UNMASKING RADIOTHERAPY

Looking forward to Maskless Radiotherapy @ Gippsland Radiation Oncology

Zeb Carvalho

theAlfred | Radiation Oncology

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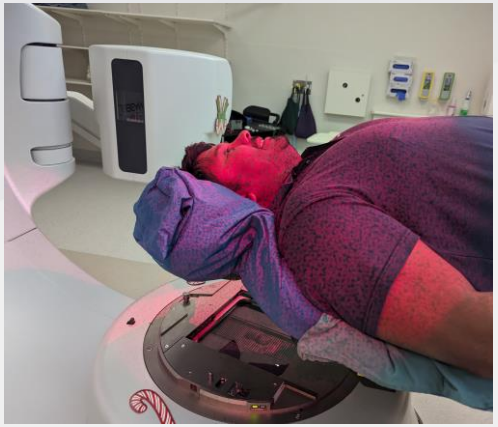
BACKGROUND AND INSPIRATION

- **Patient feedback and radiation therapist experience with thermoplastic masks**
- **An example of patient experience and motivation to proceed with developing a maskless process was a presentation by Julie McCrossin AM in 2019 titled "Remove the mask"**
- **For ideas and process development from any mask form to maskless was largely inspired by "Removing the mask for H&N and other advancements in SGRT" video presented by Mike Tallhamer in 2019**



PATIENT EXPERIENCE

- **Patient care is our highest priority**
- **H&N patients undergo a myriad of side effects that play on their well being**
- **Thermoplastic masks have and can accentuate phobias like claustrophobia**
- **Thermoplastic masks have been described as:**
  - uncomfortable
  - claustrophobic
  - choking sensation
  - Swallowing problems
  - Pain

VIDEO › BREAKING The Canberra Times SUBSCRIBE Log In

Inside your head inside the radiation therapy immobilisation mask, no one can hear you scream

By James Joyce
Updated October 21 2022 - 7:13am, first published October 20 2022 - 7:00pm | 0 Comments

You cannot freak out about this.

Don't panic. Stay still. Breathe.

There's another welling of anxiety. *I'm trapped.* The panic swells like a wave. *I can't move.* Is this claustrophobia? *I can't MOVE!*

Feels like being 'buried alive'

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Latrobe Regional Hospital

Gippsland Radiation Oncology
Latrobe Regional Hospital in partnership with The Alfred

theAlfred
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PATIENT EXPERIENCE

- **Credit to Alfred Health Radiation Oncology (ARO), who have led the implementation of Open Faced masks with the use of AlignRT/SGRT**
  - Standard of care @ Alfred since 2019
- **Patients still have anxiety as they do not compare open vs close faced masks**
  - Lorazepam – Impact for Regional patients
- **SGRT has allowed for the complete removal of tattoos and Skin Marks on all patient sites**
  - AHRO – Tattoo-less for Breast since early 2000s
  - Will we look back on masks as well?
- **The next step <u>IS</u> maskless H&N Radiotherapy**
  - We have the tools and experience

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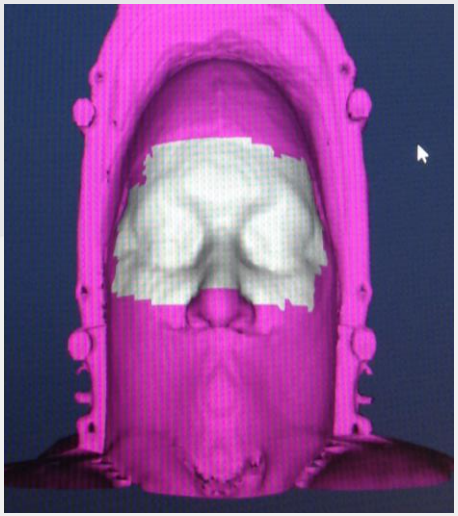


STAFF EXPERIENCE

- **Anxiety & side-effects from H&N RT can be exacerbated by ill fitting or tight masks**
- **Tension and Anxiety at CT can lead to poor setup and imaging**
    - Increased Treatment times
- **Shrinkage between Sim & Treatment can result in extremely tight masks or treating “unclipped”**
    - Golf ball head
- **Masks can inhibit assessment of contour changes**
    - Daily CBCT helps with this
    - Not current AHRO policy
- **Mask Quality can depend on skill of the RT at simulation**

STAFF EXPERIENCE

- **Ill fitting masks can lead to:**
  - re simulation
  - treatment delays
  - increased daily treatment times
- **This can result in:**
  - embarrassment
  - frustration
  - increased anxiety for patients and **staff**
- **Maskless process could resolve many of these issues**

CAN WE REMOVE THE MASK?

