

Set-up Accuracy with Frameless Radiosurgery of Intracranial Lesions using Exac Trac 6-D Robotic Couch on Novalis Tx Linear Accelerator

Revathy Kesavan(2) Karthikeyan Srinivasan(2) Niteen More(1)* Vijay Anand Reddy(1) Vinitha Reddy(1)
Padma Ganesan(2) Tamilselvan Kasirajan(2) Muthulingam Shunmugavel(2)

1) Dept of Radiation Oncology, (2) Dept of Medical Physics, Apollo Health City, Hyderabad, India

Objective

To determine set-up accuracy in patients undergoing frameless radiosurgery of intracranial lesions using Exac Trac 6 degree-of-freedom robotic couch on Novalis Tx linear accelerator.

Methods

- 10 patients with intracranial lesions were the study population.
- Patients planned for single or fractionated stereotactic radiosurgery (SRS) using 6 to 9 beams with BrainLab iPlan treatment planning system.
- Planning CT images were transferred to the Brain Lab Exac Trac X-ray verification system and DRRs were generated for all treatment couch positions.

Isocenter Calibration



Aligns couch top with machine isocentre

X-Ray Calibration



Ensures that the central axis of the X-ray beam passes through the machine isocenter

Isocenter Verification



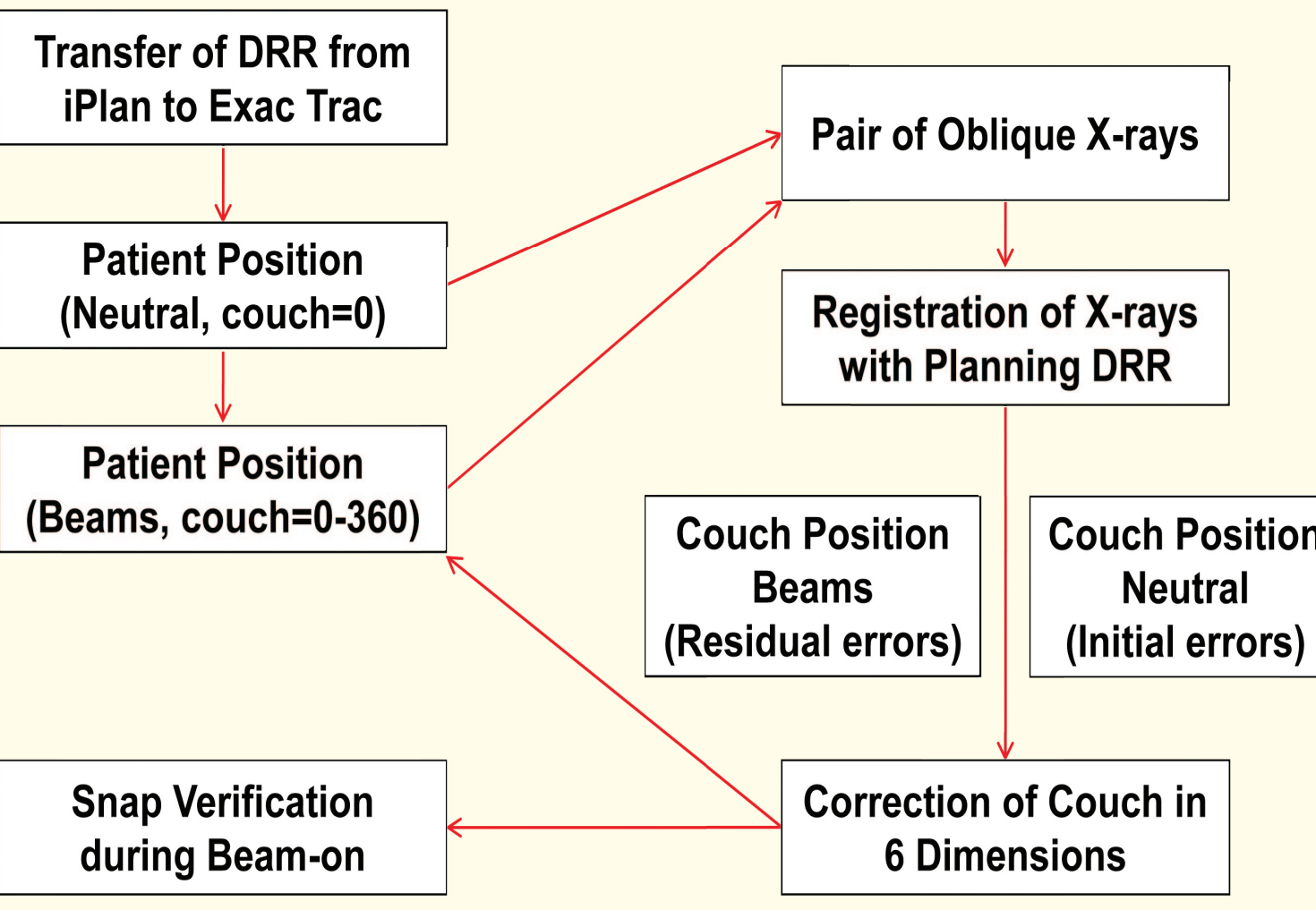
Ensures accuracy of the isocenter calibration and X-ray calibration

