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Analysis of Inter- and Intrafraction Variation for Patients with Head and Neck Cancer Immobilised with an Open-Face Mask

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Speaker Disclosures

- This presentation has been reviewed by Vision RT for factual accuracy and consistency with product labeling.
- My comments and the accompanying slides reflect my own opinions and are not necessarily those of Vision RT or my institution.
- Peter MacCallum Cancer Centre is a Centre of Excellence for Vision RT.

Mask anxiety

Radiotherapy plays a key role in the of the management of head and neck cancer

Approximately 80% of patients will receive RT at least once during their cancer journey

Thermoplastic mask-based immobilisation

Masks are associated with treatment related distress and “mask anxiety”

Masks are notoriously uncomfortable

Many patients have difficulty swallowing and breathing which makes a closed facemask even less tolerable

Provides stability against gross movements

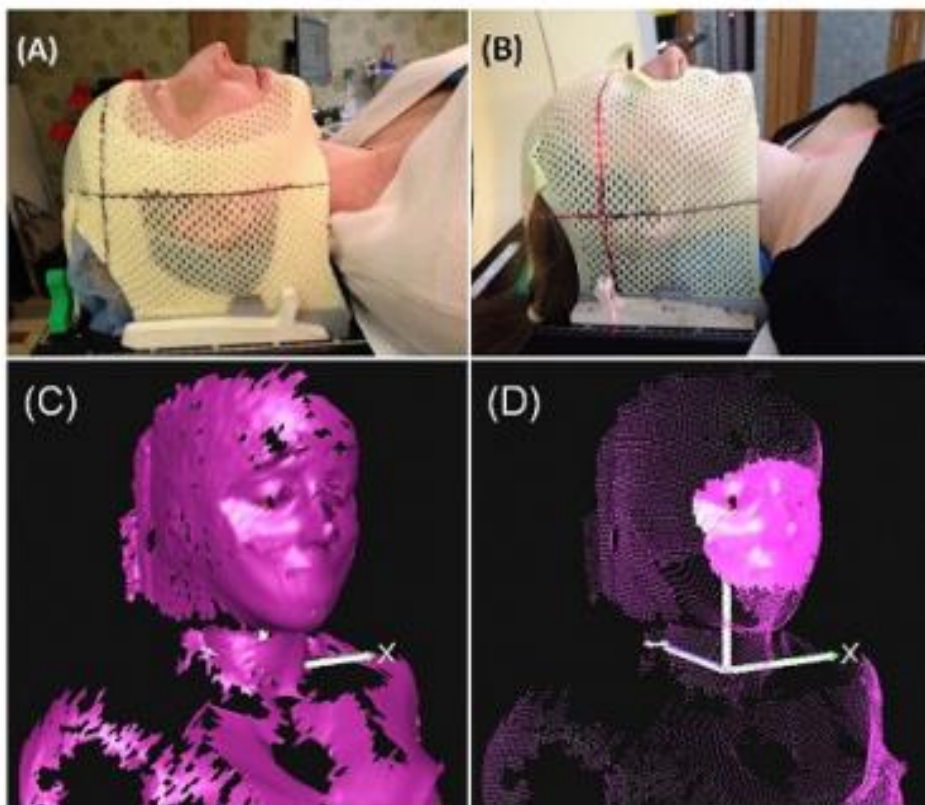
However, actual positional uncertainty is in the order of 1-4mm

Anatomical changes [weight loss] even small ones, may affect mask fit

Migration from full-head mask to “open-face” mask for immobilization of patients with head and neck cancer

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15 subjects

10 volunteers [employees]

5 patients with claustrophobia who did not tolerate closed face-mask.

Orfit closed-mask and open-mask (pre-cut)

The open-face mask is characterized for its immobilisation capability and can immobilize patients sufficiently (<2 mm) during radiotherapy.

Most (80%) of the volunteers preferred the open-face mask to the full-head mask.

