Investigating Immobilization Consistency in Surface Guided Radiation Therapy (SGRT): A Study on Open Face Masks and Conventional Masks

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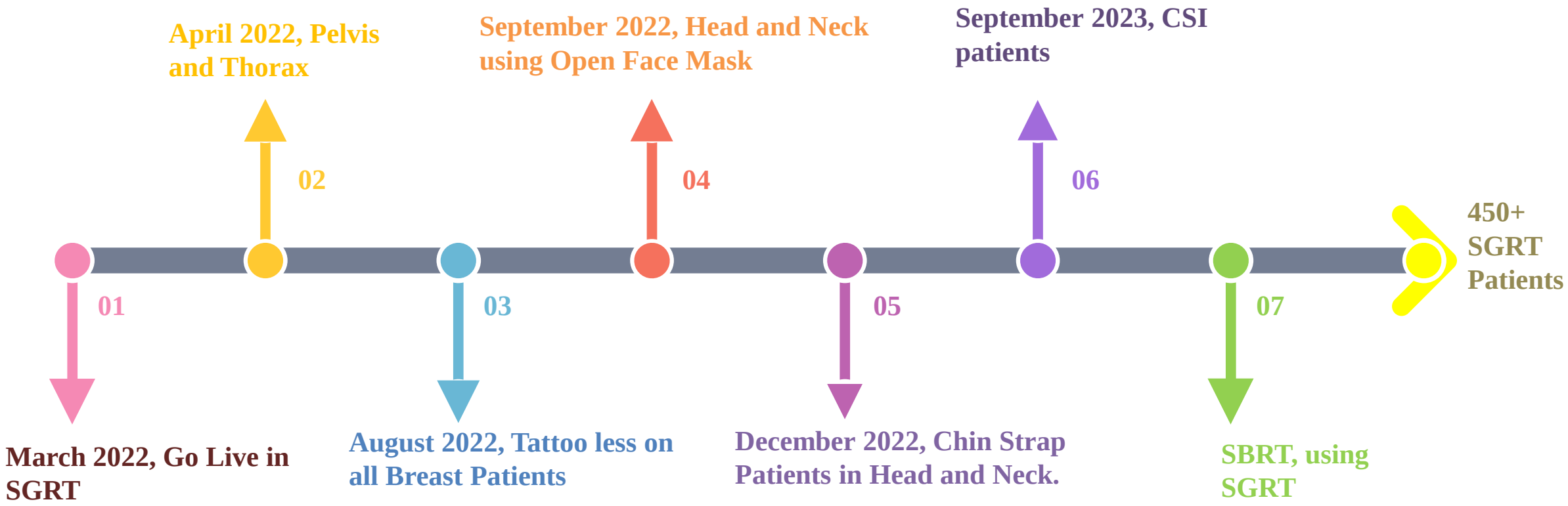
SGRT at KSSSCI



Why we need SGRT in HN?

1.Patient Experience:

Many patients find masks constrictive and stressful.

Solution for patients suffering from claustrophobia.

2.Deformation Over Time:

Inaccuracies can arise due to deformation of mask over time.

3.Proximity to Critical Structures:

The treatment area is often close to critical structures such as the spinal cord, salivary glands, and eyes.

4.Limitations in Intra-fraction Imaging:

Intra-fraction imaging capabilities are often limited for Image-Guided Radiation Therapy (IGRT), giving rise to Surface Guided Radiation Therapy (SGRT)

Study Design:

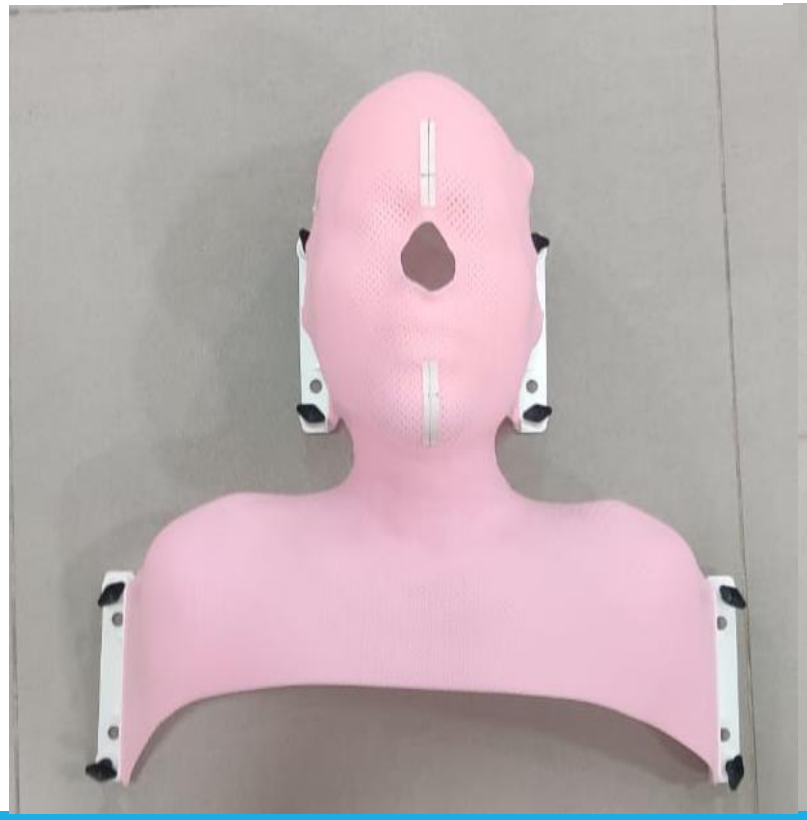
- Patients undergoing Head and Neck Treatment
- Group 1: Open Mask (OM) vs Group 2: Closed Mask (CM)
- 26 patients in each group

