Facing the Future and Unmasking the Best Fit: A Retrospective Comparative Evaluation of Open and Closed Facemasks for Stereotactic Radiotherapy/Radiosurgery Treatments

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London SGRT Conference 2024

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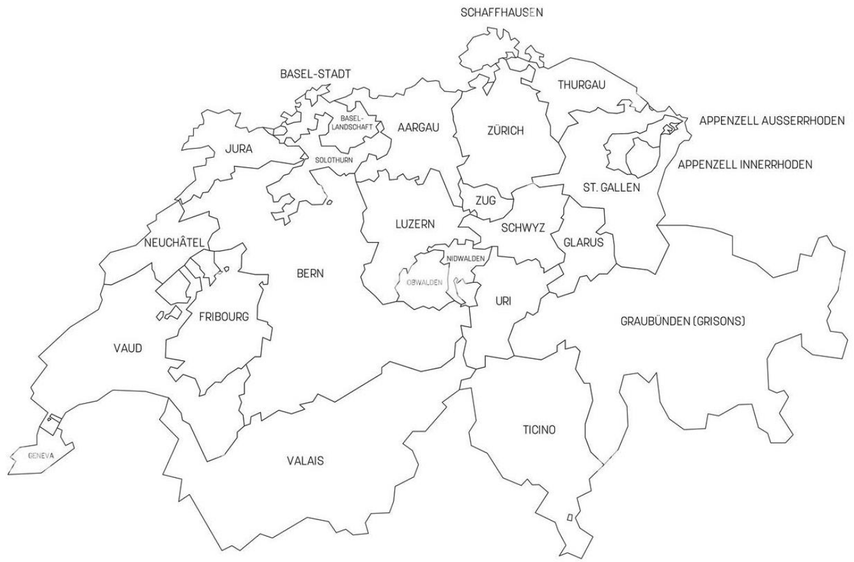
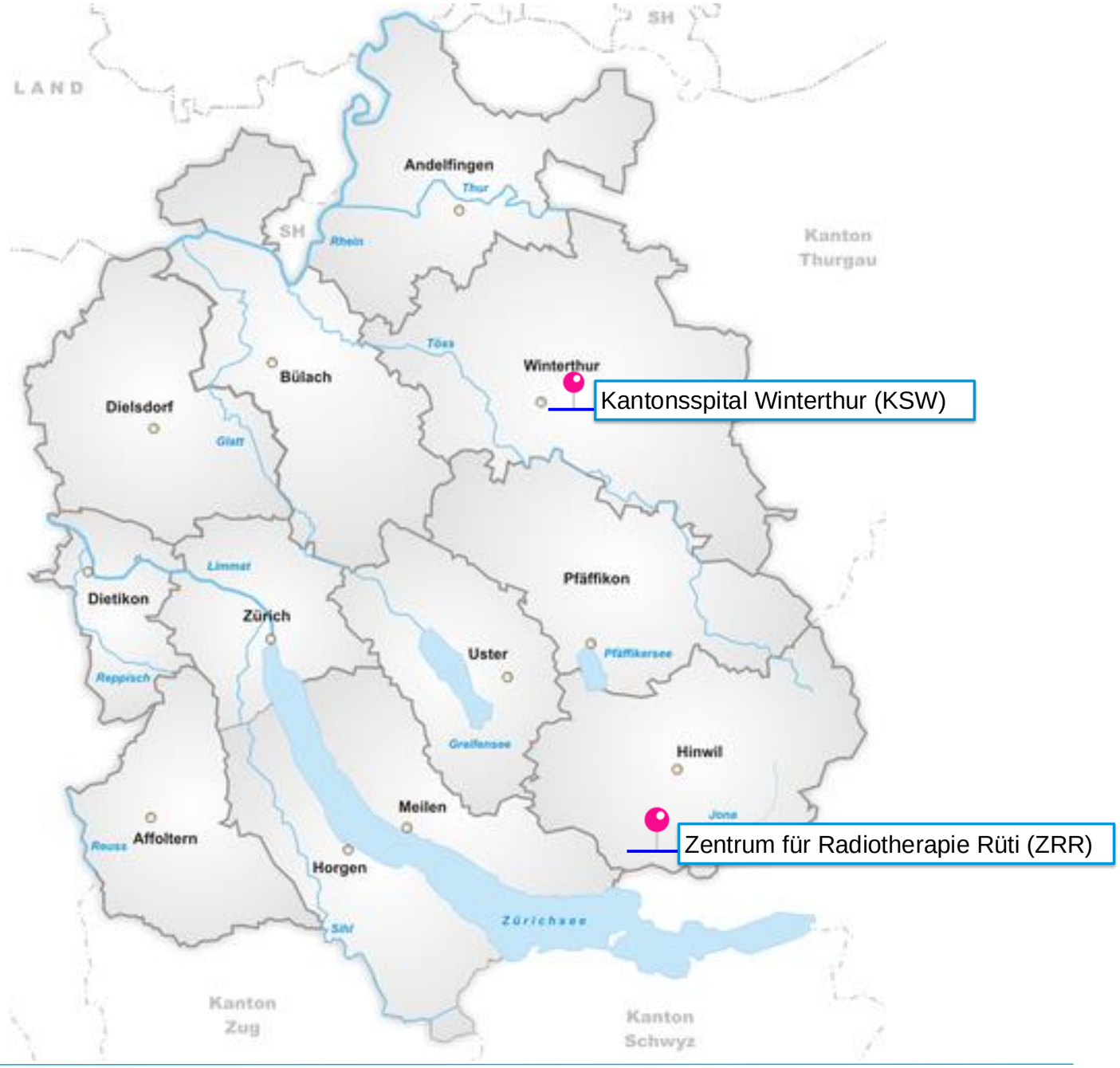
No conflicts of Interest