Original Article

A prospective evaluation of open face masks for head and neck radiation therapy



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Table 2 Intrafraction motion group mean values

	3DVL	Vertical	Longitudinal	Lateral	Yaw	Roll	Pitch
Mean (mm)	0.9	-0.4	0.0	0.0	0.0	0.0	0.0
1 SD (mm)	0.5	0.5	0.7	0.5	0.3	0.3	0.2
Range (mm)	0.1 to 3.5	-3.0 to 1.7	-2.7 to 3.5	-2.2 to 3.0	-1.3 to 1.3	-1.8 to 1.4	-0.9 to 1.1
Range of means (mm)	0.6 to 1.3	-0.9 to -0.1	-0.4 to 0.3	-0.4 to 0.3	-0.2 to 0.1	-0.1 to 0.2	-0.1 to 0.1

3DVL, 3-dimensional vector length; SD, standard deviation.

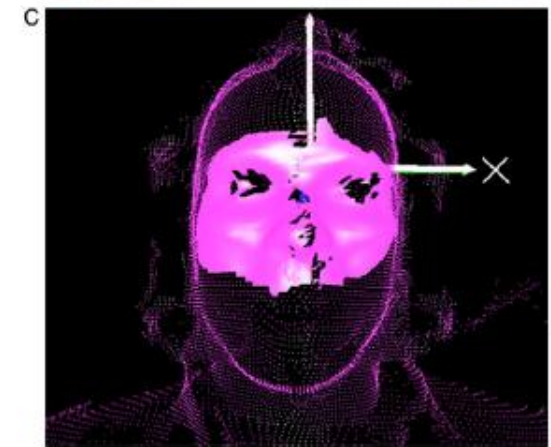


Figure 1 (A) Closed mask. (B) Open mask. (C) Representative AlignRT reference surface with the region of interest shown in solid pink.

45 patients prospectively randomised to closed or open-mask (23 closed-mask, 22 open-mask)