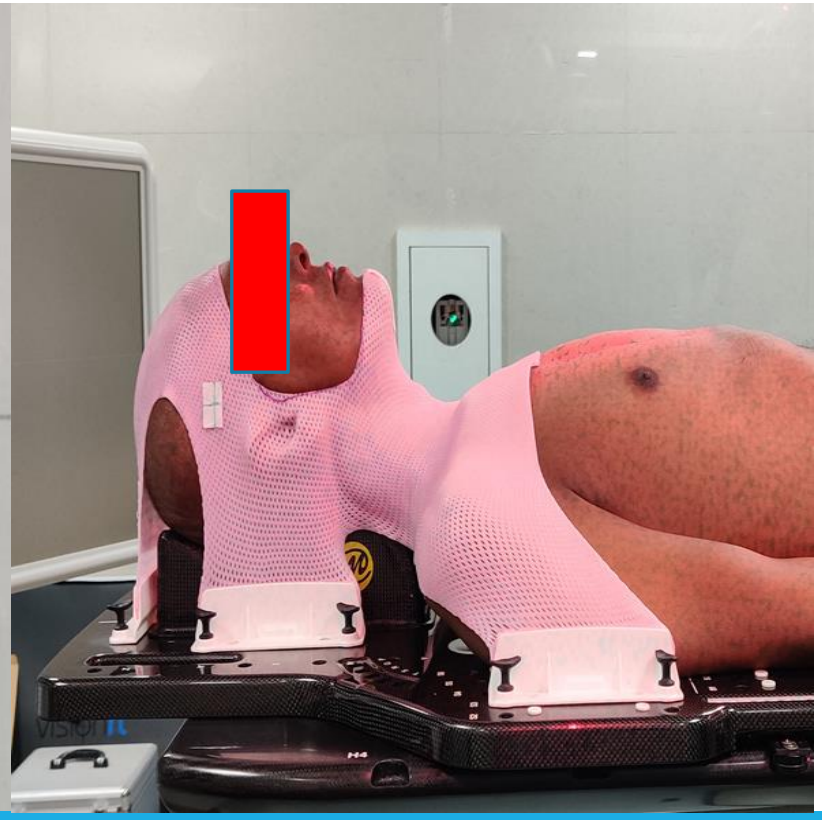
Objectives

1. To analyze the benefit of SGRT in head and neck patients treated using conventional and open masks.
2. To assess the reliability and consistency of the immobilization devices.
3. To scrutinize the variations in treatment times between using OMs and CMs

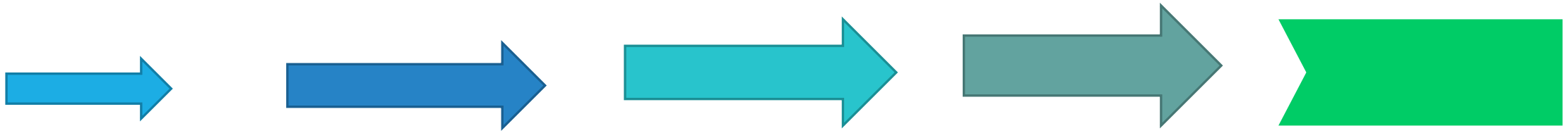
Materials:

- Group A: Open Mask - Inhouse modified RayFit/ MacroCast by Macromedics 5 Point / 2.3mm with open on the face for SGRT Compatible
- Group B: Ray fit/ MacroCast 5 Point Mask/2.3mm by Macromedics





SGRT workflow:



CT

- Custom modified Face Mask prepared

Planning

- Outer Contour as reference surface
- Export outer contour and plan/isocenter to SGRT system
- Optimize the reference surface

Preparation

- Import and verify contour & isocenter
- Define ROI
- Error thresholds of 2 mm for longitudinal, lateral, and vertical shifts and 1.5 ° for rotation, pitch, and roll .

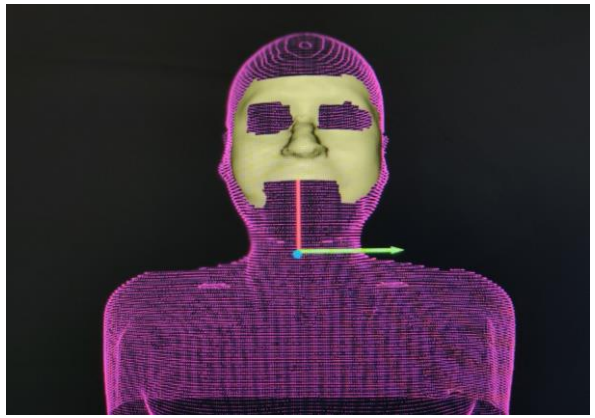
Positioning

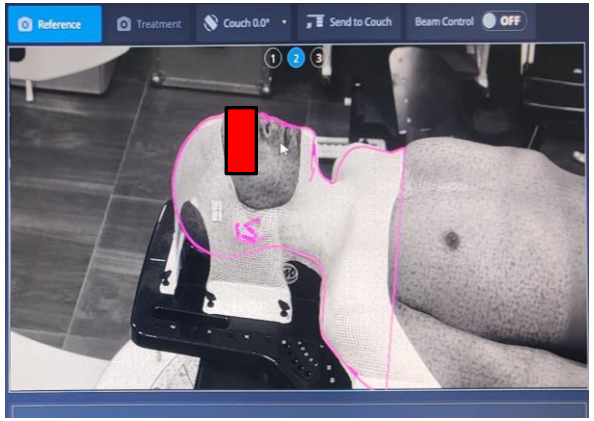
- Position Patient with reference image
- Align the nose and chin followed by lower neck and shoulder will be matched
- Verify pre Treatment Position and applied shifts