KSW Kantonsspital Winterthur

Kantonsspital Winterthur (KSW)
- 2 Linear Accelerators (Varian Trubeam) with AlignRT
- 1 CT with SimRT
- Brachytherapy
- Orthovoltage Therapy
- Hyperthermia

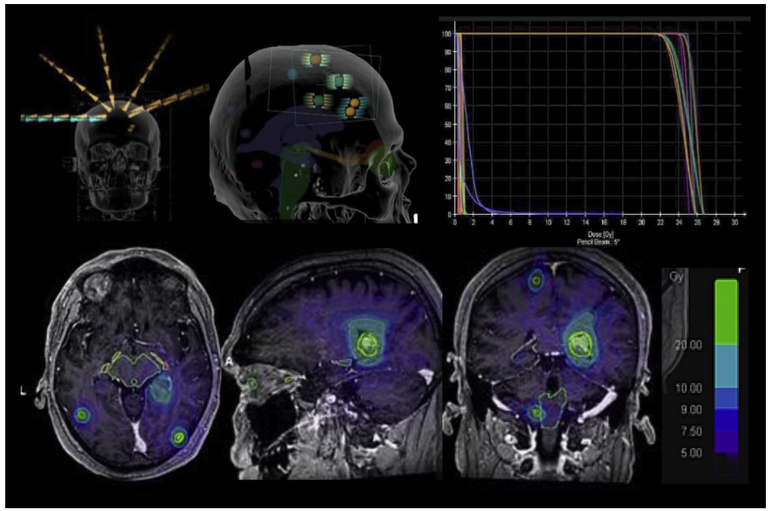
Zentrum für Radiotherapie Rüti (ZRR)
- 1 linear Accelerator (Varian Truebeam) with AlignRT
- 1 CT with SimRT
- Orthovoltage Therapy



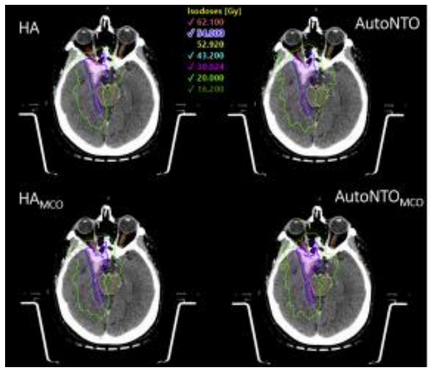


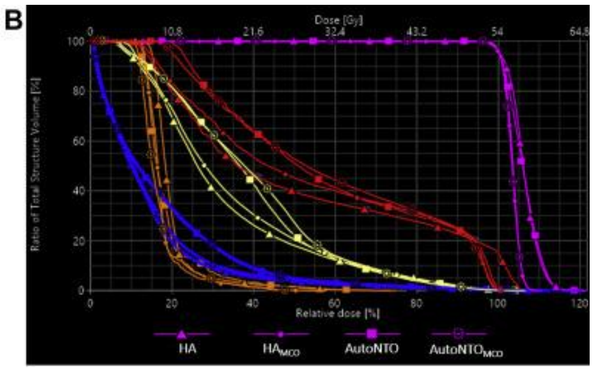
Introduction

- Delivers high doses of radiation with precise conformity to the tumor and steep dose gradients to surrounding normal tissues
  - Options:
  + Stereotactic Radiosurgery (SRS): single fraction
  + Stereotactic Radiation Therapy (SRT): multiple fractions