Klarity 3.2 mm closed-mask vs. 2.4 mm Qfix open-mask.

Mean Intrafraction motion = 0.9 ± 0.5 mm for the open mask patients

The mean anxiety and claustrophobia scores were 1.63 and 1.44 for the closed-mask group, and 0.81 and 0.63 for the open-mask group but not significantly different

Minimal mask immobilization with optical surface guidance for head and neck radiotherapy

Bo Zhao¹ | Genevieve Maquilan¹ | Steve Jiang¹ | David L. Schwartz^{1,2}

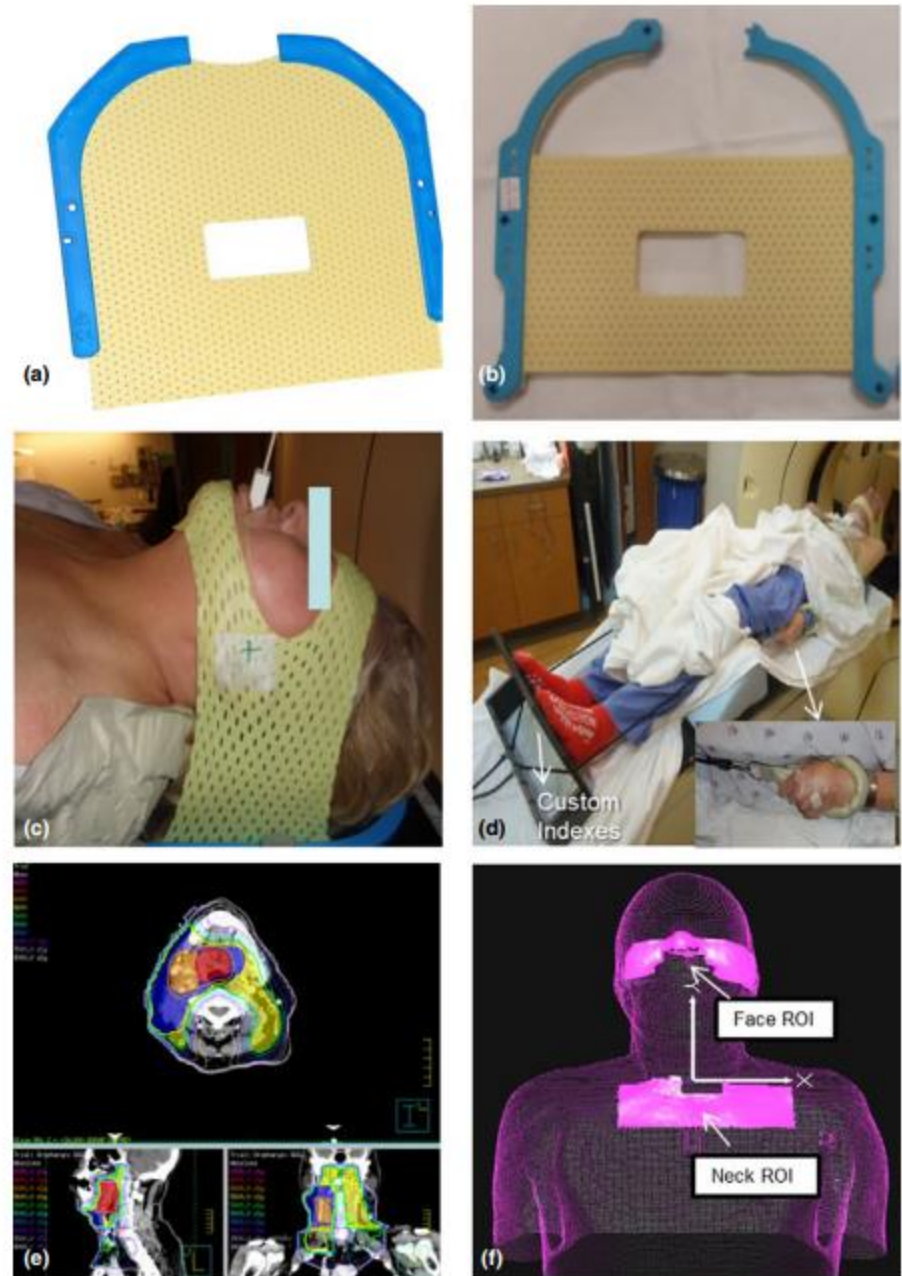
Patient Cohort	Vrt (mm) (min, max)	Lng (mm) (min, max)	Lat (mm) (min, max)	Rotation (°) (min, max)	Pitch (°) (min, max)	Roll (°) (min, max)	
Setup shift based on CBCT (mm or °)							
Total cohort	Group average	-0.51 ± 2.42	-0.49 ± 3.30	0.23 ± 2.58	-0.15 ± 1.01	-0.02 ± 1.19	0.06 ± 1.08

