Queen Elizabeth Hospital Birmingham: Our journey with SGRT.

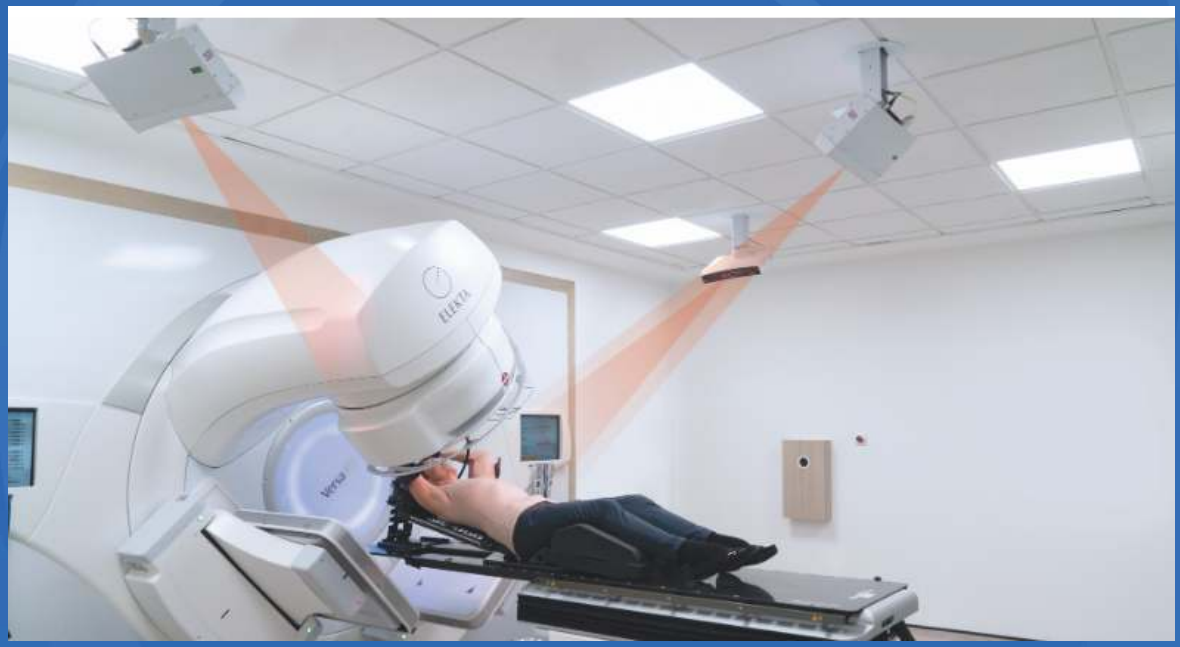
Initial SGRT interest @ QEHB

- DIBH technique required
- Preferred option - SGRT facilitated technique
- Team interested in VisionRT – Approached hospital charity to fund AlignRT purchase for DIBH.

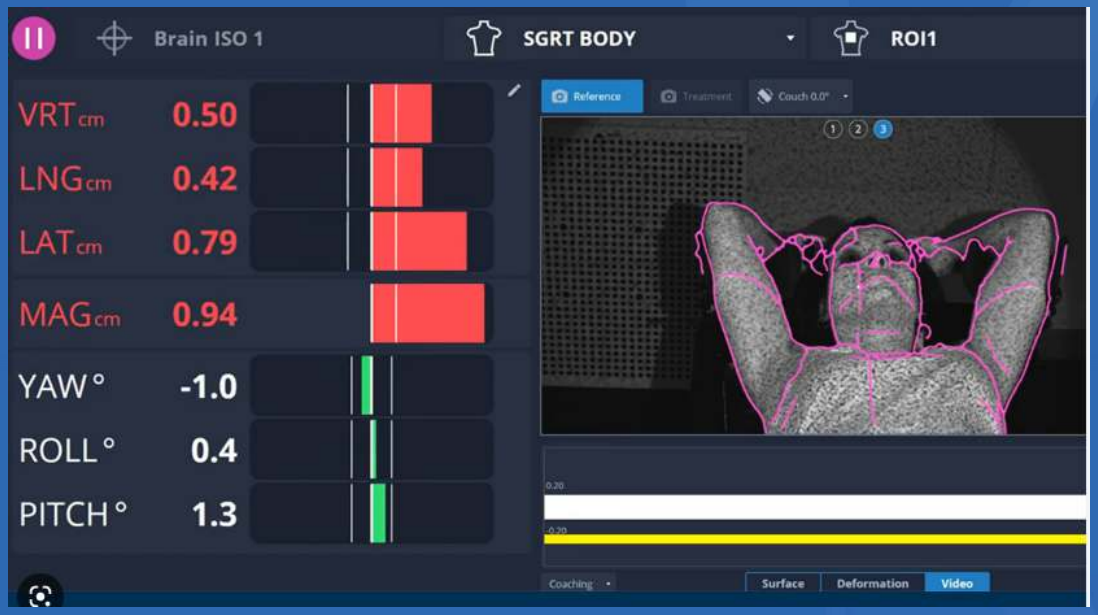
- Clinical in June 2018 with DIBH originally
- Training and support form VisionRT
- By December 2018 – 100% DIBH