- Accurate Patient Immobilisation: A Key Factor
  + Traditional approach: Closed Facemask
  + Alternative: Open Facemask with Surface-Guided RT





Purpose of the Study

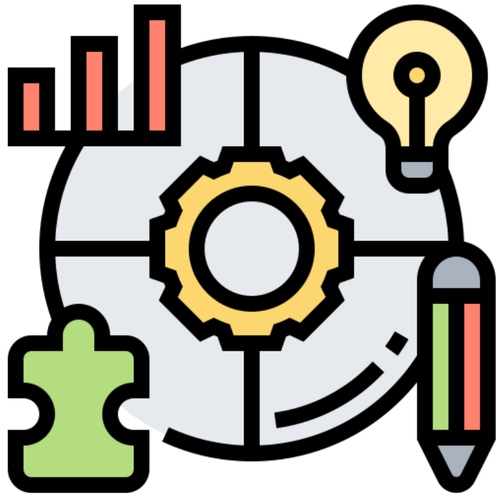
Primary Study Outcomes

- Compare the accuracy between:
  - Closed Facemask and Open Facemask with Surface-Guided Radiation Therapy (SGRT)

- Compare the frequency of repeat imaging and repositioning between:
  - Closed Facemask and Open Facemask with Surface-Guided Radiation Therapy (SGRT)

Newer "Alternative" Approach= New standard?

Materials and Methods



- **Study Design:** Retrospective Study

- **Inclusion Criteria:**

+ Patients treated for intracranial lesions

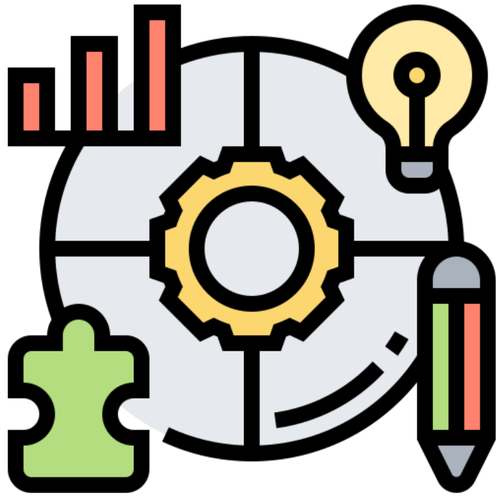
+ Treated with Stereotactic Radiation Therapy (SRT) or Stereotactic Radiosurgery (SRS) technique

+ Used either:
  - Closed facemasks with Biteblock
  - Open facemasks with Surface-Guided Radiation Therapy (SGRT) -Vision RT

+ Completed the prescribed treatment

- **Linear Accelerator:** Varian Truebeam
- **SGRT System:** Vision RT (AlignRT)

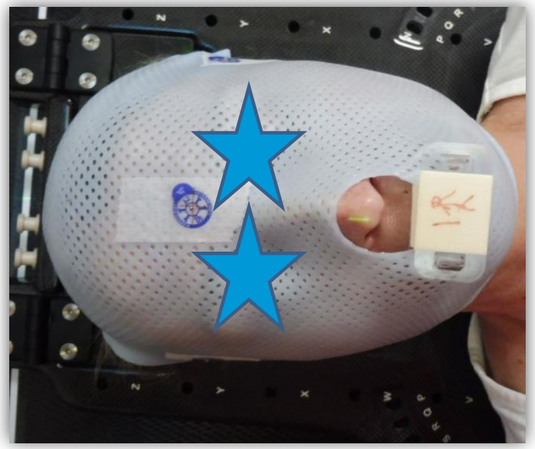
Materials and Methods



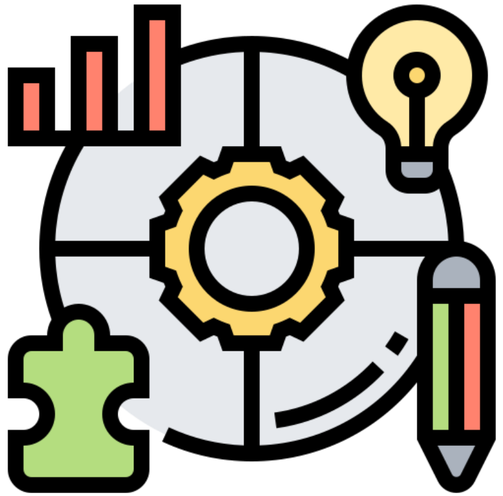
- **Types of Masks**

+ Closed Facemask with Biteblock

Posicast-Plus® 3-Point Masks 2.3mm thickness, Posifix® and Precise Bite™ Patient Re-Positioner by CQ Medical™ (Formerly CIVCO RT™ and Q-fix®)