Modified Qfix to immobilise only forward and chin.
Moldcare cushion

Shoulder cushion or retractors

Setup shifts were very small [between 2-3mm]

Comparable results to previous literature



Before QA Project

- Limited access to SGRT for H&N
- Adhoc use of open-face masks
- Poor quality baseline data for closed-face masks



Study Design and Endpoints

Design

- Quality assurance project at Moorabbin campus only
- Target accrual of forty patients (20 closed-faced mask, 20 open-faced mask)

Objectives/endpoints

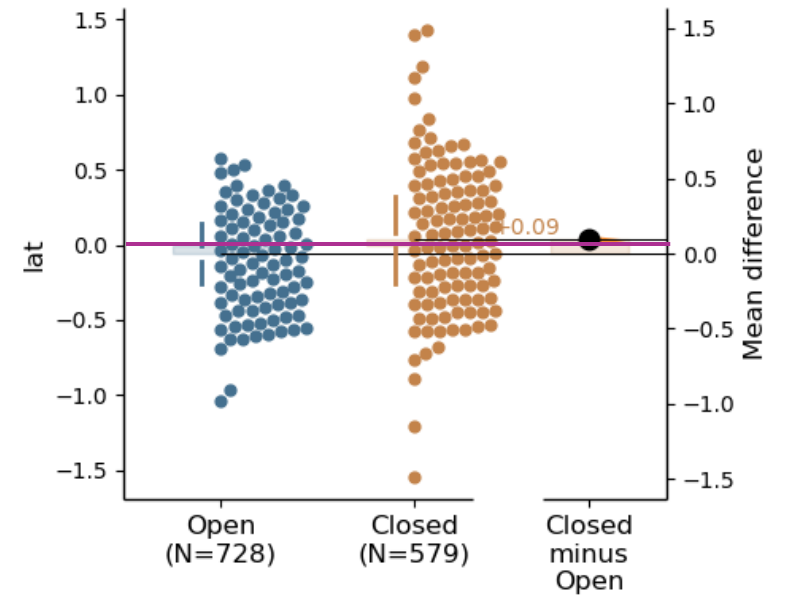
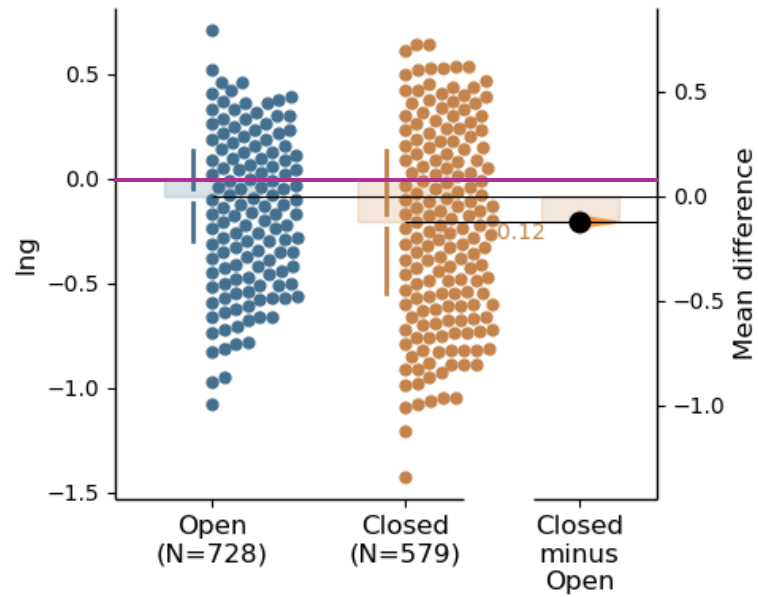
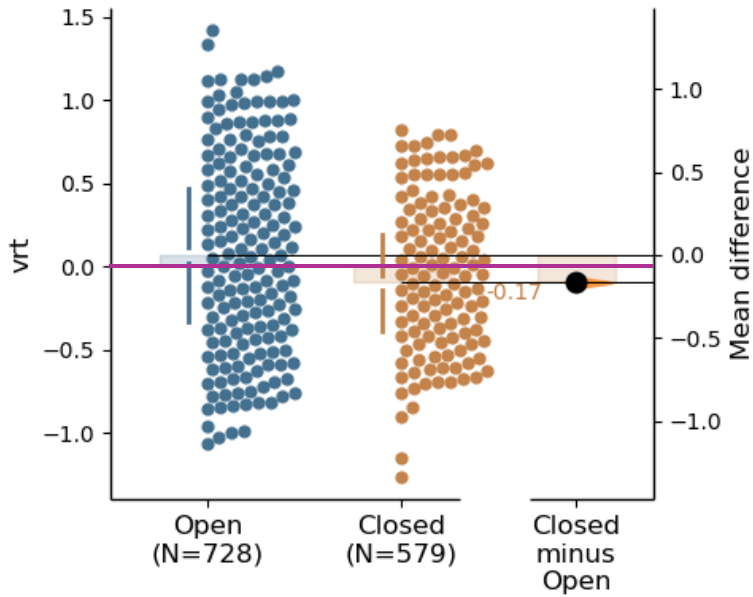
No.	Objectives	Endpoints
1	To measure the change in setup and treatment time when using SGRT (open-face mask) compared with non-SGRT positioning (closed-face mask)	<ul style="list-style-type: none">• Setup - Time between initial patient couch positioning and first IGRT acquisition• Treatment – Time between initial patient couch positioning and last beam on time
2	To compare the setup accuracy and patient stability of patients immobilised with closed-face thermoplastic masks with patients immobilised with open-faced masks.	<ul style="list-style-type: none">• Initial IGRT setup shifts in patients with open-face mask compared with patients treated with closed-face masks• Intrafraction patient position variation from initial setup to end of treatment as measured by weekly post-treatment cone beam CT (CBCT)• Intrafraction patient position stability as measured by number of times the treatment beam is paused due to the monitored position exceeding the defined threshold, as measured by SGRT (open-face masks only)