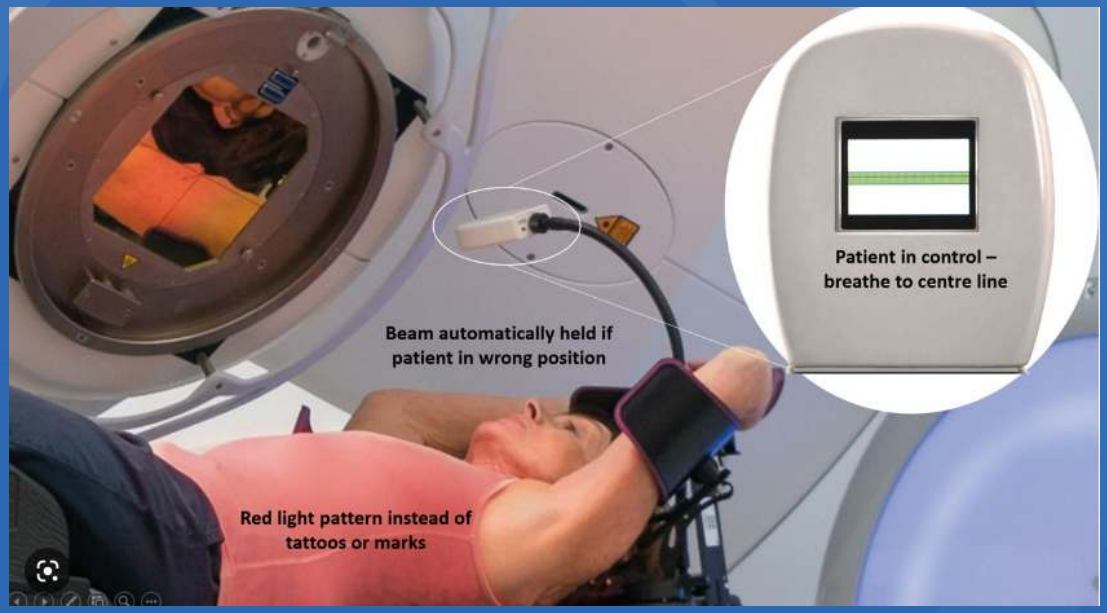
Benefits of SGRT for DIBH

- Remote from patient



- Feedback to patient – Real Time Coach





- Real time monitoring during RT (and beam off)
- Identifies any back arching or shoulder shrugging
- Accuracy and efficiency gains

Accuracy

- Audit confirmed our experience – improved accuracy for DIBH based on EPID results
- When DIBH became routine, we moved to SGRT set ups for all breasts – NB. patients still had tattoos
- Accuracy audit repeated on this group - improved accuracy for free breathing patients.

Accuracy summary

	Tattoo	SGRT DIBH	SGRT FB
% of patients with systematic error – shifts applied	28.1%	4.2%	5.4%
% of patients requiring repeat imaging	21.9%	10.5%	23%
Maximum number of repeat images throughout a patients treatment course	6	1	3
	n=96	n=95	n=91

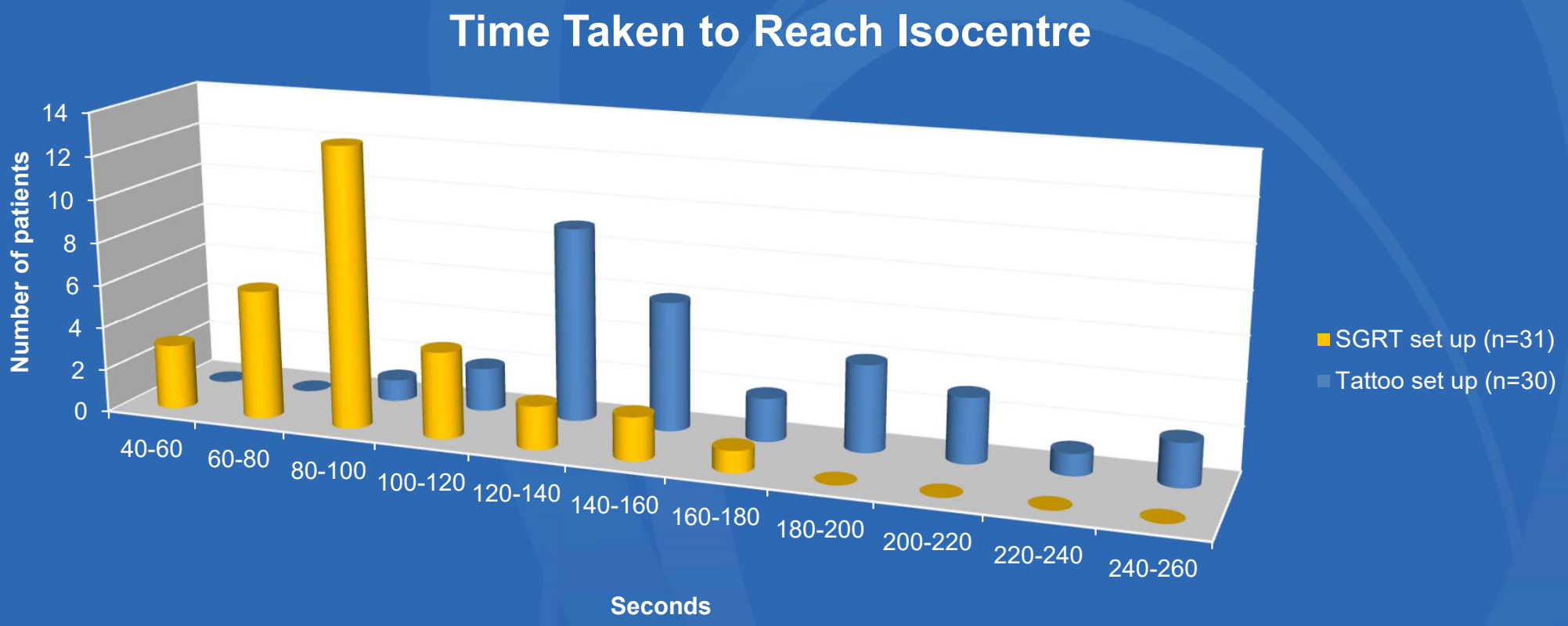
- These results gave us the information and confidence needed to go fully markerless
- Unethical not to
- Consultants were supportive.