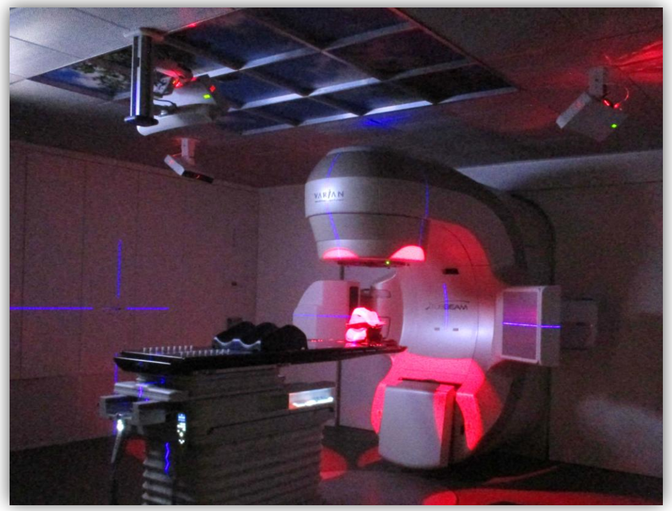
Materials and Methods



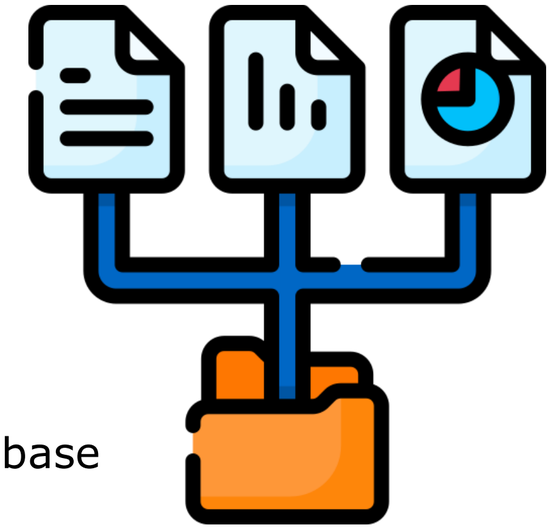
- **Types of Masks**

+ Open Facemask (without Biteblock) with SGRT

Solstice™ SRS Immobilization System comprised of a carbon fiber head support, customizable cushion and dedicated thermoplastic mask 3.2mm thickness.