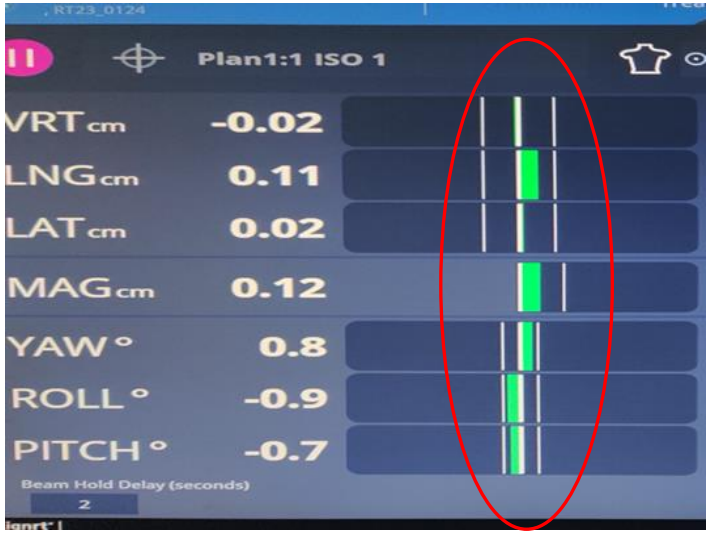
Treatment

- Continue Surface Monitoring Beam Hold If patients moves

SGRT treatment workflow:







Skin Surface data taken from reference CT

One ROI drawn at the face

Initial setup with nose and chin after that lower neck and shoulder will be matched

Error thresholds of 2 mm for longitudinal, lateral, and vertical shifts and 1.5 ° for rotation, pitch, and roll

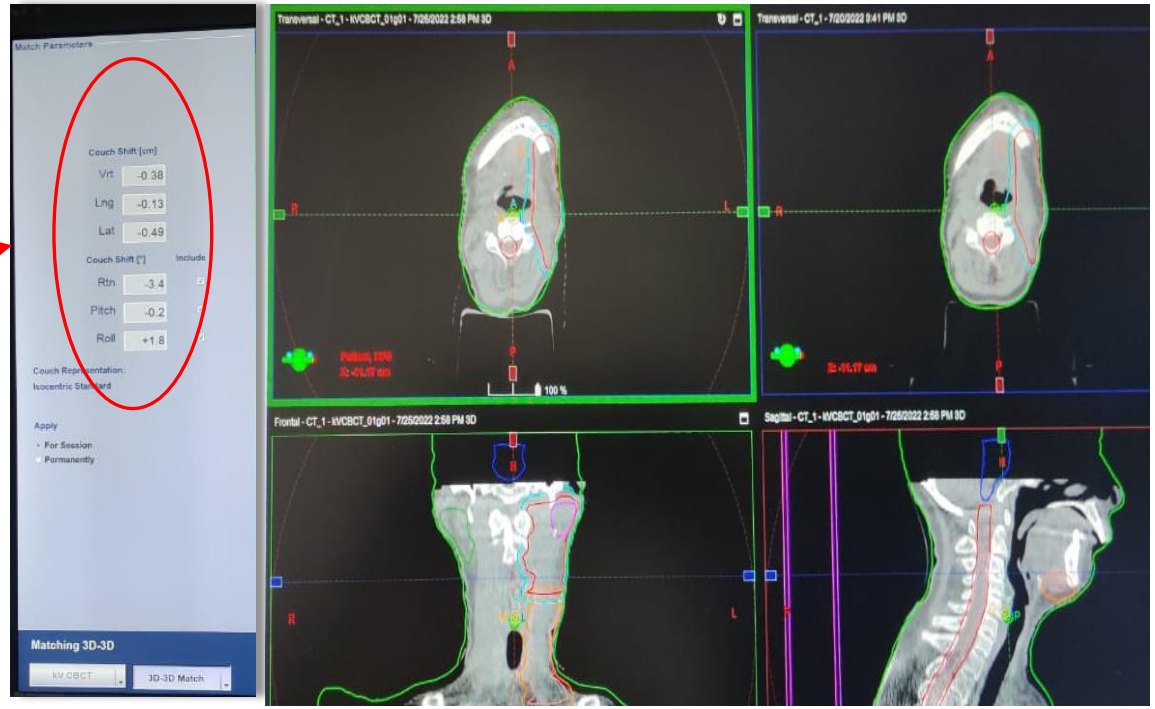
Online CBCT matching first included bony spine and skull anatomy, followed by soft tissue matching around PTV

