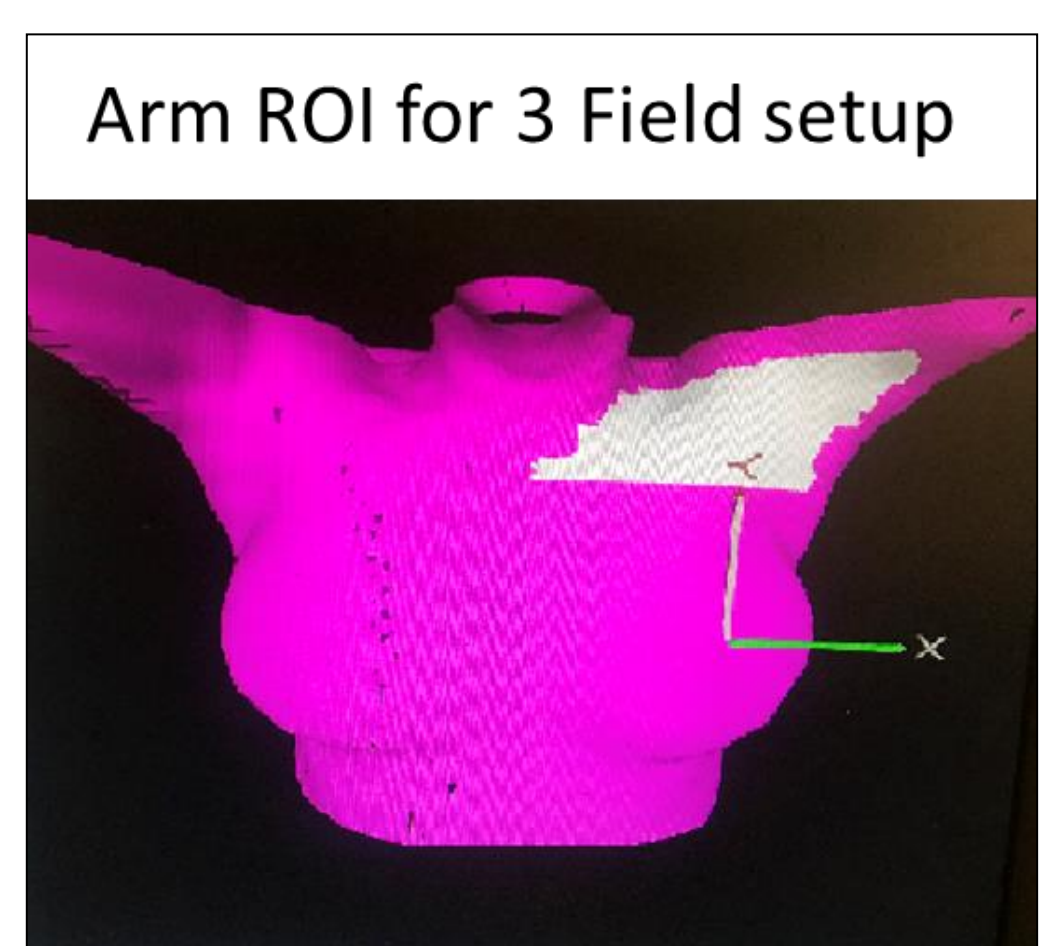


Fig. 7 Align RT - additional arm ROI for setting up 3 Field breast treatments.

