Abdominal/Pelvis setup accuracy using skinmark-free SGRT – a retrospective analysis

Catherine Russell

Alfred Health Radiation Oncology
Melbourne, Victoria

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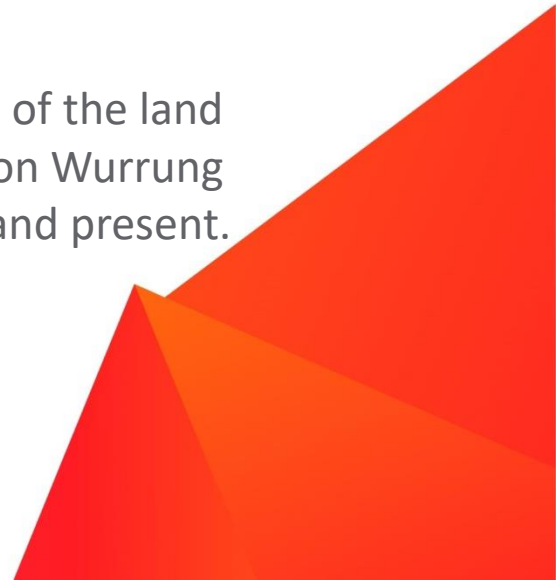
Disclosures

Alfred Health is an Australasian Reference Site for VisionRT. Travel relating to this event has been reimbursed by VisionRT.

Acknowledgement of Country

I would like to respectfully acknowledge the Traditional Owners of the land on which we meet today, the Wurundjeri Woi-Wurrung and Boon Wurrung people of the Kulin Nation, and pay my respects to Elders past and present.



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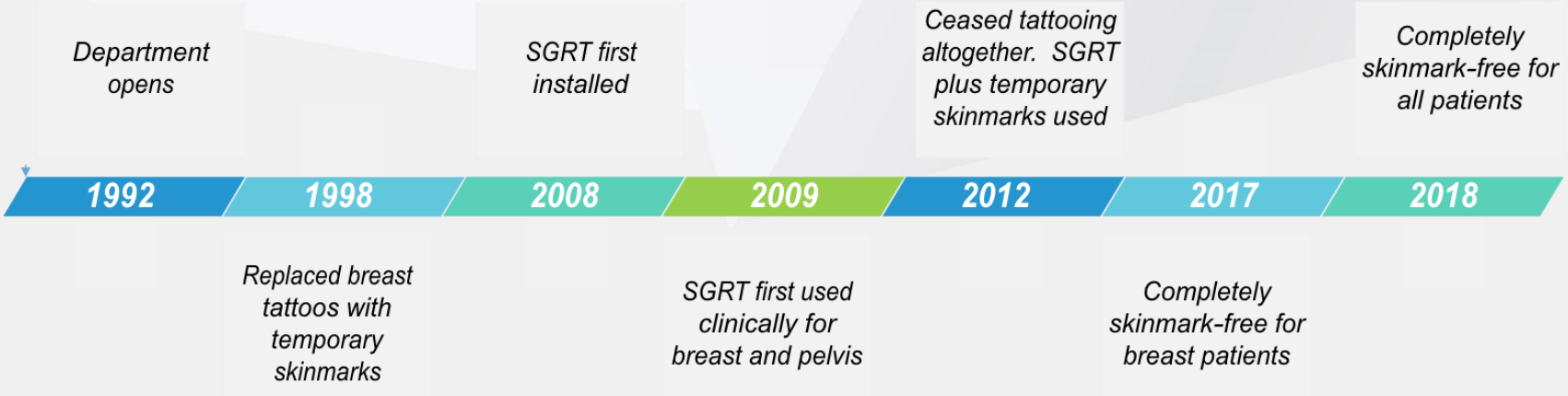
SGRT at Alfred Health – a very brief history