Data Collection

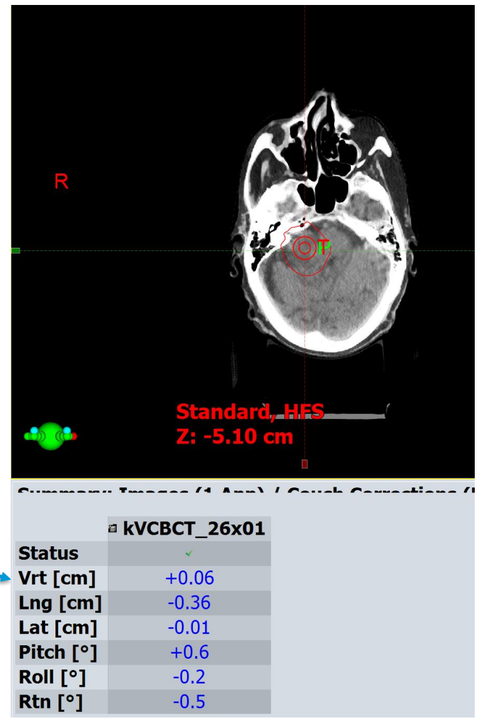


- **Data Sources:**

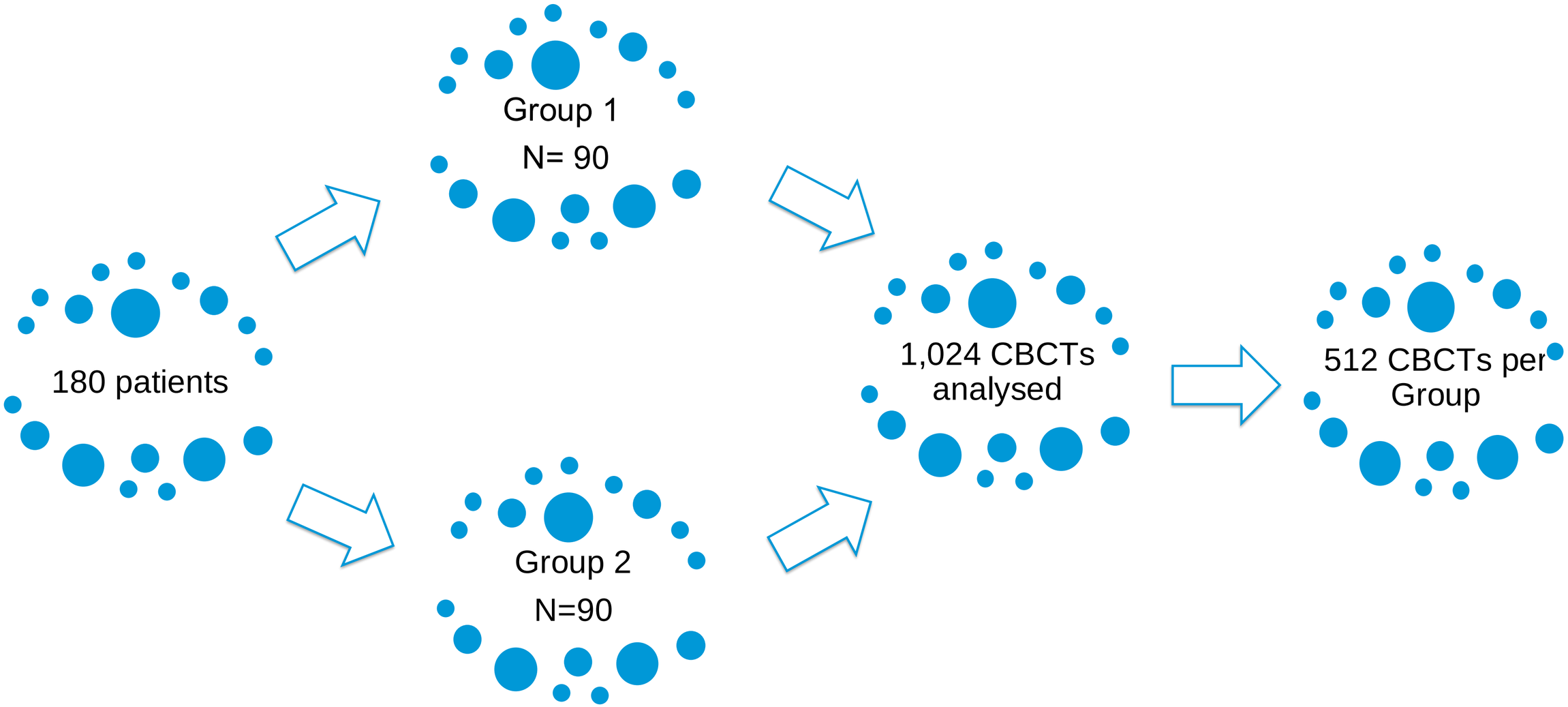
+ Extracted from Kantonsspital Winterthur- Institute for Radiation Oncology's database
+ Varian ARIA Oncology Information System