Methods

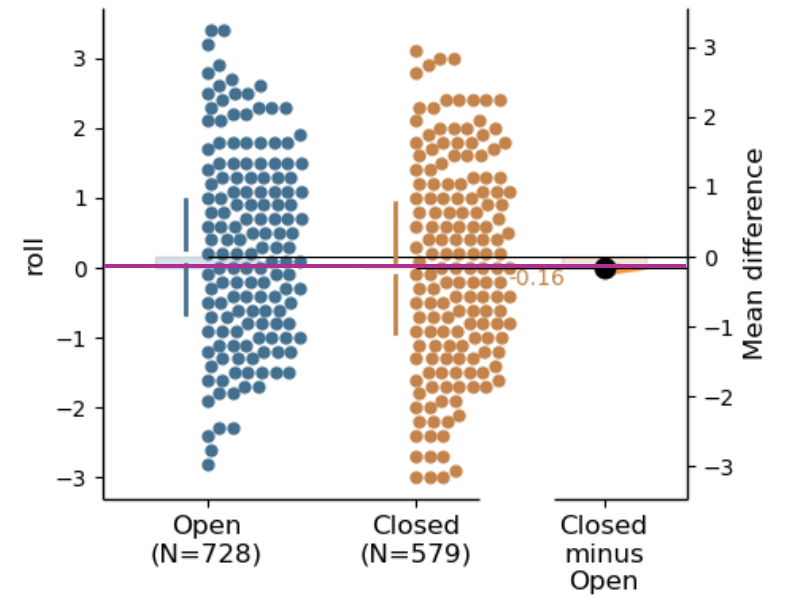
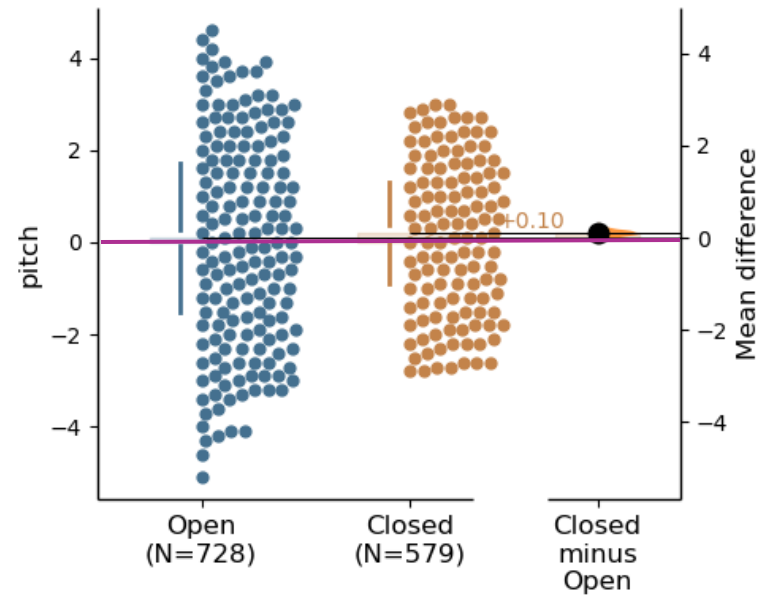
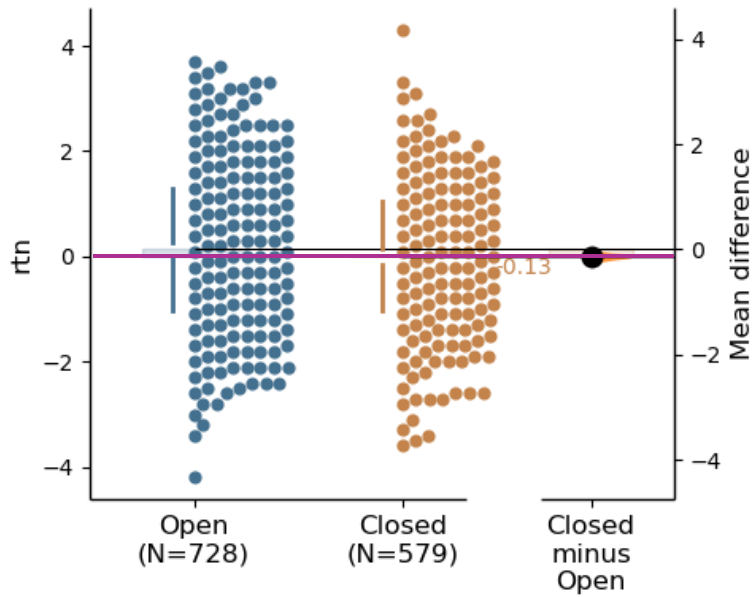
- Recruited 41 patients with H&N cancer who were **consented** and treated with radical intent between June 2024 and August 2025 at Moorabbin.
- All patients were immobilised using personalised Instaform™ foam neck rest and 3.2 mm head, neck, and shoulder white Hexspand™ thermoplastic mask (CDR Systems, Calgary, Canada). **An open drape, not covering the face was used for the Open Face (OF) group**, whereas a **standard closed drape was used for the Closed Face (CF) group**.
- All patients were treated on TrueBeam (v2.7, Varian Medical Systems, Palo Alto, USA). The **OF group was setup and monitored using AlignRT Advance (v6.3 MR1, Vision RT, London, UK) SGRT system**, while the **CF group was setup with marks on mask and monitored via closed-circuit television**.
- IGRT was performed using kV/kV imaging with 2D/3D matching for all patients. The initial **IGRT matches (in 6DoF) were analysed for interfraction variations. Pre- and post-treatment CBCTs** were acquired weekly, and the differences between pre- and post-treatment auto-matches **were analysed for intrafraction variations**.
- Variations were compared between groups using a Mann-Whitney U test ($p \leq 0.05$).