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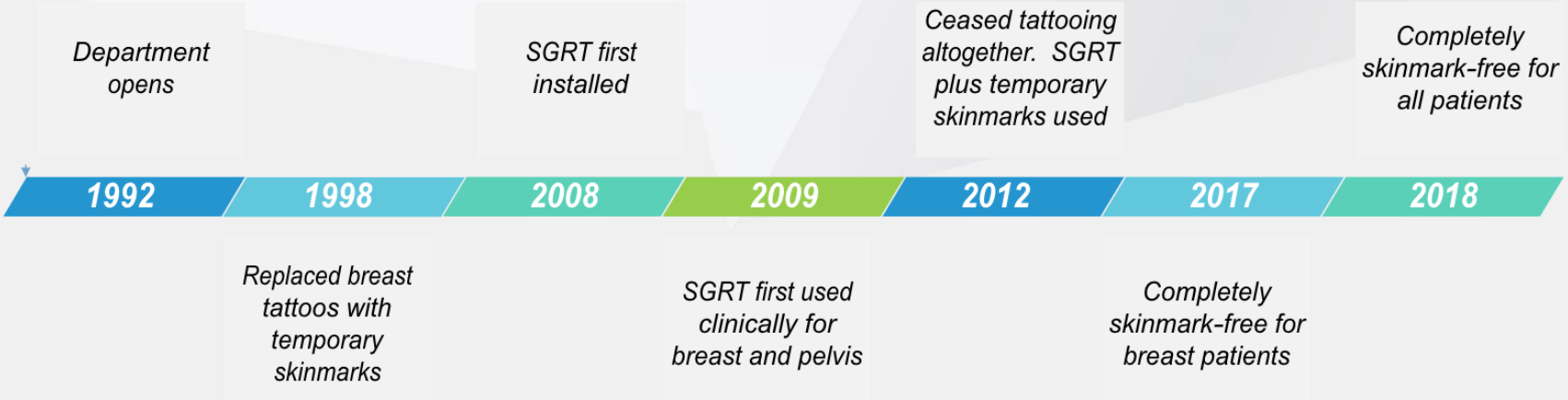
SGRT at Alfred Health – the leap to “skinmark-free”



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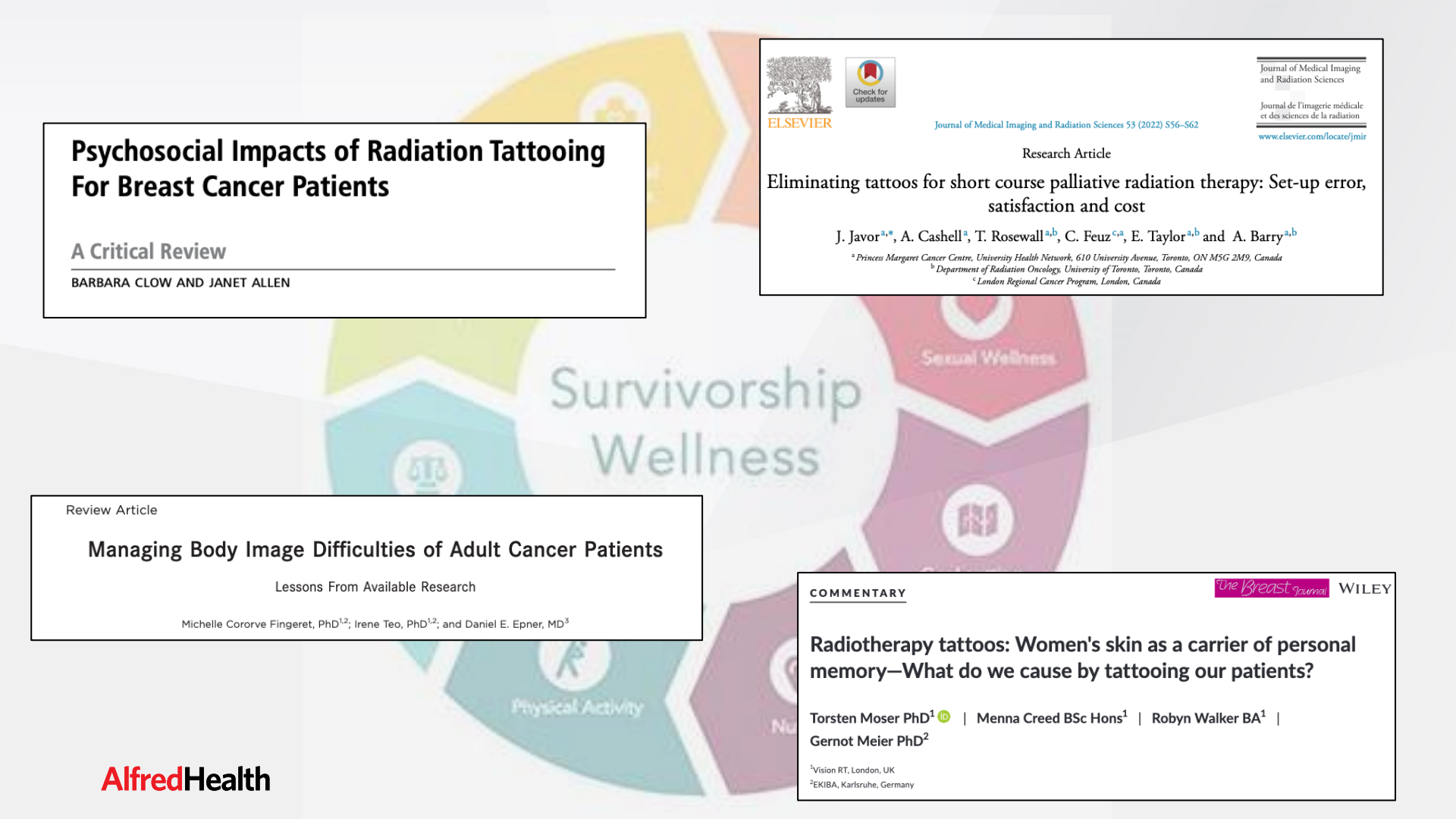