Repeat Surface capturing is acquired

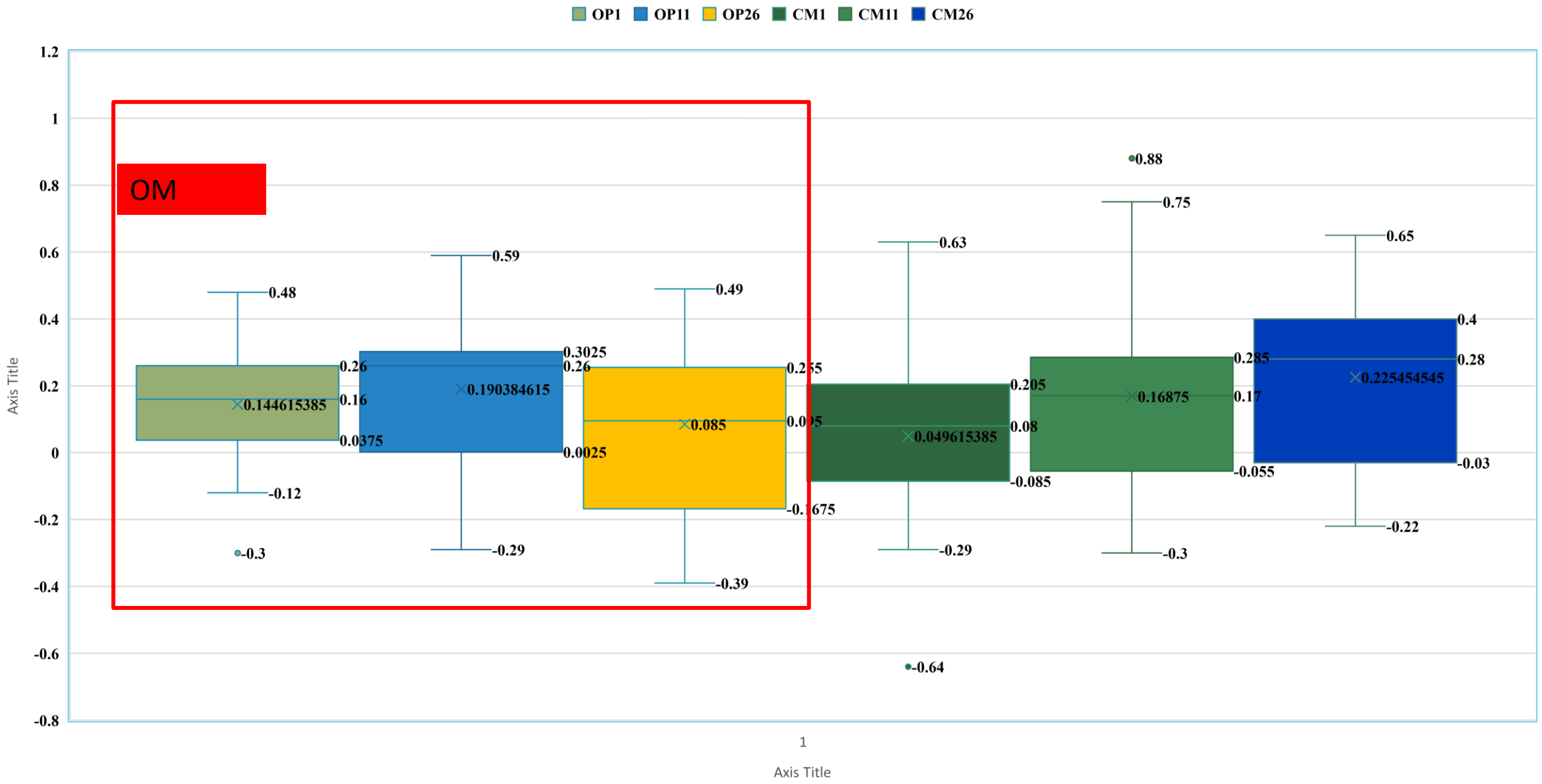
CBCT Matching Workflow:

- Online CBCT matching with bony spine and skull anatomy, followed by soft tissue matching around PTV
- We have used setup error data during 1st , 11th and 21st fraction
- 156 images analysed for this studied
- True Beam SVX 6D Couch

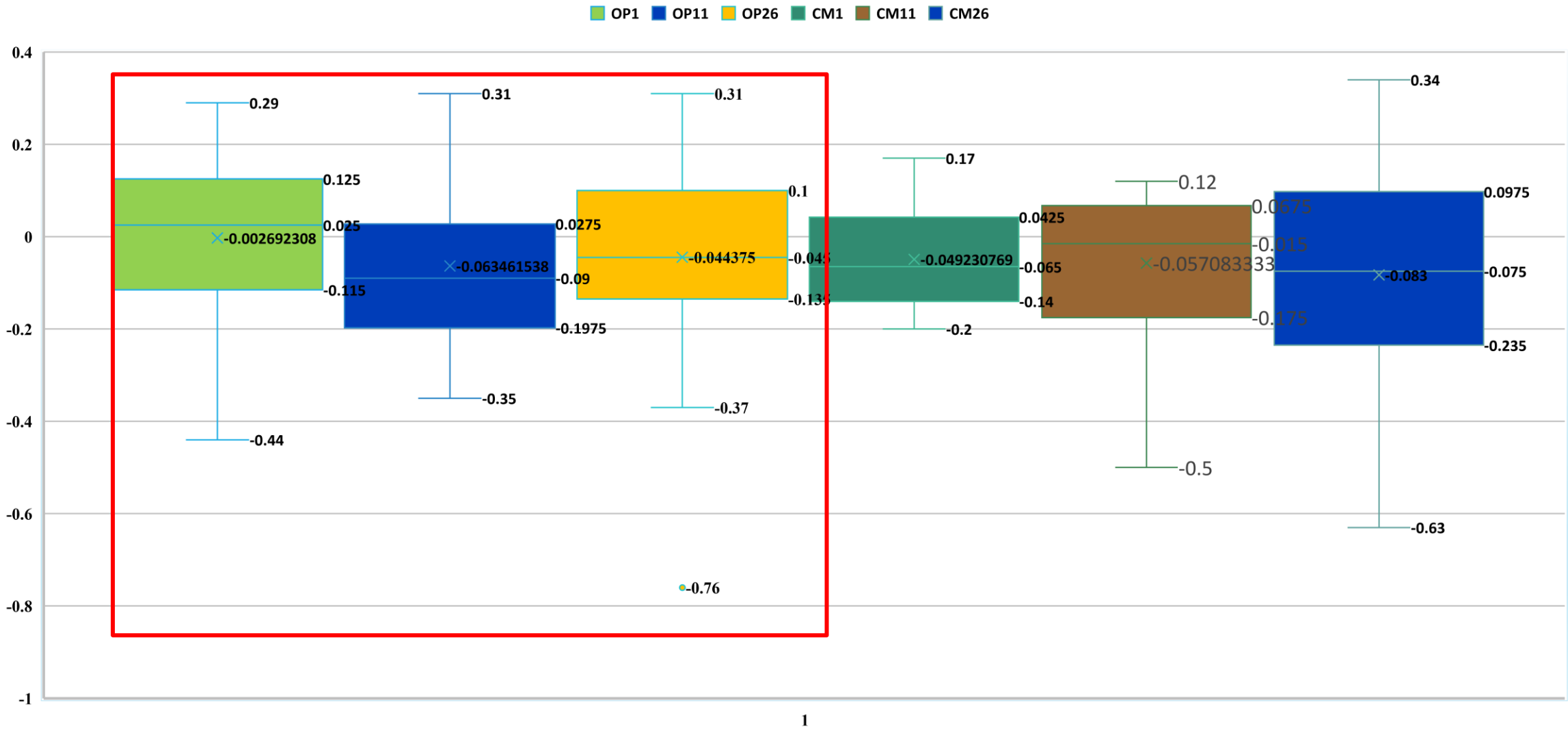
1. Vertical
2. Longitudinal
3. Lateral
4. Yaw
5. Pitch
6. Roll