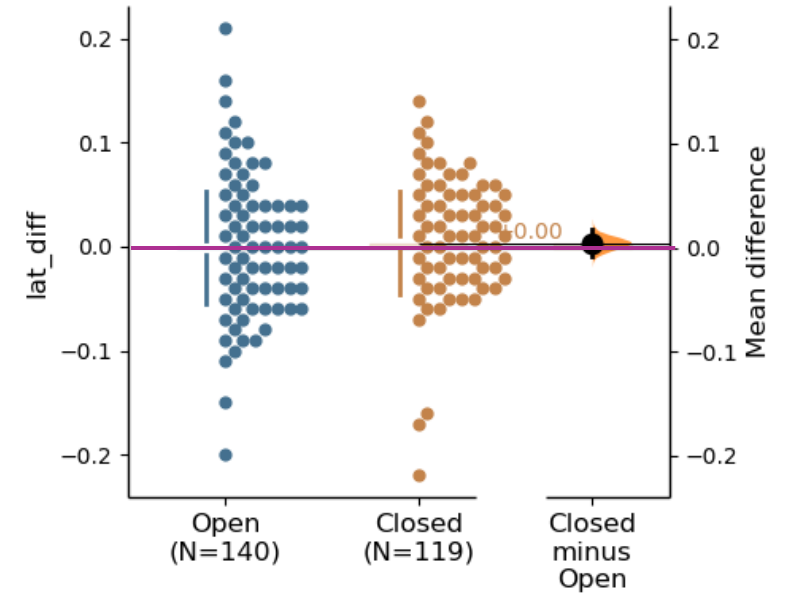
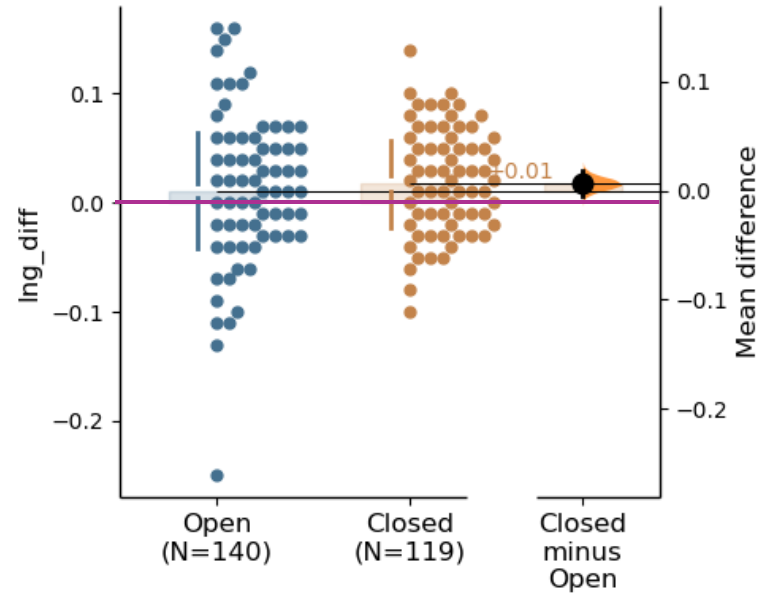
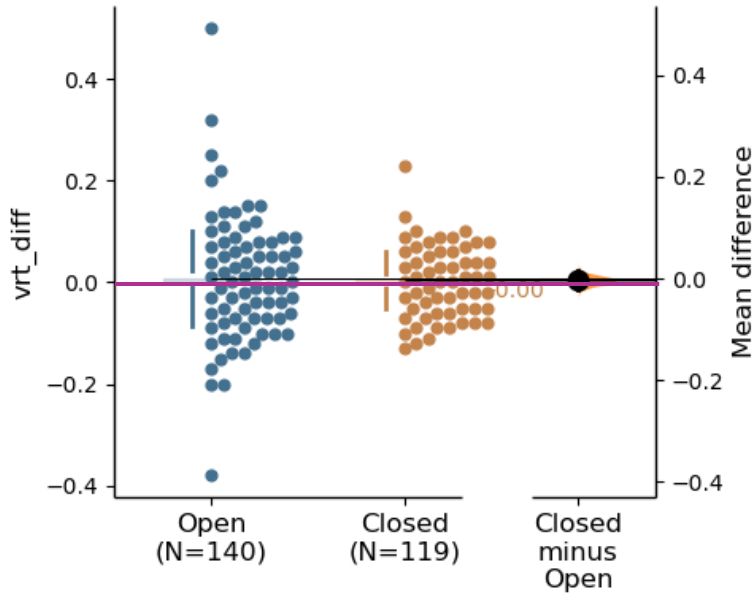
Results - Interfraction