Psychosocial Impacts of Radiation Tattooing For Breast Cancer Patients

A Critical Review

BARBARA CLOW AND JANET ALLEN

ELSEVIER

Check for updates

Journal of Medical Imaging and Radiation Sciences

Journal de l'imagerie médicale et des sciences de la radiation

Journal of Medical Imaging and Radiation Sciences 53 (2022) S56–S62

www.elsevier.com/locate/jmir

Research Article

Eliminating tattoos for short course palliative radiation therapy: Set-up error, satisfaction and cost

J. Javor[a,*], A. Cashell[a], T. Rosewall[a,b], C. Feuz[c,a], E. Taylor[a,b] and A. Barry[a,b]

[a] *Princess Margaret Cancer Centre, University Health Network, 610 University Avenue, Toronto, ON M5G 2M9, Canada*
[b] *Department of Radiation Oncology, University of Toronto, Toronto, Canada*
[c] *London Regional Cancer Program, London, Canada*

Review Article

Managing Body Image Difficulties of Adult Cancer Patients

Lessons From Available Research

Michelle Cororve Fingeret, PhD[1,2]; Irene Teo, PhD[1,2]; and Daniel E. Epner, MD[3]

COMMENTARY

The Breast Journal WILEY

Radiotherapy tattoos: Women's skin as a carrier of personal memory—What do we cause by tattooing our patients?

Torsten Moser PhD[1] | Menna Creed BSc Hons[1] | Robyn Walker BA[1] | Gernot Meier PhD[2]

[1]Vision RT, London, UK
[2]EKIBA, Karlsruhe, Germany

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Skinmark-free RT workflow at the Alfred

CT Simulation	Planning	Pre-Treatment Preparation	Treatment Setup	IGRT and Treatment Delivery
Select equipment well indexed to couch Record/photograph virtual reference line landmarks based on CT lasers (e.g midline, horizontal baselines) No marks/tattoos drawn on patient	Selecte appropriate isocentre position Isocentre recorded in relationship to virtual reference lines Rendered views/ diagrams created showing isocentre on patient surface	RTs export patient to SGRT system DICOM body contour selected as default daily setup surface RTs define ROI based on departmental protocols	Patient positioned on indexed equipment. Set planned couch values SGRT monitoring turned on. Check gross position ok? Crosscheck iso against planning landmarks/ diagrams Fine tune translations/ rotations based on SGRT	Acquire either kV paired or CBCT verification images Online match, correction to zero in all available translations and rotations New daily SGRT monitoring surface acquired after corrections Treatment proceeds

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Study aims

- What setup accuracy was being achieved with completely skinmark-free setup of abdomen and pelvis patients at our centre?

- As setup accuracy was determined by analysing IGRT in this study, what was the relationship between setup accuracy and method of image assessment (bony vs soft tissue)?