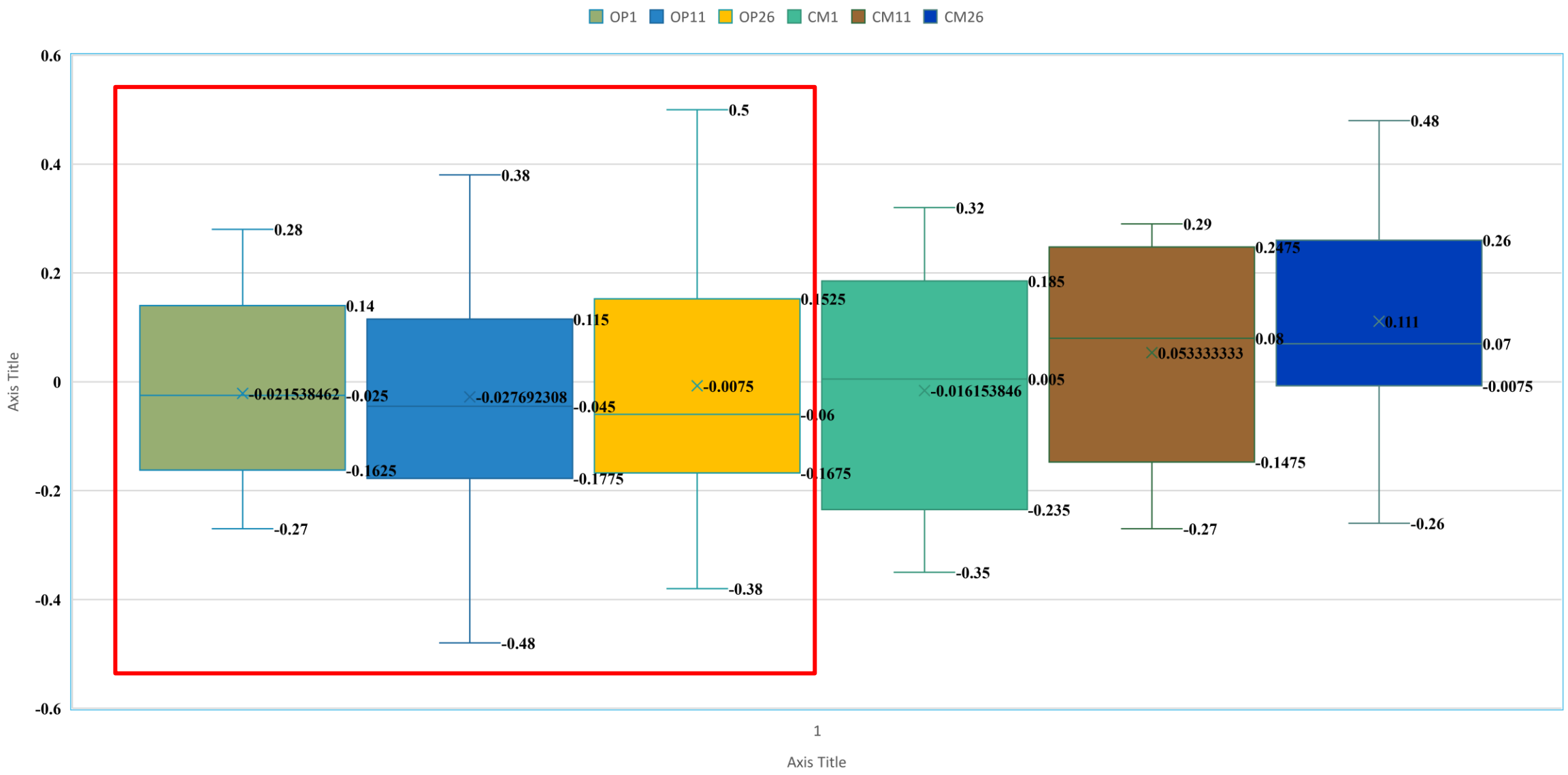
Vertical Setup Error b/w Open Face Mask (OM) and Closed Mask(CM)