- **Data Components:**

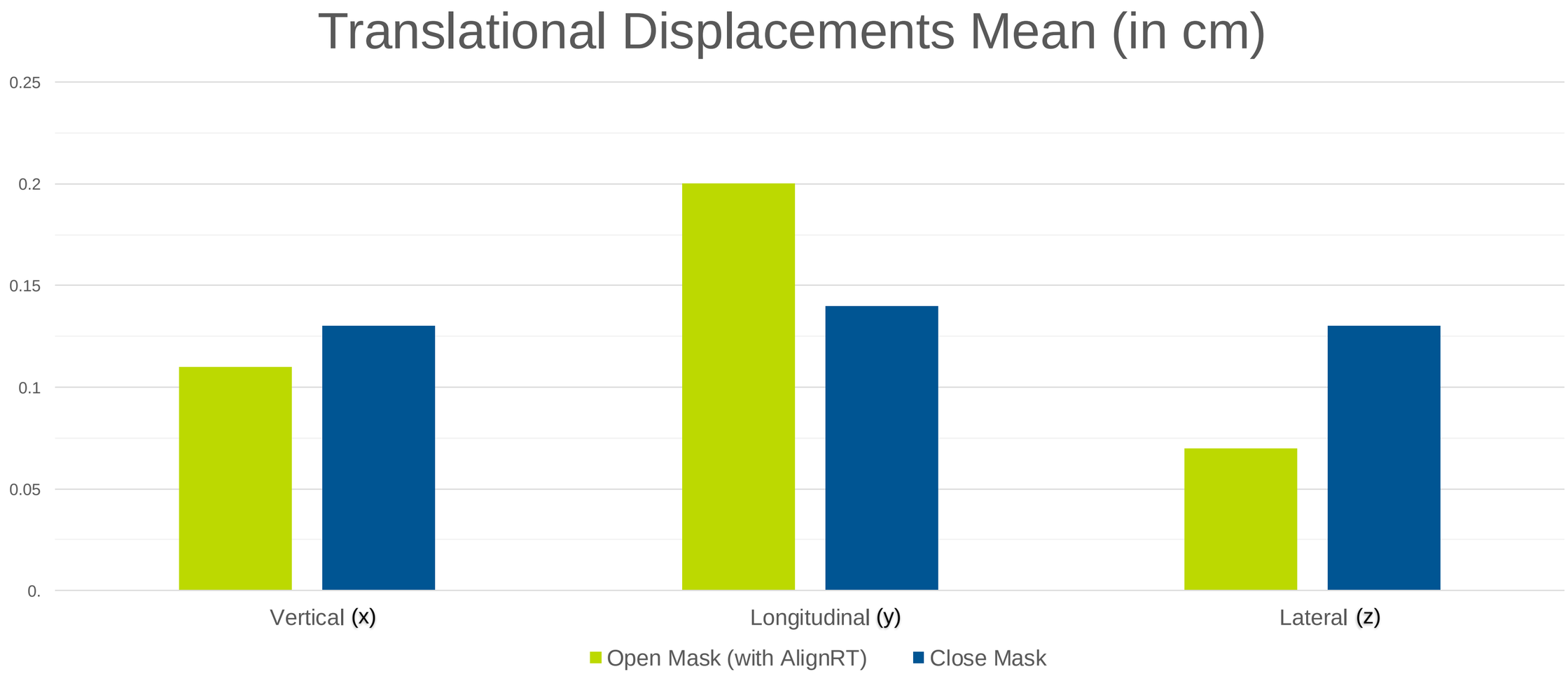
+ Treatment details:
  - Mask type
  - Treatment plans
+ Imaging Data:
  - CBCT shifts/corrections in all 6 directions
+ Additional Data:
  - Frequency of repeat imaging
  - Frequency of re-positioning