Winston-Lutz test



Ensures accuracy of Laser with isocentre of Gantry, Collimator and Table. Deviation <0.7 mm acceptable.

ExacTrac Verification

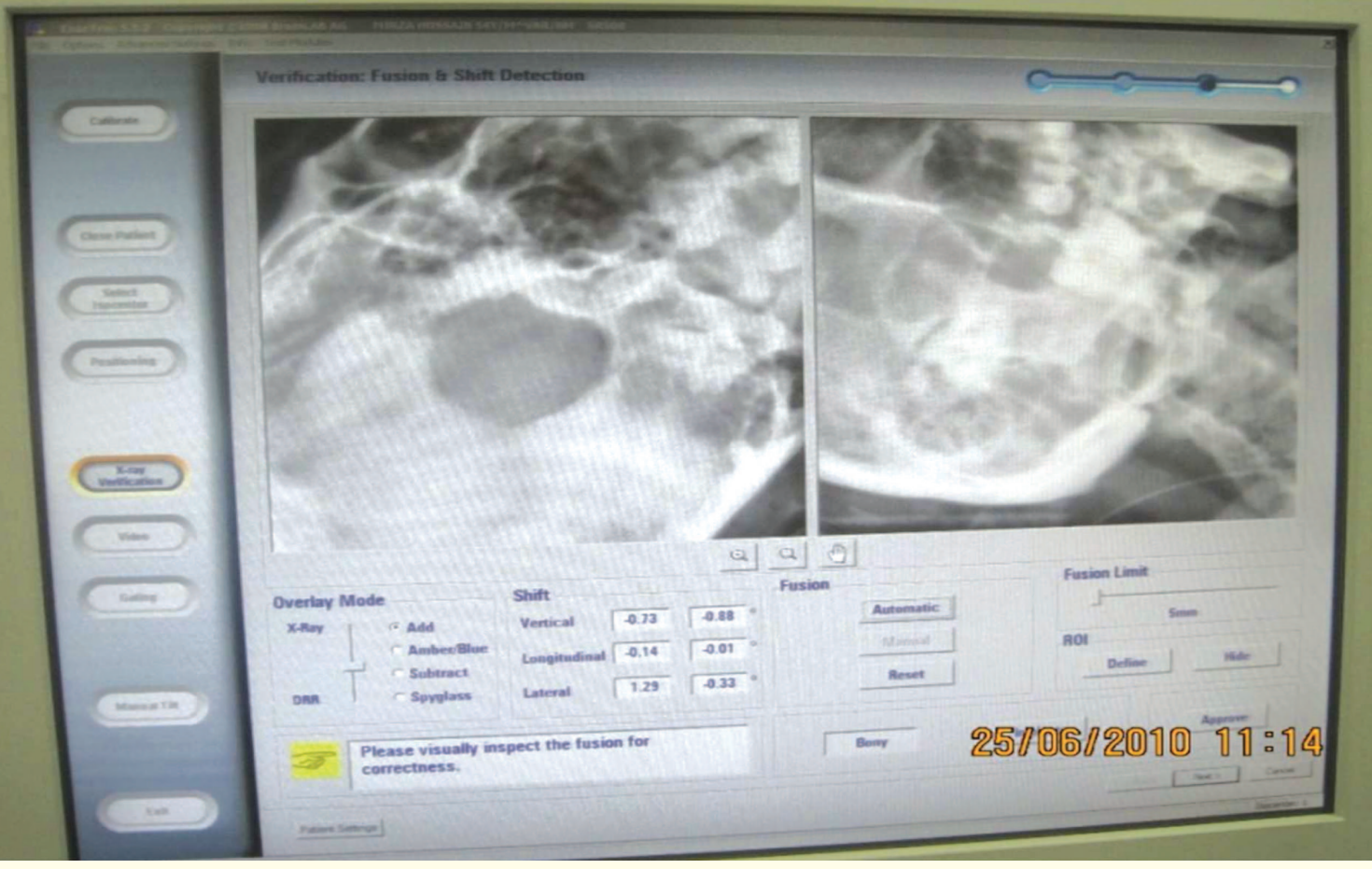