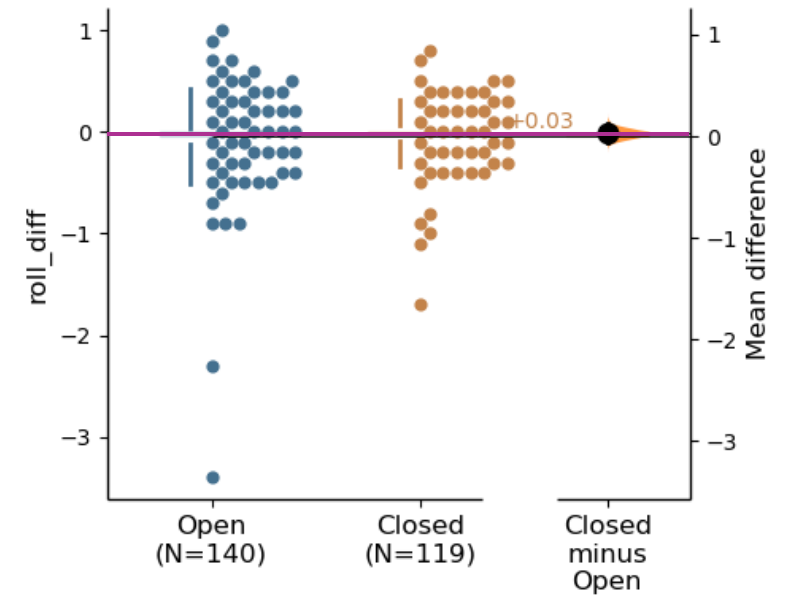
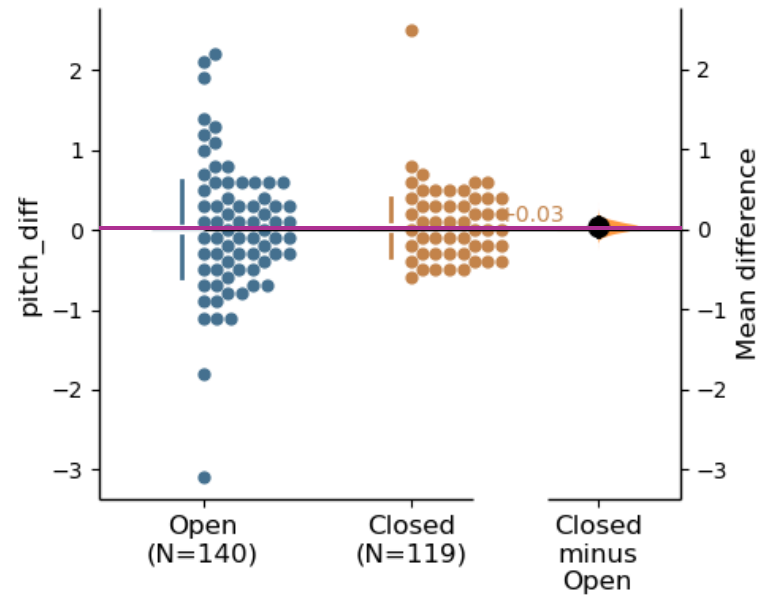
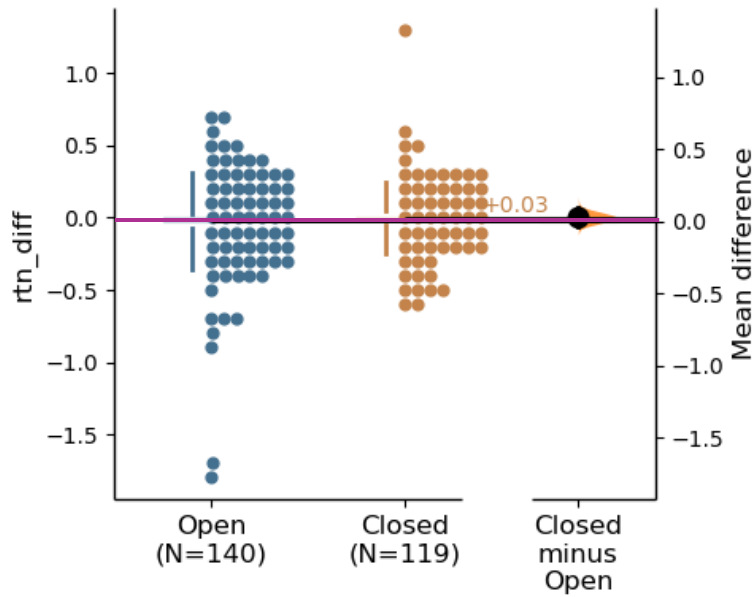
Results - Interfraction