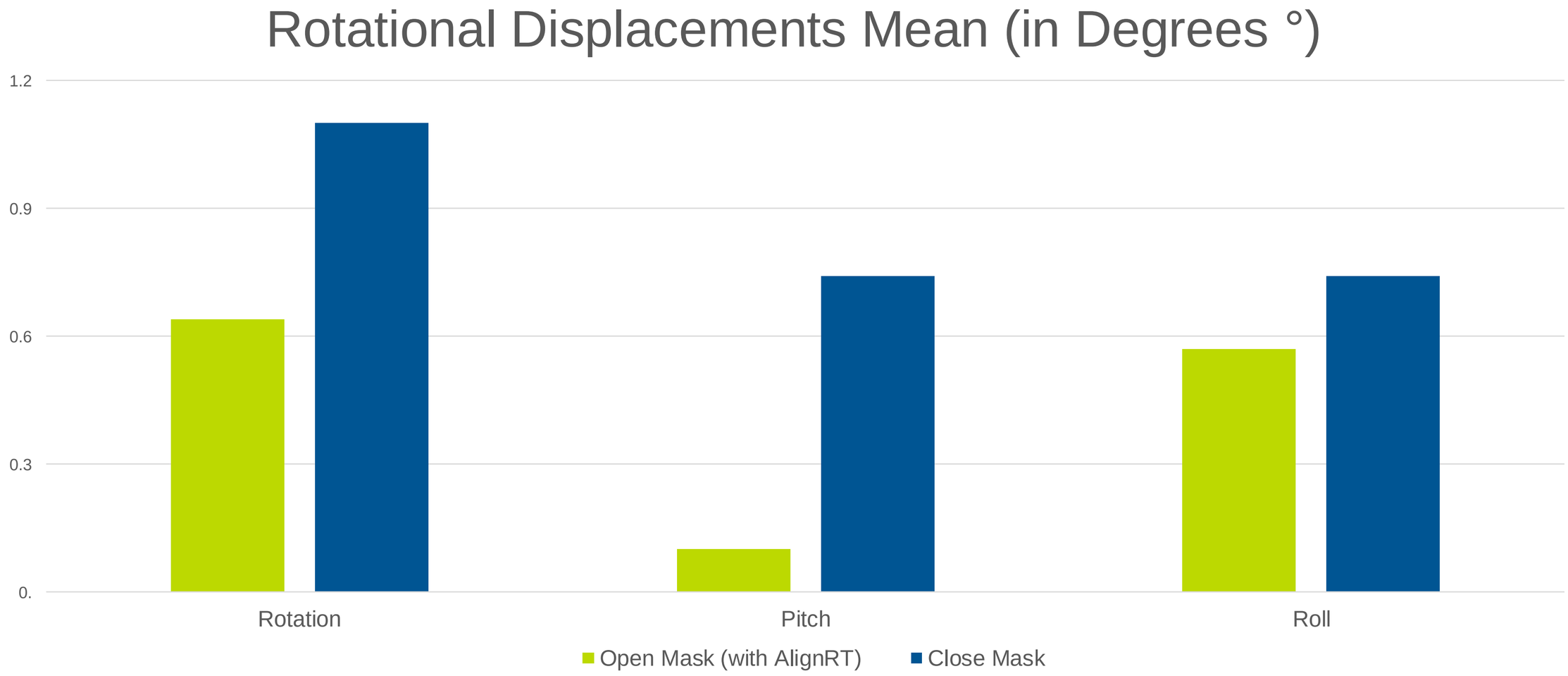
Results


Group 1
N= 90
180 patients
1,024 CBCTs analysed
512 CBCTs per Group
Group 2
N=90

Results (Accuracy)



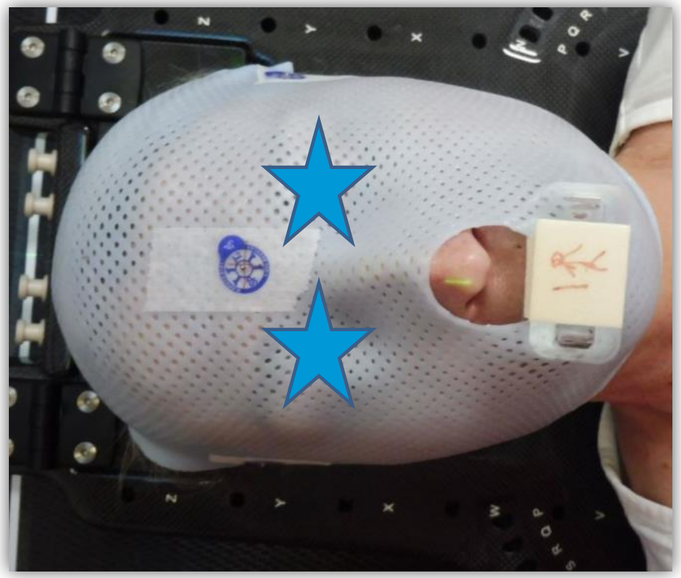
Results (Accuracy)



Potential Explanations

- Open-face masks and individualized cushioning provide excellent immobilization performance in reproducing patient positions.

- The thickness of the open facemask (3.2mm versus 2.3mm) provided rigid immobilisation.



Potential Explanations

The closed mask workflow is more prone to human error and inaccuracies. SGRT mitigates these human errors from happening.

JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS, VOLUME 14, NUMBER 6, 2013

Prevention of gross setup errors in radiotherapy with an efficient automatic patient safety system

Guanghua Yan,[a] Kathryn Mittauer, Yin Huang, Bo Lu, Chihray Liu, Jonathan G. Li
Department of Radiation Oncology, University of Florida, Gainesville, FL, USA
yan@ufl.edu

Unintended exposure in RT

Unintended exposure in radiotherapy: Identification of prominent causes ☆

Mary Boadu [a b], Madan Mohan Rehani [a]

Original Article

The role of surface-guided radiation therapy for improving patient safety

Hania Al-Hallaq [a], Vania Batista [b c d], Malin Kügele [e f], Eric Ford [g], Natalie Viscariello [g], Juergen Meyer [g h]