Treatment Setup

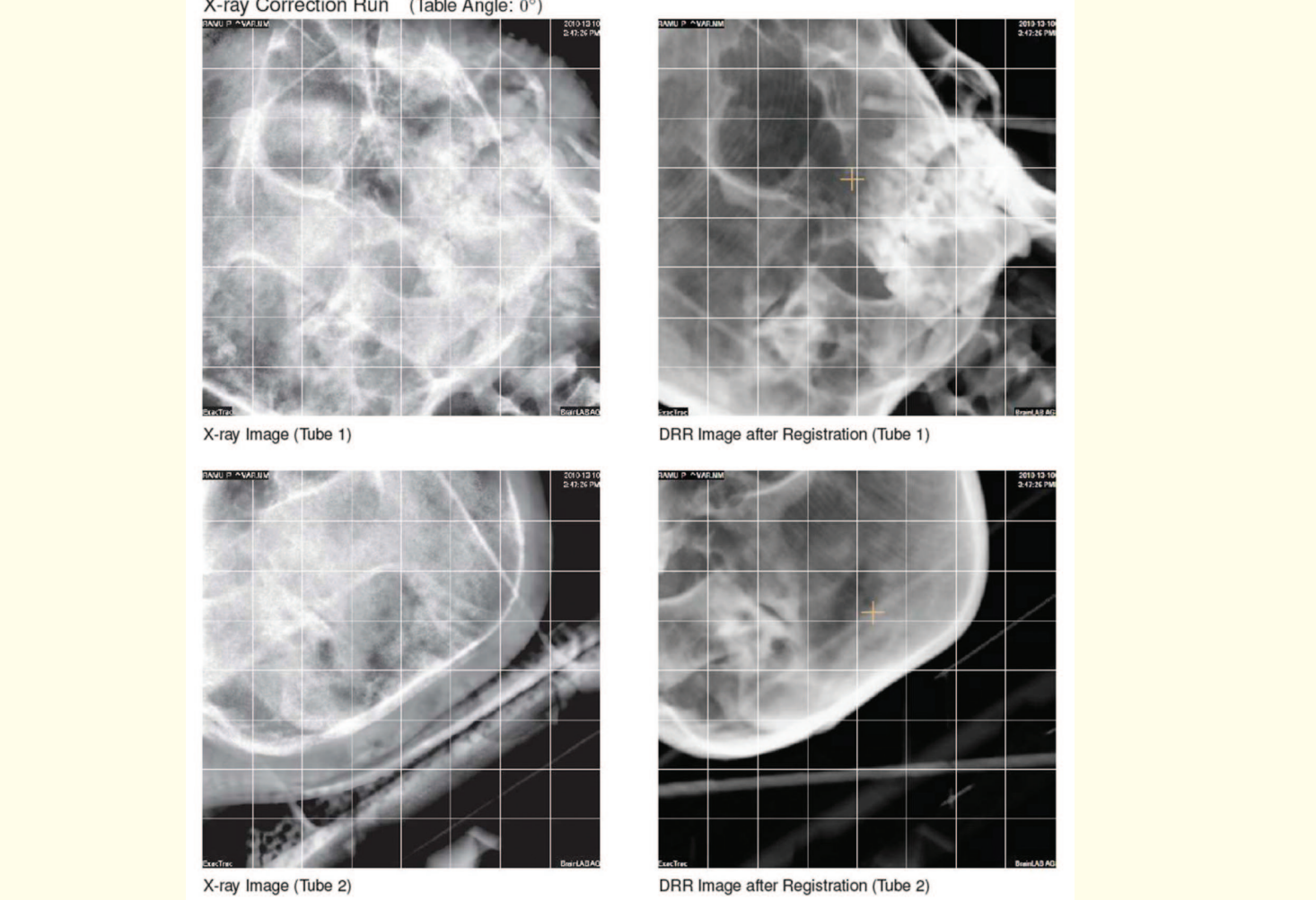


Patient is positioned using infrared localizer attached with the couch and infrared camera attached in the room