Results - Intrafraction



Results - Intrafraction



Results

Table 1. Inter- and Intrafraction variations for OF and CF.

	Interfraction Variations			Intrafraction Variations		
	OF Median (IQR)	CF Median (IQR)	P Value	OF Median (IQR)	CF Median (IQR)	P Value
Vrt (cm)	0.05 (-0.18 - 0.32)	-0.12 (-0.29 - 0.08)	<0.001	0.01 (-0.03 - 0.05)	0 (-0.03 - 0.04)	0.71
Lng (cm)	-0.06 (-0.19 - 0.05)	-0.21 (-0.43 - 0.01)	<0.001	0.01 (-0.02 - 0.04)	0.02 (-0.01 - 0.05)	0.23
Lat (cm)	-0.05 (-0.16 - 0.06)	0.06 (-0.15 - 0.2)	<0.001	0 (-0.03 - 0.02)	0 (-0.02 - 0.03)	0.23
Rtn (deg)	0.1 (-0.5 - 0.8)	0 (-0.5 - 0.6)	0.72	0 (-0.1 - 0.1)	0 (-0.1 - 0.1)	0.85
Pitch (deg)	0.1 (-0.9 - 1.1)	0.2 (-0.4 - 0.9)	0.14	0 (-0.2 - 0.2)	0 (-0.2 - 0.2)	0.65
Roll (deg)	0.1 (-0.3 - 0.5)	0 (-0.5 - 0.5)	0.004	0 (-0.2 - 0.1)	0 (-0.1 - 0.2)	0.64

Summary

Endpoints

- **Setup - Time between initial patient couch positioning and first IGRT acquisition**
- **Treatment – Time between initial patient couch positioning and last beam on time**
- **Initial IGRT setup shifts in patients with open-face mask compared with patients treated with closed-face masks**
- **Intrafraction patient position variation from initial setup to end of treatment as measured by weekly post-treatment cone beam CT (CBCT)**
- **Intrafraction patient position stability as measured by number of times the treatment beam is paused due to the monitored position exceeding the defined threshold, as measured by SGRT (open-face masks only)**



Summary

- **Inter- and intrafraction variations for OF were comparable to CF** and within clinically acceptable variations
- These findings **support the use of OF in conjunction with SGRT as a safe, patient-friendly** alternative for H&N radiotherapy
- **Implemented as new standard of care** with CTV-PTV margins, IGRT and SGRT tolerances currently unchanged
- **Training and processes** for mask making and treatment with SGRT standardised
- Baseline data for **future research and development**



Thank you



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