- **We already do it when we need to**
- **GRO has treated approx. 30 patients maskless (not all were simulated without a mask)**
  - These are the problem patients
  - If maskless from CT significantly less issues
- **Complicated by bite-block & bolus**
- **It always works…**
  - Despite poor patient profile
  - What if we used it on our “run-of-the-mill” H&N patients?
- **We have the technology & experience**

RESULTS

- **Our results were positive despite poor patient profiles. The question is now how much better could they be on more cooperative H&N patients?**
- **Example of results for a patient setup that was NOT IDEAL**

	*PRE TREATMENT IMAGING								**POST TREATMENT IMAGING								***TREATMENT TIME (min)	
FRACTION		VRT	LONG	LATERAL	PITCH	ROLL	ROTATION	COMMENT	FRACTION		VRT	LONG	LATERAL	PITCH	ROLL	ROTATION	COMMENT		Scheduled Time
1		-0.1	-0.2	0.2	1.2	1.3	1.2				-0.1	0.1	-0.1	0.8	0.4	-0.4		25	20
2		-0.1	-0.1	-0.1	0.2	0.1	1.6				0	0	0	0	0.6	0.3		17	15
3		0	0.2	0	0.3	1.3	1.3				0	0.1	0	0	0	0.8		17	15
4		-0.1	-0.1	0.1	0.2	0.8	0.4				-0.2	0.3	-0.2	1.7	1.3	-0.8		13	15
5		0	-0.2	-0.1	0.3	-0.5	-2.2				N/A	N/A	N/A	N/A	N/A	N/A	Post image missed	12	15
6		0	-0.1	-0.1	-1.2	-0.3	-1.3				0	0	0	0.4	0.4	0.2		25	15
7		0.1	-0.1	0	0.6	2.5	1.6				0	0	-0.1	0.5	0.9	0.8		13	15
8		-0.1	-0.1	0.1	-1.5	0.8	0.3				0	0	0	0.6	0.7	0.4		12	15
9		-0.2	0	0	2.2	1.8	2.2				-0.1	0.2	-0.2	1.4	1.6	-0.3		14	15
10		-0.1	-0.1	0.1	2.8	1.4	2.2				0	0	0	1.1	0	0		16	15
11		-0.1	-0.3	0	-0.2	0.6	-0.2				0	0	0	0	0.2	-0.3		16	15
12		0.1	-0.3	0.1	0	-1.4	-1.6				-0.1	0.1	0	0.6	-0.7	-1.1		12	15
13		-0.1	0	-0.1	0.7	-0.2	0.2				-0.2	0.1	0	1.1	-1	-0.5		15	15
14		-0.1	-0.1	0.2	1.4	1.7	2.2				-0.1	0.2	0	1.1	0.1	0.3		17	15
15		0	0.1	0.1	2.9	0.4	1.1				0	0	0	-0.3	0	-0.3		13	15
16		-0.2	0.1	0.1	2.3	1.6	0.6				0	0	0	-0.1	0	0.1		15	15
17		-0.2	-0.1	0.2	0.1	0.3	1.6				-0.1	0.1	-0.1	0.8	-0.1	-0.5		16	15
18		-0.2	-0.2	0	0.2	-0.6	-1.3				0	0	0	0	0	0		16	15
19		0.1	-0.1	-0.1	0.5	0.2	-0.7				-0.1	0.1	-0.2	1.3	0.8	-1		15	15
20		0	0	0	0.6	0.3	1.8				0	0.1	0	-0.2	-0.1	0.4		20	15
21		-0.1	-0.1	0	0.9	1.1	0.9				-0.1	0.1	-0.1	1	0.7	-0.2		14	15
22		-0.1	0	0.1	0.8	-0.7	0.6				0	0.1	-0.1	1.1	1.4	-0.3		13	15
23		0.1	-0.3	0	0.2	2.4	0.4				0	0.1	-0.1	0	0	0		16	15
24		-0.2	0	0	0.8	-1.1	1.6				-0.2	0.1	0	1.3	-0.1	0		12	15
25		-0.1	-0.3	-0.2	0.1	2	-1				-0.2	0.2	-0.1	3.5	1	0.5	Patient moved after tmt	14	15
26		-0.1	-0.1	0	0.1	1.4	1.4				0	0	0	0.1	-0.1	0		17	15
27		-0.1	0	0.1	-0.2	-0.1	1.2				-0.1	-0.1	-0.1	0.3	0.3	-0.1		11	15
28		-0.2	-0.4	0.2	-0.1	0.7	-0.5				-0.1	0.2	-0.2	2.5	1.3	-1		23	15
29		0.1	-0.2	0.1	-1.4	0.9	1				-0.1	0	-0.3	0.6	0.7	-1.2		19	15
30		0	-0.1	0.1	-0.3	-0.2	-1				-0.2	0.2	-0.1	2	0.4	-0.2		16	15
																		15.8	15.16667