Low Risk Ethics approval obtained for this study

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Method

Study period July 2018 – June 2021

Obtained list of all patients treated at our centre, sorted by VRMDS site

VRMDS site codes used to identify abdomen and pelvis treatments

316 patients (74 abdomen, 242 pelvis)

Treatment encompassed palliative, radical, SABR

4,883 fractions

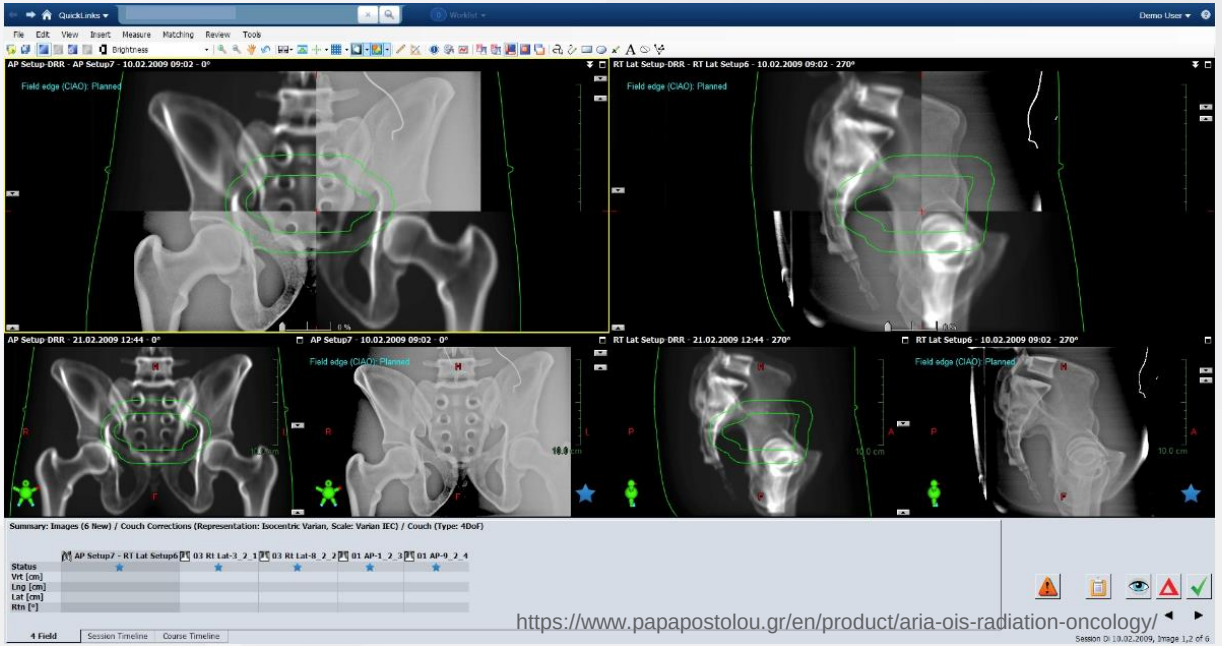
Method

Data taken from first IGRT after SGRT setup

ARIA Offline Review reporting extracted using in-house Python script

Available translations and rotations recorded

Each individual fraction considered separate data point



https://www.papapostolou.gr/en/product/aria-ois-radiation-oncology/

kV paired data: Vert, long, lat, yaw

CBCT data: Vert, long, lat, yaw, pitch, roll

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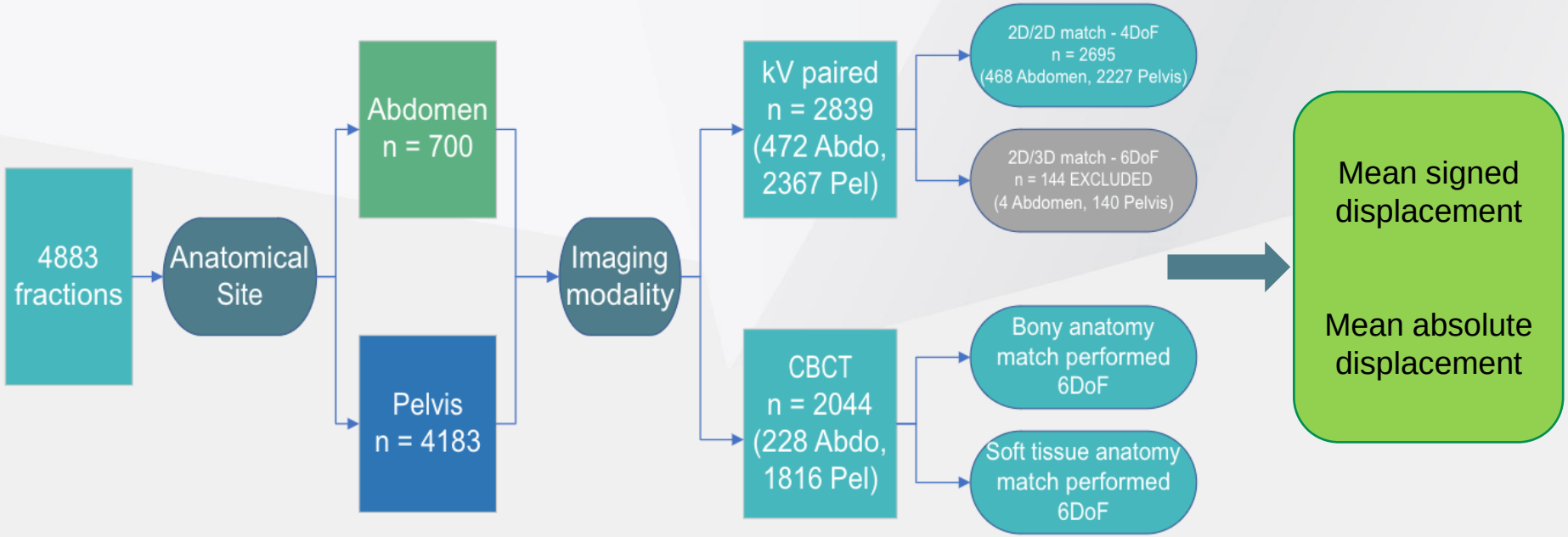
Method