Efficiency

- As we increased the amount of patients we positioned with SGRT, it became apparent that it was more efficient

- Accuracy and efficiency – perfect addition to any B/C

Efficiency Results:



Summary

	Time taken to reach isocentre
Tattoo: Range Average n=30	 1 min 28 secs – 4 mins 5 secs 2 minutes 38 secs
SGRT: Range Average n=31	 48 secs – 2mins 55 secs **1 minute 31 secs**
SGRT saving	**1 minute 7 secs (42.5%)**

- Time saving comes from the removal of planned shifts from tattoos to isocentre
- No time wasted moving largely irrelevant tattoos in to position
- Position the area we actually want to treat directly into the correct position.

- Reduction in the difficult set ups that delay the room and inconvenience the patient
- Reduction in physical manipulation of the patient – maintaining their dignity/manual handling
- Some patients could only be positioned with AlignRT.

Other SGRT sites

- Open face masks

- AlignRT gating activated with 0.1cm and 1 degree tolerances set

- Mid-way CBCT first 5 # to monitor intrafractional motion

- If less than 0.2cm move to weekly mid-way CBCT

Reproducibility – pre treatment CBCT

Translational Standard Deviation			
	X	Y	Z
Non-SGRT (Group A)	0.14	0.29	0.20
SGRT (Group B)	0.12	0.18	0.10

Rotational Standard Deviation			
	X	Y	Z
Non-SGRT (Group A)	0.97	3.55	1.37
SGRT (Group B)	1.09	1.22	1.23

Intrafractional motion

Mid-way translational changes on CBCT	
Translations on all axis ≤1mm	76/99# (76.8%)
Translations on all axis >1mm ≤1.5mm	21/99# (21.2%)
Translations on all axis ≥1.6mm ≤2.5mm	2/99# (2%) AlignRT interrupted delivery of RT on 2/2

Mid-way rotational changes on CBCT	
Rotations on all axis ≤1 degree	92/99# (92.9%)
Rotations on all axis >1 ≤1.5 degrees	7/99# (7.1%)

Conclusions

- **Reproducibility**
  - AlignRT reduced the amount of translational and rotational error seen on the pre-treatment CBCTs when compared to the non-SGRT technique, suggesting a more accurate setup is achieved
  - AlignRT alerts the radiographers to positional error prior to CBCT acquisition.

- **Intrafractional motion:**
  - ➢Majority of patients demonstrate continued immobilisation
  - ➢AlignRT correlates well with the mid-way CBCTs
  - ➢AlignRT interrupted delivery in 2 patients when intrafractional motion was identified.

- SGRT enables the safe utilisation of open faced masks
- Clear benefit of improving patient experience without compromising on accuracy of radiotherapy
- Massive potential for paediatric patients.

Markerless for paediatric patients

- We have treated several paediatric patients without tattoos – particularly important for patient group
- Less trauma at CT planning – no needles for tattoos
- Quick set up, minimal manual handling

SABR

- Monitoring alone – less subjectivity
- BH facilitation for lung (potential benefit for lower lobe particularly)
- BH for abdominal SABR

Limbs

- Limbs are notoriously difficult to reposition
- AlignRT greatly assists with rotations
- Multiple ROIs can be utilised

Ad-hoc

- If we have a potentially difficult patient at CT we make sure they are booked on to a linac with SGRT.

Any site

- SGRT could be used to treat any site
- Breast is obvious as we don't all online image and it's a surface structure
- Paediatrics, limbs, pelvic, SRS - anything

Thank you!