*All pre treatment images corrected to 0 discrepancy

**All post treatment images undertaken after completion of dose delivery

***Treatment time includes post treatment imaging that is not a daily department procedure

Out of tolerance setup (>0.3cm and/or >1deg)

Out of tolerance post imaging (≥0.3cm and/or ≥1deg)

Imaging results for L Post Scalp, 60Gy/30#, Maskless, partial PLA bolus head cradle, No Vacbag immobilisation

RESULTS

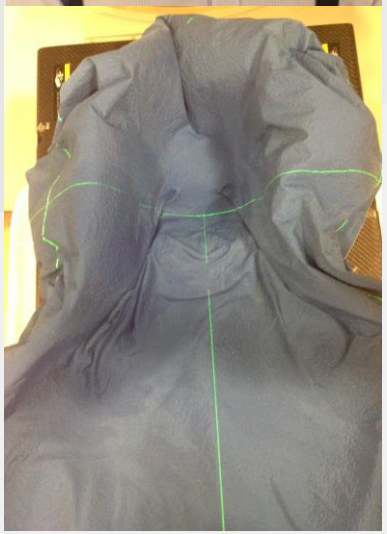
- Example of results for a patient setup that was IDEAL

	*PRE TREATMENT IMAGING								**POST TREATMENT IMAGING								***TREATMENT TIME (min)	
FRACTION		VRT	LONG	LATERAL	PITCH	ROLL	ROTATION	COMMENT	FRACTION		VRT	LONG	LATERAL	PITCH	ROLL	ROTATION	COMMENT		Scheduled Time
1		0.1	-0.3	0.2	0.3	-1.8	-1.6				0	0	0	0.5	-0.2	0.1		21	20
2		-0.2	-0.5	0.1	-1.2	-1.4	-0.9				0.1	-0.1	0	0.8	-0.3	0		18	15
3		-0.1	-0.3	0	-0.2	-0.8	-0.6				0.1	-0.1	0	1.1	-0.1	0.3		19	20
4		-0.2	-0.3	0.2	2.4	-1.9	0.1				0.1	0	0.1	0.5	0.1	0		19	20
5		0.2	-1	0.2	-2	-0.8	-0.2				0.1	-0.1	-0.1	0.8	0	0.2		17	20
6		-0.3	0	0	-1.5	-0.1	-0.1				0	-0.1	0	0	0.2	-0.1		14	20
7		-0.1	-0.4	0.2	-0.3	-0.4	-0.6				0	0	0	0	0	0		17	20
8		0	-0.4	0.2	0.9	0.9	-1.6				0	0	-0.1	0.4	0.3	0.6		14	20
9		-0.1	0	0.3	1.9	-1.9	-1.7				0	0	0	0.2	0.3	0		16	20
10		-0.1	-0.3	0.2	-0.6	-0.6	-0.4				0	-0.1	0	0.4	0	-0.1		16	20
11		-0.3	-0.3	0.2	-1.2	-1	-1.1				0	-0.1	0	0	-0.2	-0.1		14	20
12		-0.1	-0.5	0	-1.7	-0.8	-0.7				0	0	0	0	-0.2	0.1		14	20
13		-0.2	-0.3	-0.1	-1.1	-2.1	0.1				-0.1	0	0	0	0.6	0.4		13	20
14		0	-0.7	0	-0.8	-0.9	-1.3				0	0	0	-0.6	-0.4	0.3		12	20
15		-0.2	-0.3	-0.1	-0.6	-0.3	0				0	0	0	0.6	-0.1	0.1		13	20
16		0	-0.1	0	-1.6	-1.6	-1.2				0	-0.1	-0.1	-0.1	-0.3	0.6		16	20
17		-0.1	0	0	-0.3	-1.6	-2.5				0	0	0	0.1	0	0.2		19	20
18		-0.1	-0.6	0	-1.8	-2.2	0.3				0	-0.1	0	0.9	0.8	0.2		16	20
19		0	-0.1	-0.1	0.5	-0.7	-2				0.1	-0.1	-0.1	1	-0.2	0.1		16	20
20		0	-0.2	-0.1	-1.8	-2.4	-0.8				n/a	n/a	n/a	n/a	n/a	n/a	Post image missed	13	15
																		15.85	19.5
	*All pre treatment images corrected to 0 discrepancy																		
	**All post treatment images undertaken after completion of dose delivery																		
	***Treatment time includes post treatment imaging that is not a daily department procedure																		
		Out of tolerance setup (>0.3cm and/or >1deg)																	
		Out of tolerance post imaging (≥0.3cm and/or ≥1deg)																	