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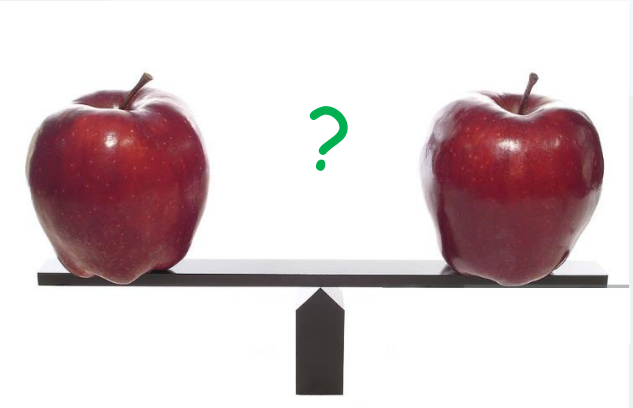
Results

		Mean signed displacement (std dev)		Mean absolute displacement (std dev)	
		kV paired *n* = 468	CBCT *n* = 228	kV paired	CBCT
Abdomen	**Vert** mm	**-0.7** (4.4)	**-1.5** (3.3)	**3.4** (2.9)	**2.9** (2.1)
	Long mm	**-0.9** (5.3)	**-2.0** (6.5)	**3.9** (3.7)	**5.0** (4.7)
	Lat mm	**0.9** (3.1)	**-0.1** (6.2)	**2.4** (2.2)	**2.9** (5.5)
	Yaw deg	**0.0** (1.0)	**-0.0** (1.1)	**0.7** (0.7)	**0.8** (0.7)
	Pitch deg	-	**0.4** (1.1)	-	**0.8** (0.8)
	Roll deg	-	**-0.1** (1.3)	-	**0.9** (0.9)
		kV paired *n* = 2227	CBCT *n* = 1816	kV paired	CBCT
Pelvis	**Vert** mm	**-1.1** (3.2)	**-1.3** (3.6)	**2.5** (2.3)	**3.0** (2.3)
	Long mm	**-1.8** (5.4)	**-1.8** (4.8)	**3.9** (4.1)	**4.0** (3.2)
	Lat mm	**0.1** (2.9)	**0.2** (1.8)	**1.6** (2.4)	**1.4** (1.1)
	Yaw deg	**-0.1** (0.9)	**-0.0** (1.1)	**0.6** (0.7)	**0.8** (0.7)
	Pitch deg	-	**0.2** (1.4)	-	**1.1** (0.9)
	Roll deg	-	**-0.1** (0.9)	-	**0.6** (0.7)