Closed Facemask and Clinical Workflow

- Patient on the couch
- Reproduce Patient position as per CT-Sim
- Align to CT Simulation Marks
- Apply Delta Couch shifts to Isocentre
- kV-CBCT Verification and Registration with Planning CT
- Shifts within departmental tolerance
- Apply Couch Shifts/Corrections
- Treat

Potential Explanations

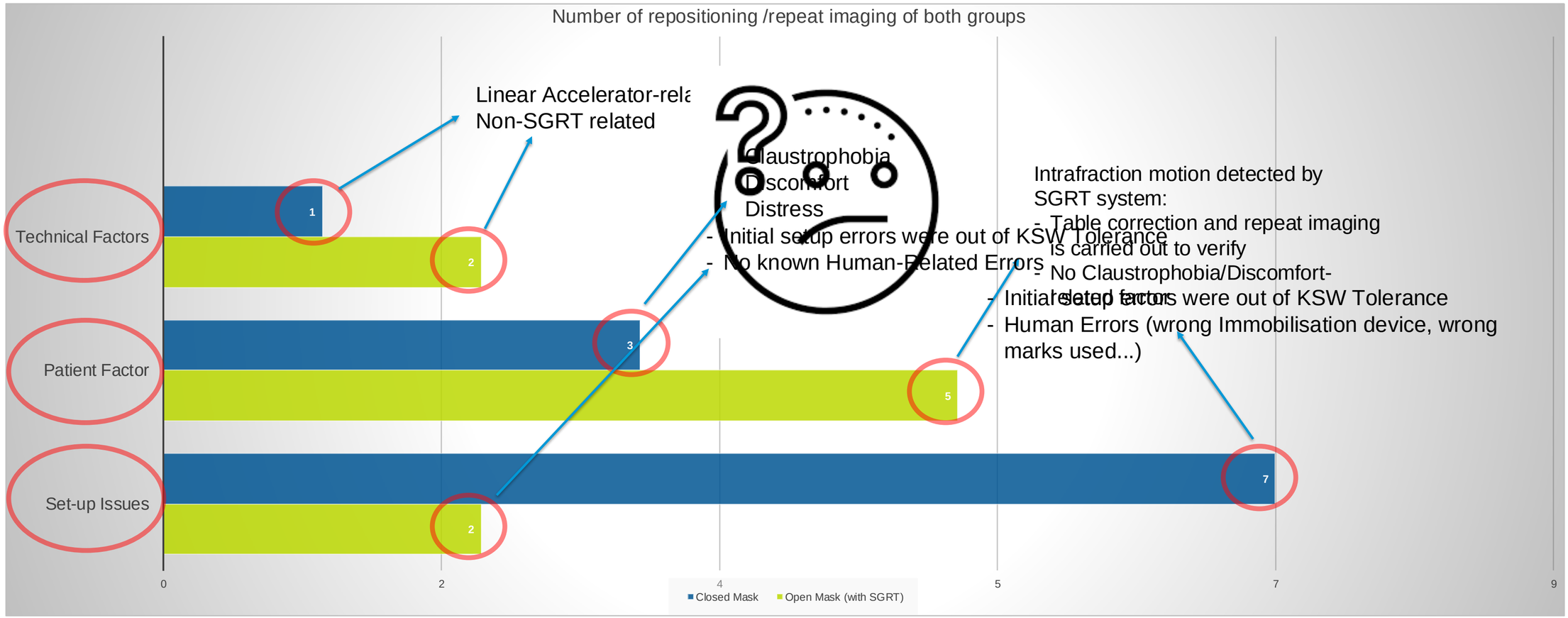
Open Facemask and Clinical Workflow

- Patient on the couch
- Reproduce Patient position as per CT-Sim
- Refine Patient Position by AlignRT Real-Time Deltas (RTD)
- RTD <1mm/1°
- kV-CBCT Verification and Registration with Planning CT
- Shifts within departmental tolerance
- Apply Couch Shifts/Corrections
- New Reference Capture and Start Monitoring
- Treat with Beam Control

- Clinical SGRT workflow
  Enables Radiation therapists to fine-tune patient postures

- Stringent endpoint requirement of <1 mm and <1 degree in RTD for surface-guided setup minimizes couch shifts in CBCT guidance

Results (Repeat imaging and repositioning)



Implications for Clinical Practice

- Open facemasks with SGRT have significant potential to become the new standard in SRT/SRS treatments due to:
  - Accuracy: Superior control over translational and rotational displacements
  - Increased patient comfort and safety , leading to more precise and effective treatments
  - Reduction in repeat Imaging and repositioning events = ALARA

= increased patient satisfaction and quality of treatment

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