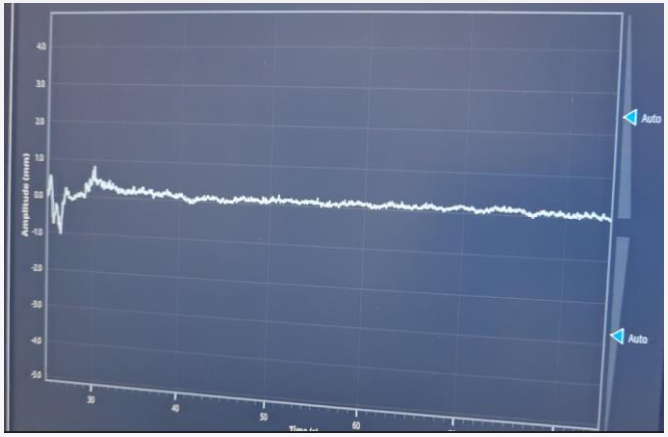
Imaging results for R Neck, 50Gy/25#, Maskless, PLA Bolus, Vacbag

IMMOBILISATION & METHOD

- **Experiment with process and procedure**
  - Not ideal to experiment with patients
  - Two RT staff members of varying contours used
  - Simulated using Vacbag and AlignRT/SGRT for compliance
  - Mock Treatment with staff lying in position for 10 minutes monitored using AlignRT/SGRT
  - Positive results aiding in progress with standard maskless implementation process

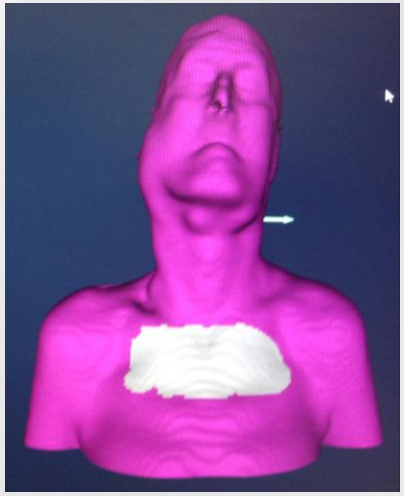


IMMOBILISATION & METHOD



TREATMENT WITH ALIGNRT/SGRT

- **Treatment Setup**
  - Original concept was adjusting pitch and roll of body using ROI for body setup
  - Found video function worked better as shoulder position could be addressed
  - Head setup using ROI of face with video function
  - SGRT capture of head used for treatment with video monitoring
  - Region of interest choice and timing SGRT capture is critical
  - Avoid ROI capture of areas that move independently such as lower jaw, neck and shoulders
  - Pre and post imaging currently till sufficient data available to solidify process



WHAT IS HOLDING US BACK?

- **Pre-conceptions that you MUST have a mask for H&N RT**
  - Just like – “You need Tattoos for Breast/Abdo/Pelvis RT”
- **Safety concerns**
  - What if the patient moves during Treatment?
  - AlignRT will “cut” the beam
  - If fully masked patients move under their mask – we are oblivious
- **With a mask removed, everything is there to see in the open**
  - Postural positioning is a game-changer for setup
  - Explore AlignRT Surface tools

WHERE TO FROM HERE?

- **ARO/GRO SGRT focus group has identified Maskless H&N RT as an achievable goal within the next 12 months**
    - Requires RO buy-in
    - Requires time as it is difficult to develop process in a high workload/understaffed department

- **Acknowledge that this likely wouldn't include all H&N/Brain sites such as stereo patients**

- **Choice – Educate patients and provide choice of mask vs maskless**
    - Some patients may find mask reassuring

- **Key considerations to consider going forward:**
    - Immobilisation – VacBags vs Accuform cushions vs Thermoplastic rear shell,
    - Staff Training – Process, Process, process
    - Formalised patient education – short video vs written info.
    - Patient Compliance – Some patients cannot stay still – ?ethics of restraint
    - Acceptable SGRT thresholds – TBD
    - Jaw position issues – Bite-Blocks versus chinstrap versus verbal instruction

LIMITATIONS

- **3D-print bolus (PLA) as we cannot tape to mask**
  - Creative thinking required
- **PTV margins**
  - More vs Less
- **ART or SGRT system goes down...**
  - More accurate landmarking without a mask
- **Treatment time increase due to change in patient compliance (simulation vs treatment)**

CONCLUSION

- **A maskless radiotherapy environment is possible**
- **Better understanding of SGRT process without a mask**
- **Allay some fears for going maskless**
- **Maskless improves the experience of H&N patients through the radiotherapy process**
- **Implementation is possible with support from the RO and SGRT group**

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- **AHRO SGRT Team**

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- **Mike Tallhamer**

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