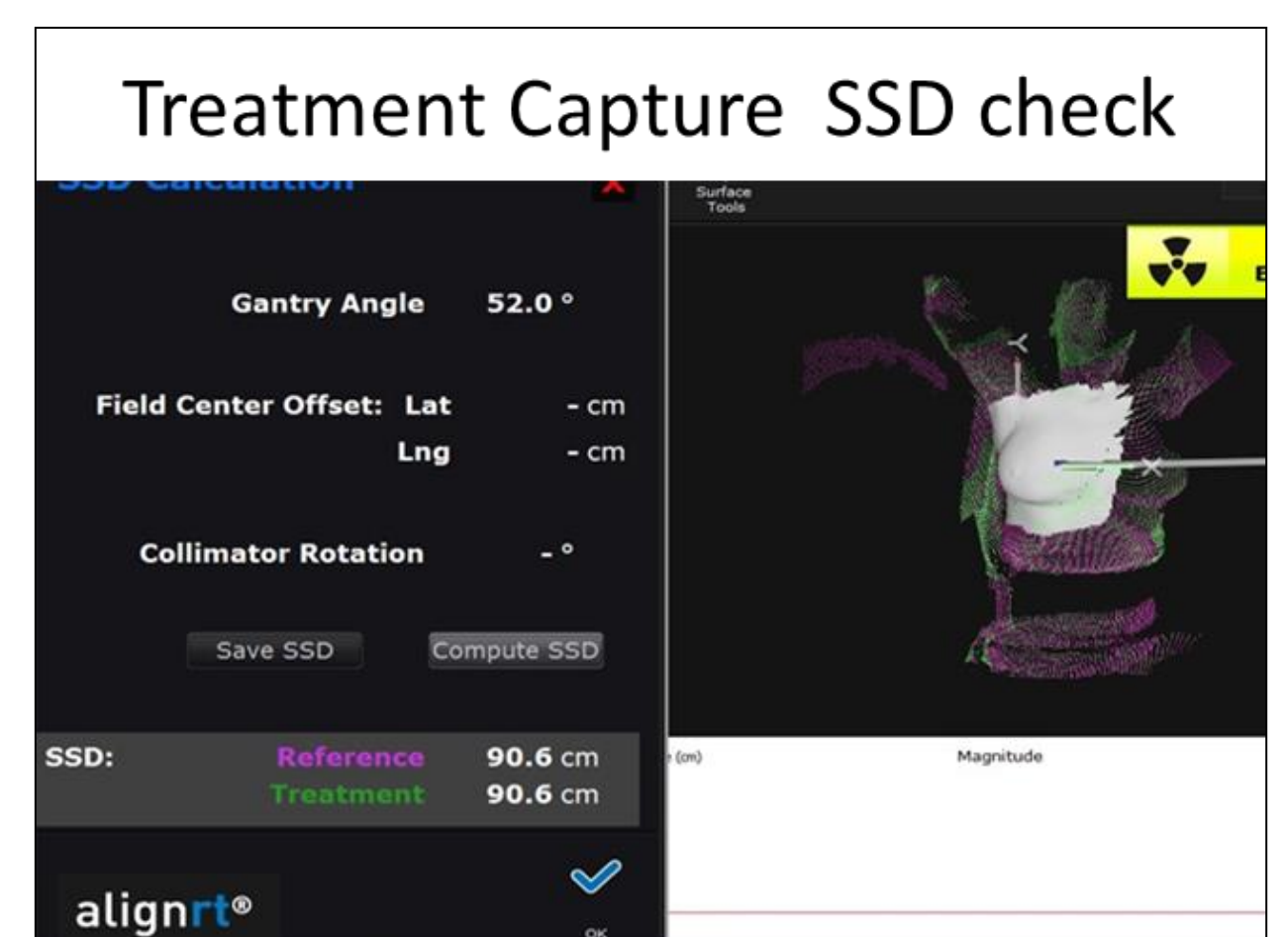


Fig. 8 SSD check performed by taking treatment capture after imaging

Average treatment time

- SGRT - treatment time reduced from average 15 minutes per patient with RPM to 10 minutes per patient with SGRT, Fig 5.