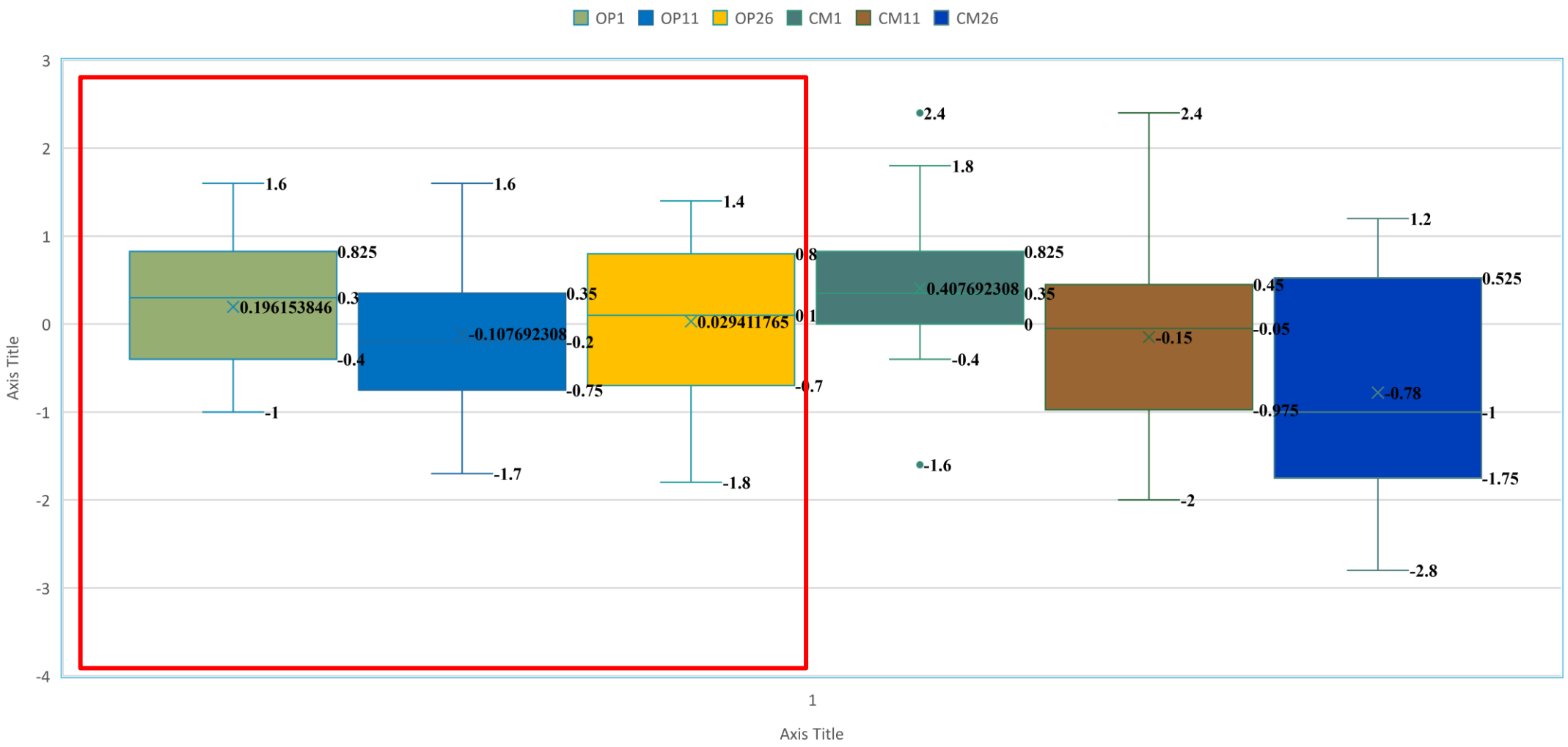
Longitudinal Setup error b/w Open Face Mask (OM) and Closed Face Mask (CM)



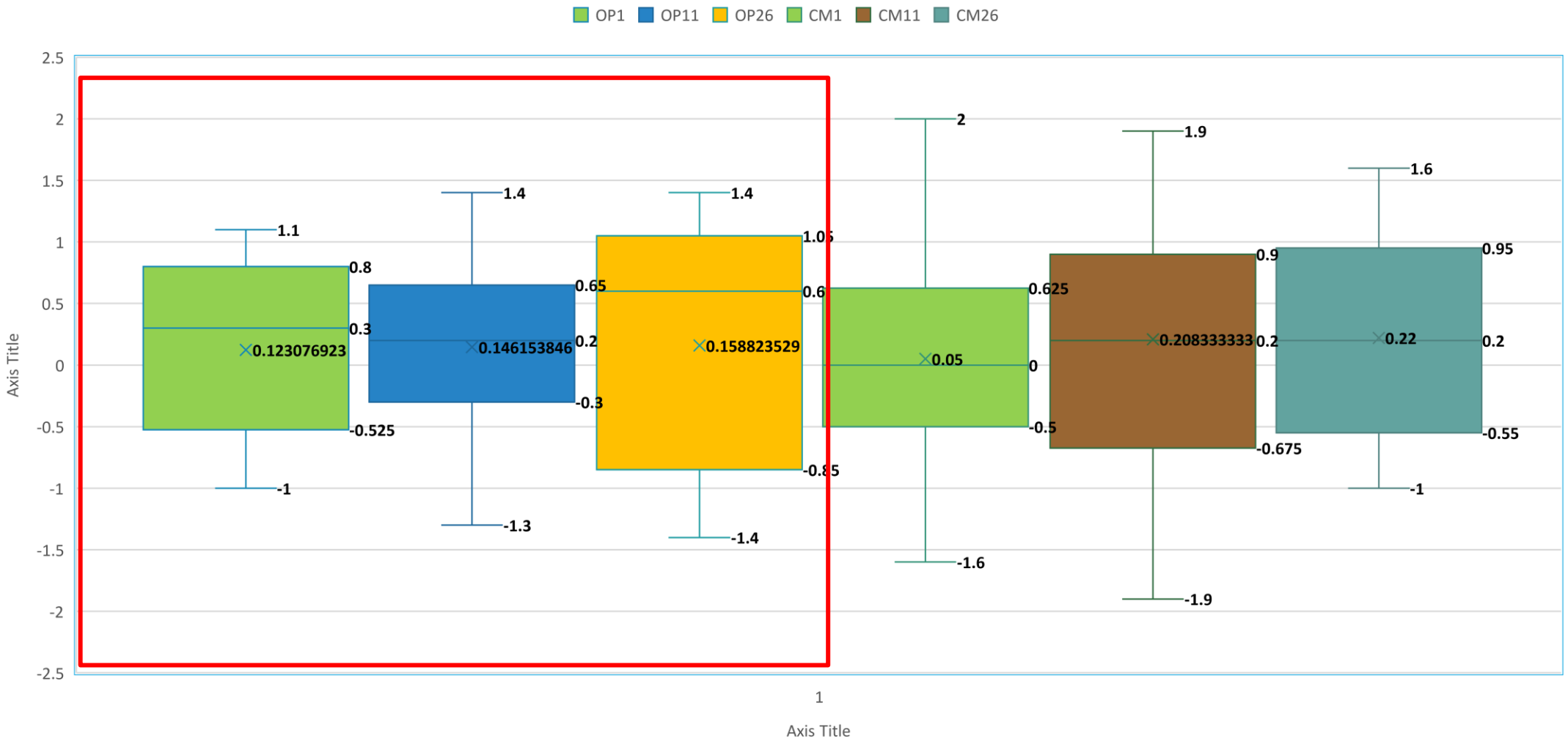
Lateral Setup error b/w Open Face Mask (OM) and Closed Face Mask (CM)