Pair of Oblique X-rays



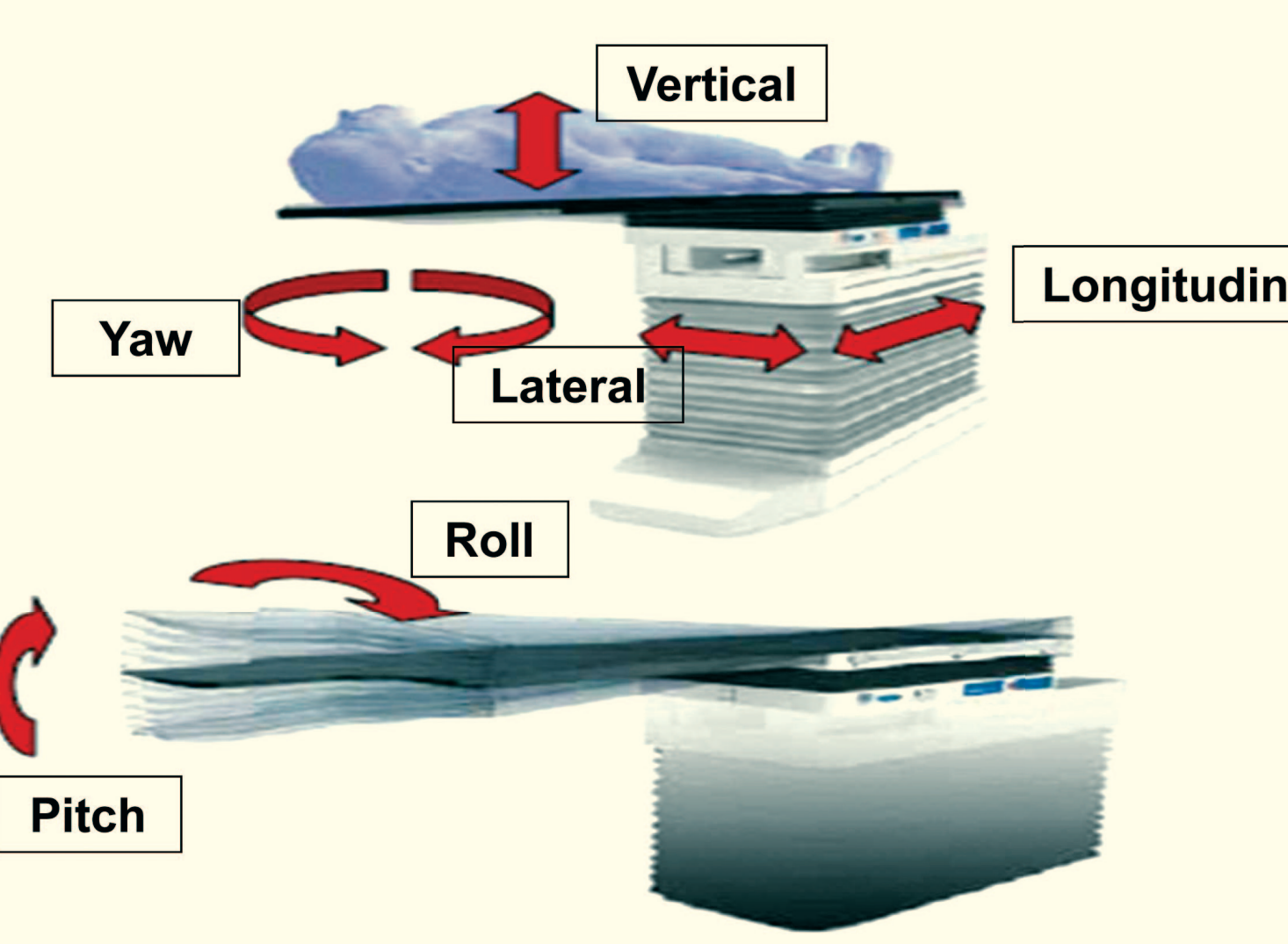
Registraion with DRR images



Novalis Tx



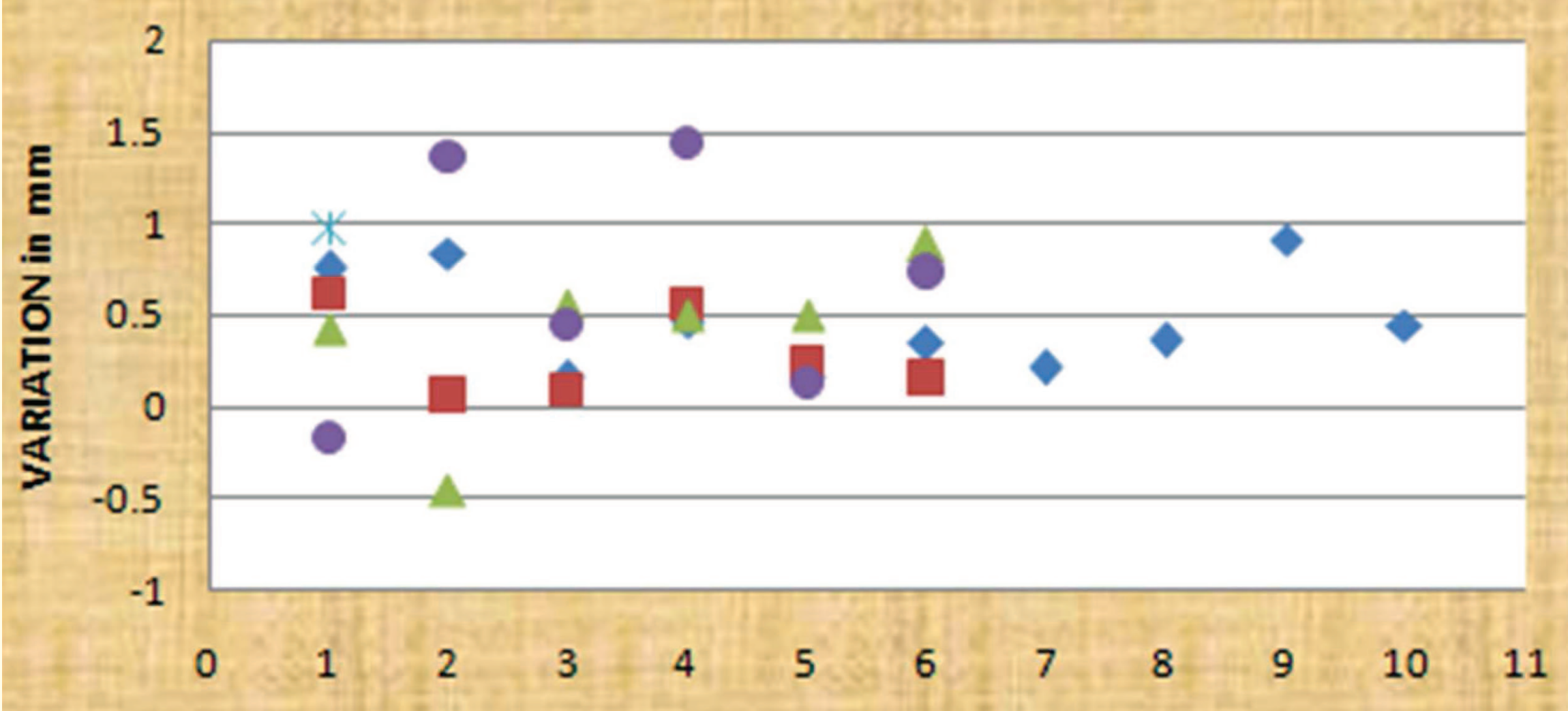
6D-ShiftingParametersofCouch



Results

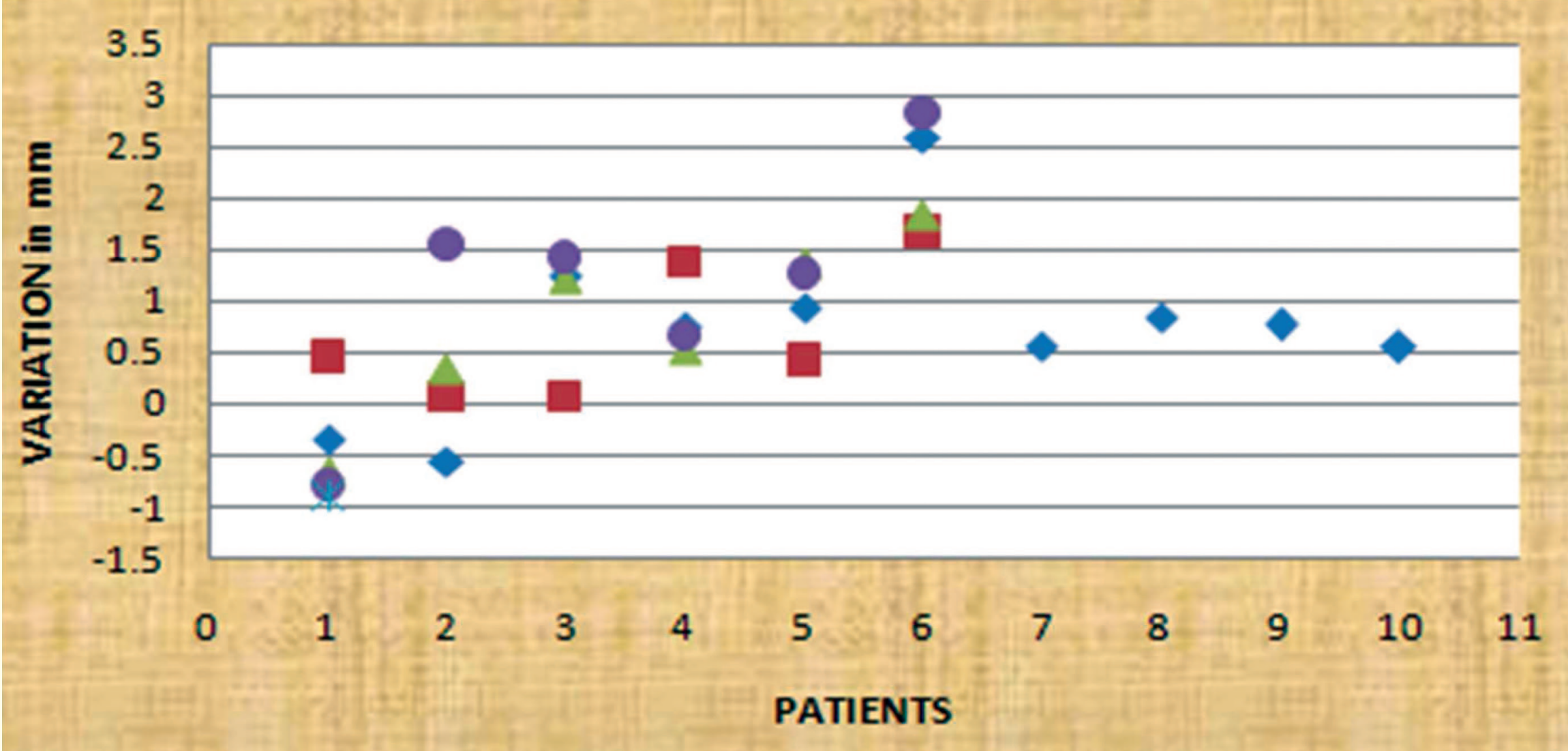
	Translational Deviations (mm)			Angular Deviations (degrees)		
	Lateral	Longit	Vertical	Roll	Pitch	Yaw
Pt 1	0.51	-0.45	-1.46	1.0	-0.3	0.5
Pt 2	0.45	0.34	1.39	0.3	1.9	0.3
Pt 3	0.31	0.98	0.32	0.3	1.3	1.4
Pt 4	0.74	0.83	0.73	0.4	0.1	0.8
Pt 5	0.25	1.00	1.03	0.8	0.6	0.5
Pt 6	0.53	2.23	0.98	0.5	1.2	1.0
Pt 7	0.21	0.56	0.68	0.9	0.5	0.5
Pt 8	0.36	0.85	0.72	0.7	0.7	0.5
Pt 9	0.91	0.76	0.59	1.0	1.1	0.4
Pt 10	0.44	0.55	0.35	0.6	0.3	0.5