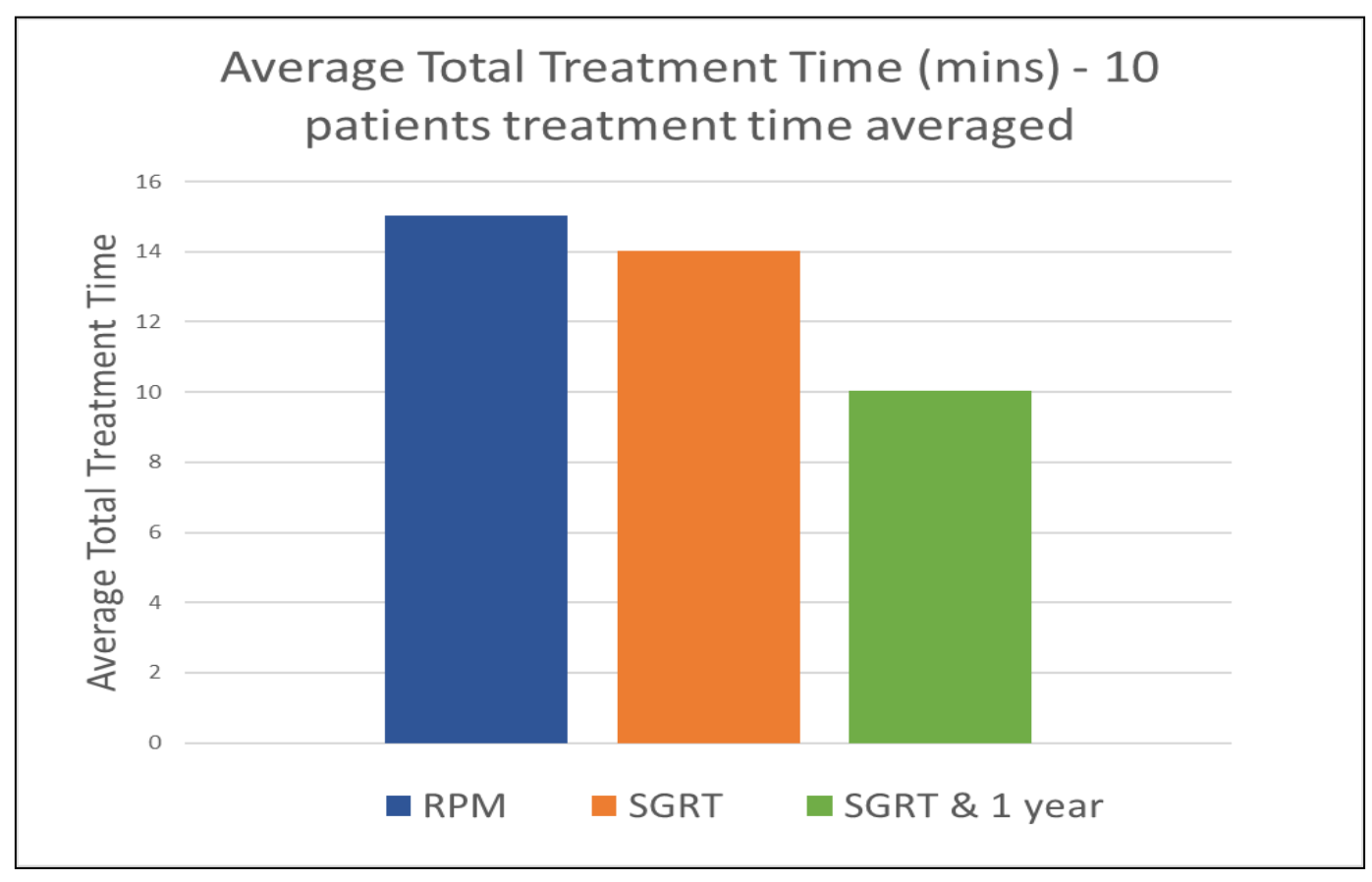


Fig. 5 Average total treatment time – reduced from 15 minutes with RPM to 10 minutes SGRT & 1 year

Conclusions

- SGRT now used as standard for all breast treatments
- Tattooless treatments – more patient friendly
- Improved accuracy with reduction in magnitude of shifts
- Reliable set up – daily imaging required?
- Faster setup, saving on average 5 minutes per patient
- Improved safety standards with real time intrafraction monitoring
- Positive staff experience, user friendly & easy to implement