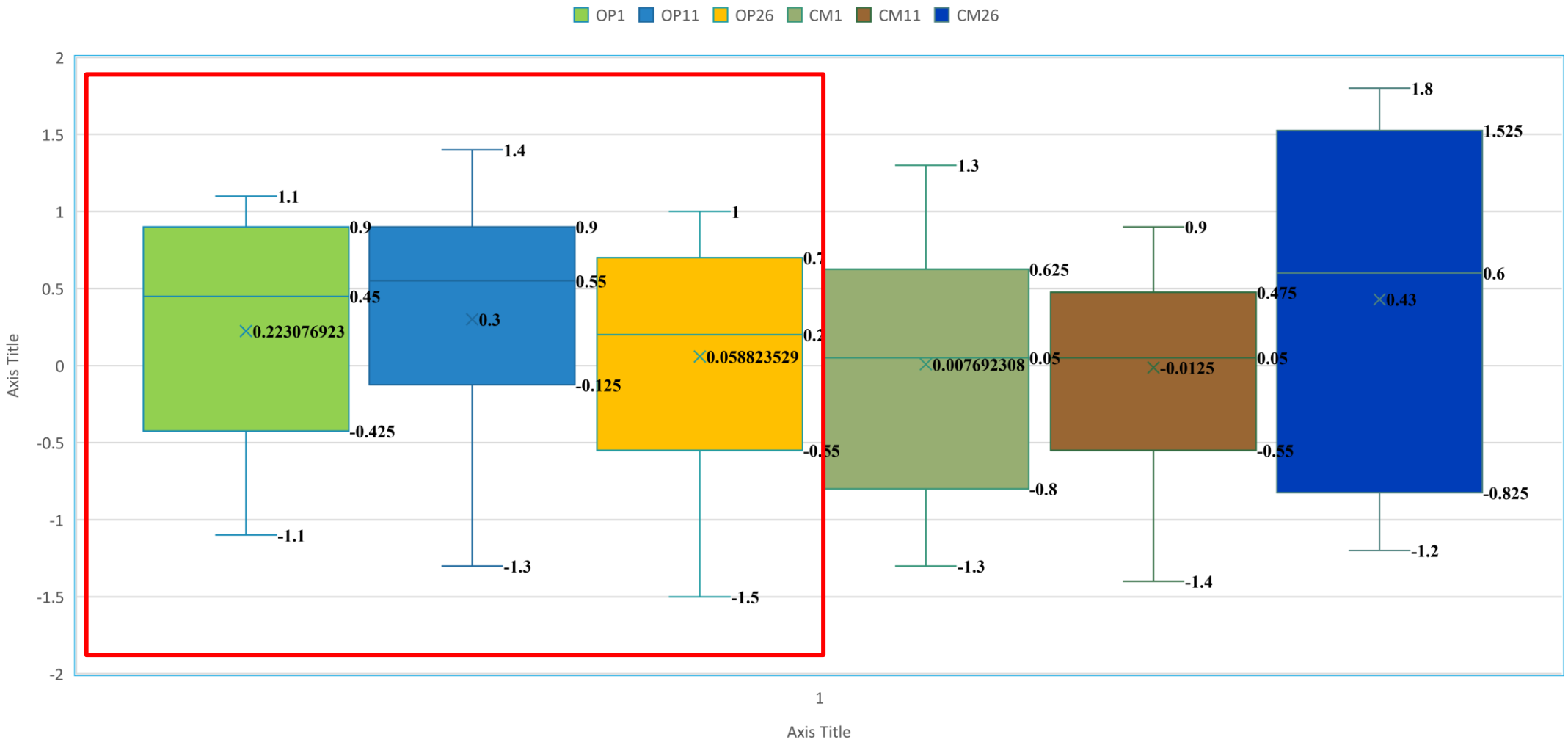
Pitch Setup error b/w Open Face Mask (OM) and Closed Face Mask (CM)