Comparison to published literature



Original Article

Optical Surface Scanning for Patient Positioning in Radiation Therapy: A Prospective Analysis of 1902 Fractions

Technology in Cancer Research & Treatment
Volume 17: 1-9
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DOI: 10.1177/1533038818806002
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G Carl[1,*], D Reitz, MD[1,*], S Schönecker, MD[1], M Pazos, MD[1], P Freislederer[1], M Reiner, PhD[1], F Alongi, MD[2,3], M Niyazi, MD[1], U Ganswindt, MD[1,4], C Belka, MD[1], and S Corradini, MD[1]

Walter *et al. Radiation Oncology* (2016) 11:154
DOI 10.1186/s13014-016-0728-1

Radiation Oncology

RESEARCH Open Access

Evaluation of daily patient positioning for radiotherapy with a commercial 3D surface-imaging system (Catalyst™)

F. Walter[1*†], P. Freislederer[1†], C. Belka[1], C. Heinz[1], M. Söhn[1] and F. Roeder[1,2]

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Comparison to published literature

CBCT Mean signed displacement (std dev)

		Alfred	**Carl et al**		**Walter et al**	
		n = 228	*n* = 630		*n* = <154	
		SGRT	**SGRT**	**Skinmarks**	**SGRT**	**Skinmarks**
Abdomen	**Vert** mm	**-1.5** (3.3)	**-0.6** (5.6)	**0.7** (3.9)	**2.1** (5.5)	**2.1** (2.7)
	Long mm	**-2.0** (6.5)	**2.0** (5.3)	**1.6** (4.2)	**2.6** (1.8)	**-0.4** (1.2)
	Lat mm	**-0.1** (6.2)	**-0.5** (4.9)	**-0.1** (4.0)	**0.3** (2.2)	**2.2** (1.3)
		n = 1816	-		*n* = <154	
Pelvis	**Vert** mm	**-1.3** (3.6)	-	-	**1.6** (2.2)	**1.0** (1.1)
	Long mm	**-1.8** (4.8)	-	-	**-1.7** (2.8)	**0.4** (1.4)
	Lat mm	**0.2** (1.8)	-	-	**-0.9** (1.5)	**-0.9** (1.4)