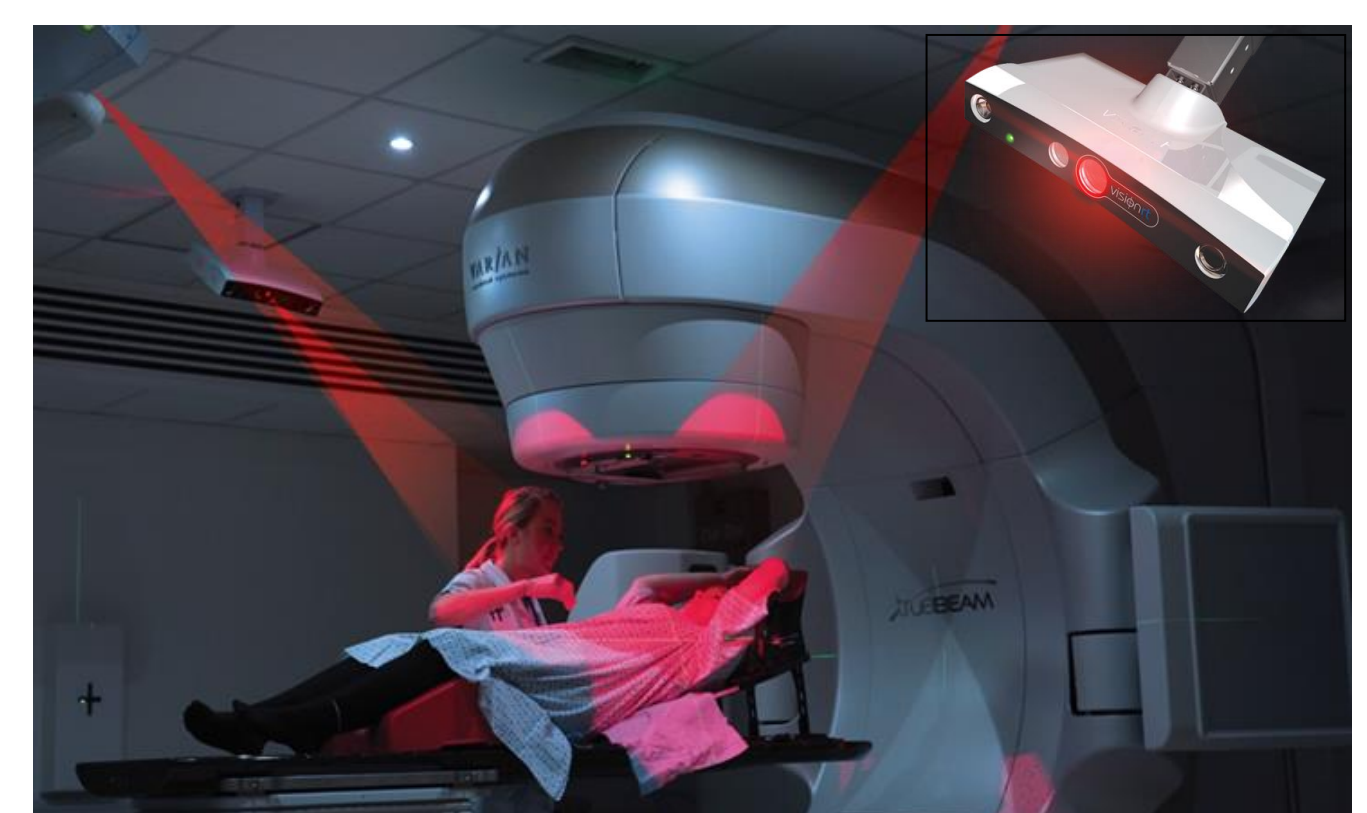


Fig. 9 Align RT red speckle pattern projected onto patient skin