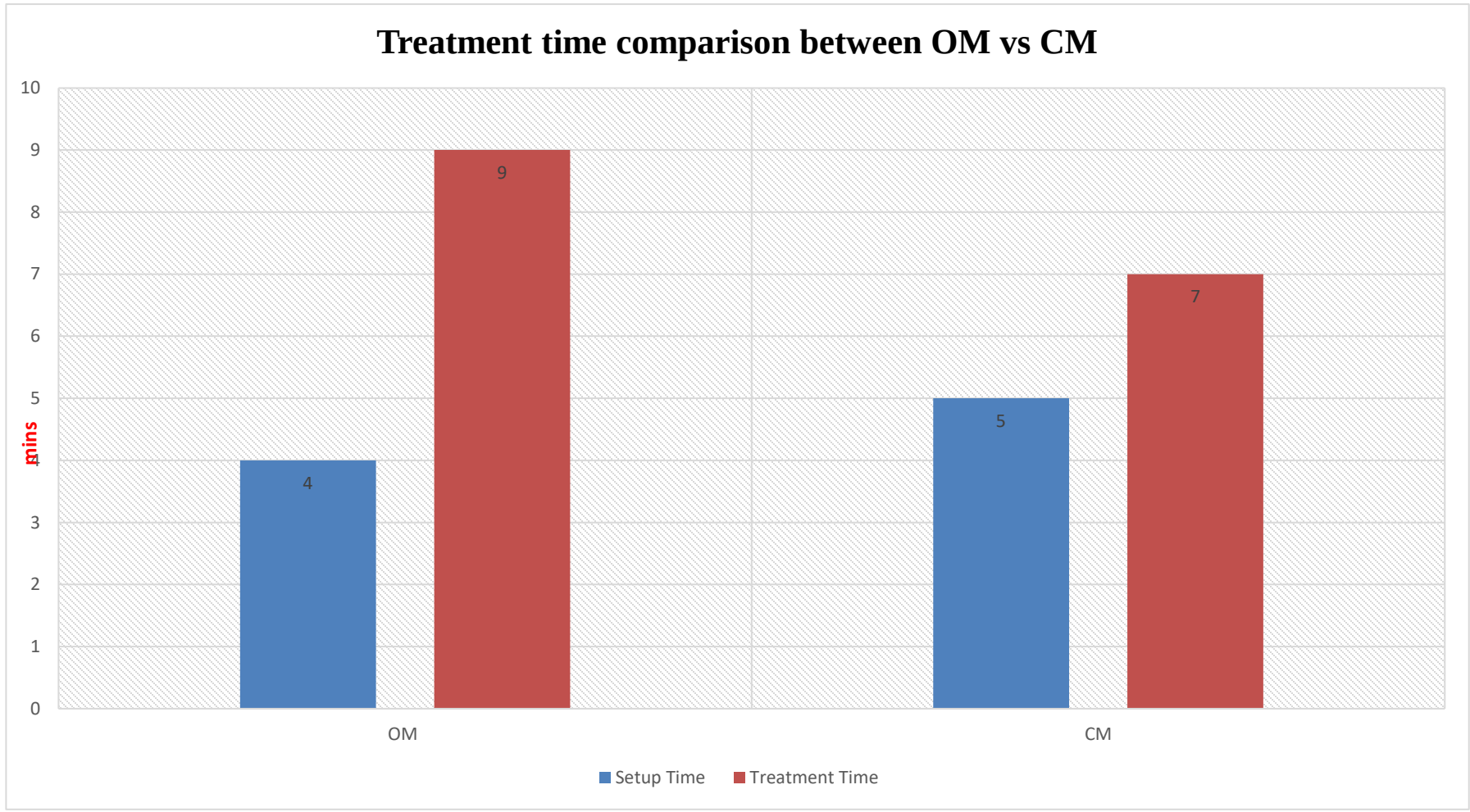
Roll Setup error b/w Open Face Mask (OM) and Closed Face Mask (CM)



Yaw Setup error b/w Open Face Mask (OM) and Closed Face Mask (CM)



Results:	Mean and SD			
Axes	**Type of Immobilizations**	**1**	**11**	**26**
Vertical(cm)	OM	0.145±0.168	0.190±0.224	0.085±0.346
	CM	0.050±0.251	0.169±0.294	0.225±0.263
	T test	**0.147088**	**0.975797**	**0.331236**
Long(cm)	OM	-0.003±0.176	-0.063±0.181	-0.044±0.263
	CM	-0.049±0.108	-0.057±0.149	-0.083±0.276
	T test	**0.272922**	**0.900497**	**0.781787**
Lateral	OM	-0.022±0.178	-0.028±0.199	-0.008±0.224
	CM	-0.016±0.204	0.053±0.198	0.111±0.210
	T test	**0.922779**	**0.184784**	**0.728928**
Pitch	OM	0.196±0.731	-0.108±0.838	0.029±0.946
	CM	0.408±0.788	-0.150±1.007	-0.780±1.302
	T Test	**0.1497**	**0.884755**	**0.135195**
Rolls	OM	0.123±0.677	0.146±0.695	0.159±1.022
	CM	0.050±0.796	0.208±0.973	0.220±0.828
	T Test	**0.737551**	**0.986031**	**0.772472**
Rotation	OM	0.223±0.695	0.300±0.698	0.059±0.756
	CM	0.008±0.769	-0.013±0.650	0.430±1.72
	T Test	**0.263595**	**0.244901**	**0.903624**


Treatment time comparison between OM vs CM
10
9
8
7
6
5
4
3
2
1
0
mins
9
4
7
5
OM
CM
Setup Time
Treatment Time

Conclusion

1. Consistency is better in Open Face Mask
2. There is no statistical difference found between the two groups.
3. Open Face Mask should be suitable immobilization for patients suffer Claustrophobia and anxiety
4. Treatment time is comparable in both masks
5. Open mask is good replacement for closed mask based on this study

Thank You !!

SGRT: MORE GUIDANCE, FOR EVERY STEP

SURFACE GUIDED RADIATION THERAPY
SGRT COMMUNITY

Peter Mac
Peter MacCallum Cancer Centre
Victoria Australia

SGRT for
EVERY step
of the RT workflow:

SIM **PLAN** **TREAT** **DOSE**

THANK YOU