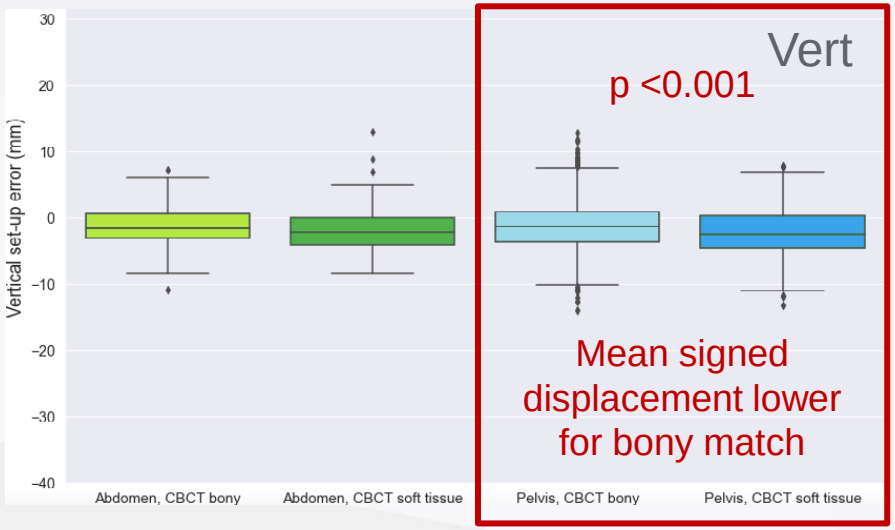
Bony vs. soft tissue match analysis

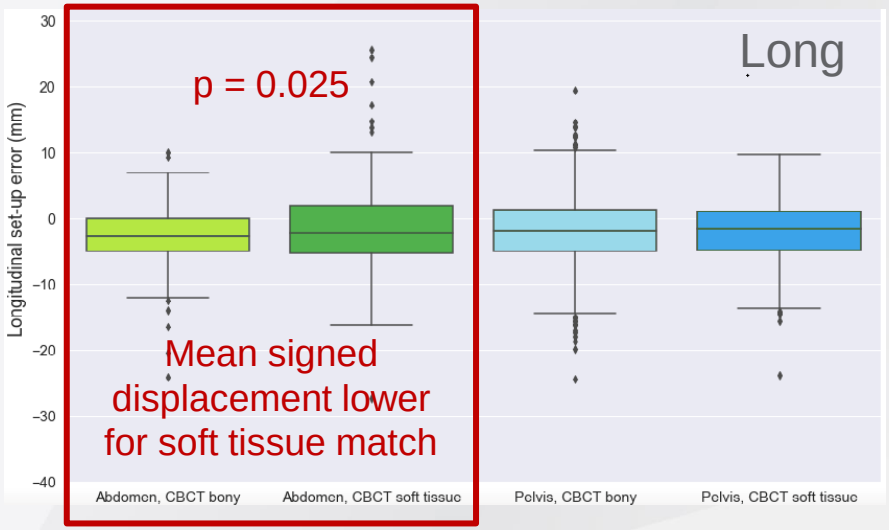
Online IGRT match method determined by departmental policy

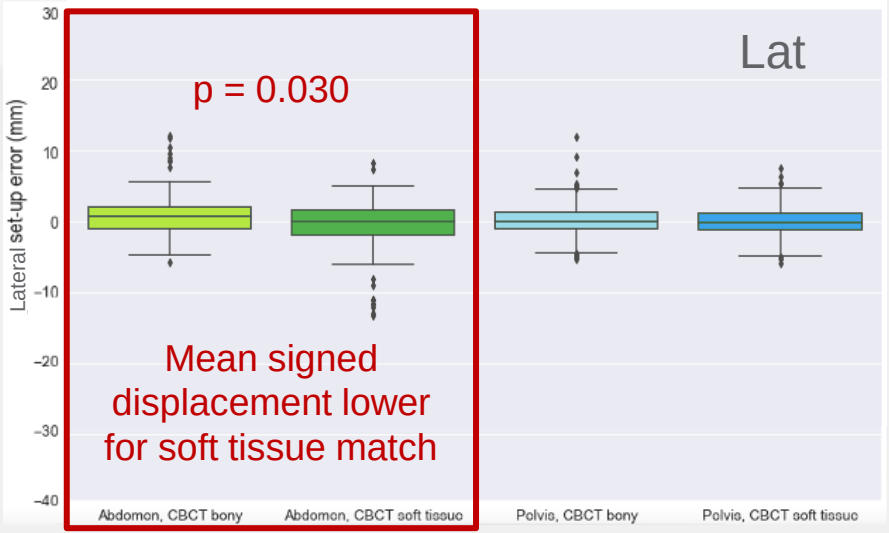
Bony match used when CBCT performed weekly/not every fraction

Soft tissue match performed when CBCT used every fraction

Hypothesis – *SGRT would perform better when bony anatomy used for online IGRT*







Two-tailed t-test used to establish any statistically significant differences in mean signed error between bony- and soft tissue-based CBCT matching

No clear trend observed

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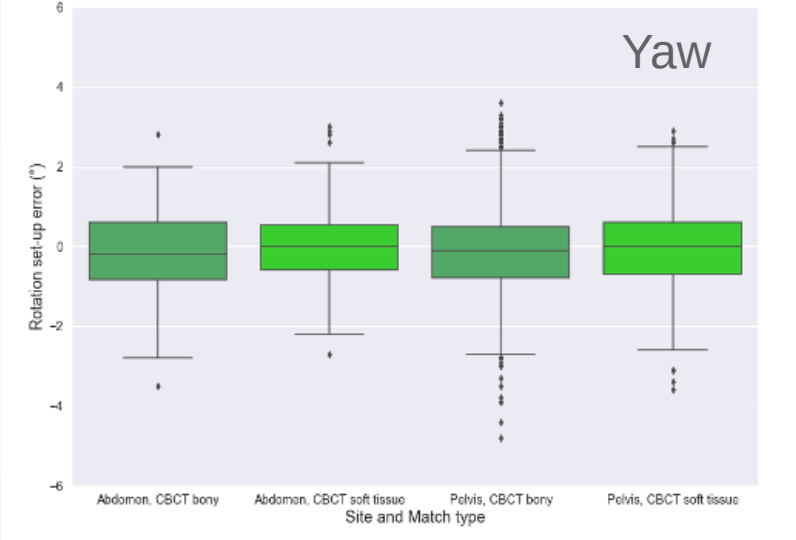

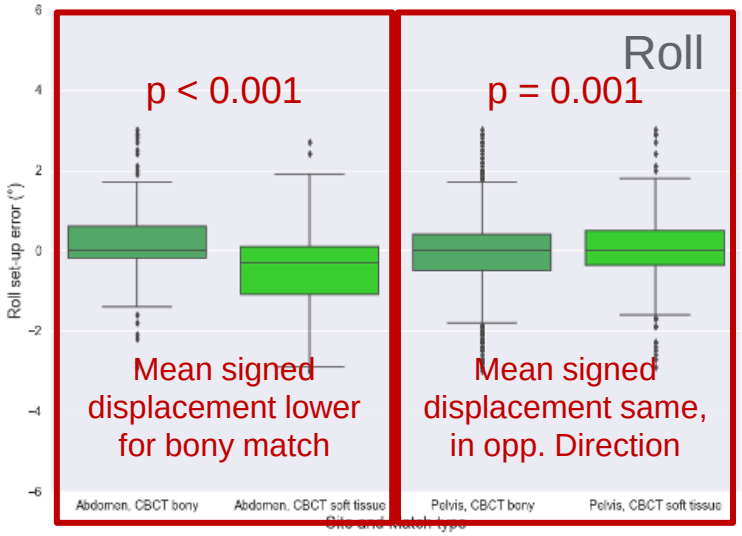

Bony matching showed statistically significant setup advantage for pitch and roll in abdomen cohort

Pelvis cohort rotational displacements non-inferior when soft tissue match used

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Summary

- Skinmark-free SGRT is a feasible setup method for patients at Alfred Health, including for abdomen and pelvis patients
- Skinmark-free SGRT for our abdomen and pelvis patients results in comparable initial setup displacement to abdo/pelvis patients with skinmarks at other institutions
- We did not observe any clear inferiority trends when analysing translational setup displacement for bony-matched fractions compared to soft tissue-matched fractions
- There was some reduced rotational displacement for the bony-matched fractions in the abdomen cohort but this was not replicated in the pelvis cohort
- Always use pre-treatment IGRT when skinmark-free SGRT utilised

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References

1. Clow, Barbara, and Janet Allen. "Psychosocial impacts of radiation tattooing for breast cancer patients: A critical review." *Canadian Woman Studies/les cahiers de la femme* (2010).
2. Javor, Joanna, et al. "Eliminating tattoos for short course palliative radiation therapy: Set-up error, satisfaction and cost." *Journal of Medical Imaging and Radiation Sciences* 53.2 (2022): S56-S62.
3. Fingeret, Michelle Cororve, Irene Teo, and Daniel E. Epner. "Managing body image difficulties of adult cancer patients: lessons from available research." *Cancer* 120.5 (2014): 633-641.
4. Moser, Torsten, et al. "Radiotherapy tattoos: Women's skin as a carrier of personal memory—What do we cause by tattooing our patients?." *The Breast Journal* 26.2 (2020): 316.
5. Heinzerling, John H., et al. "Use of surface-guided radiation therapy in combination with IGRT for setup and intrafraction motion monitoring during stereotactic body radiation therapy treatments of the lung and abdomen." *Journal of Applied Clinical Medical Physics* 21.5 (2020): 48-55.
6. Carl, G., et al. "Optical surface scanning for patient positioning in radiation therapy: a prospective analysis of 1902 fractions." *Technology in cancer research & treatment* 17 (2018): 1533033818806002.
7. Walter, F., et al. "Evaluation of daily patient positioning for radiotherapy with a commercial 3D surface-imaging system (Catalyst™)." *Radiation oncology* 11 (2016): 1-8.

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