Lateral Deviation



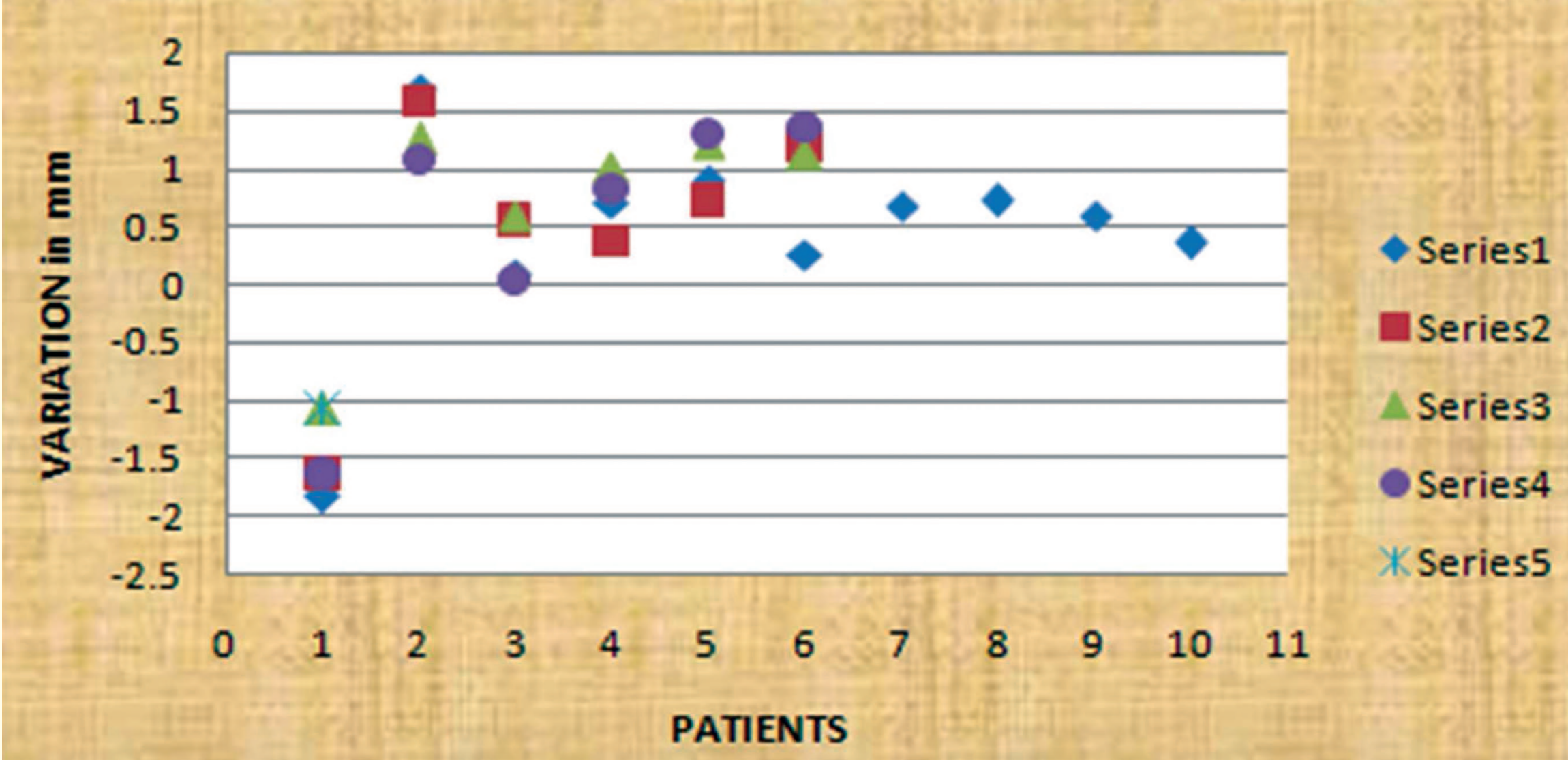
Mean Deviation
0.47 +/-0.39mm

Longitudinal Deviation



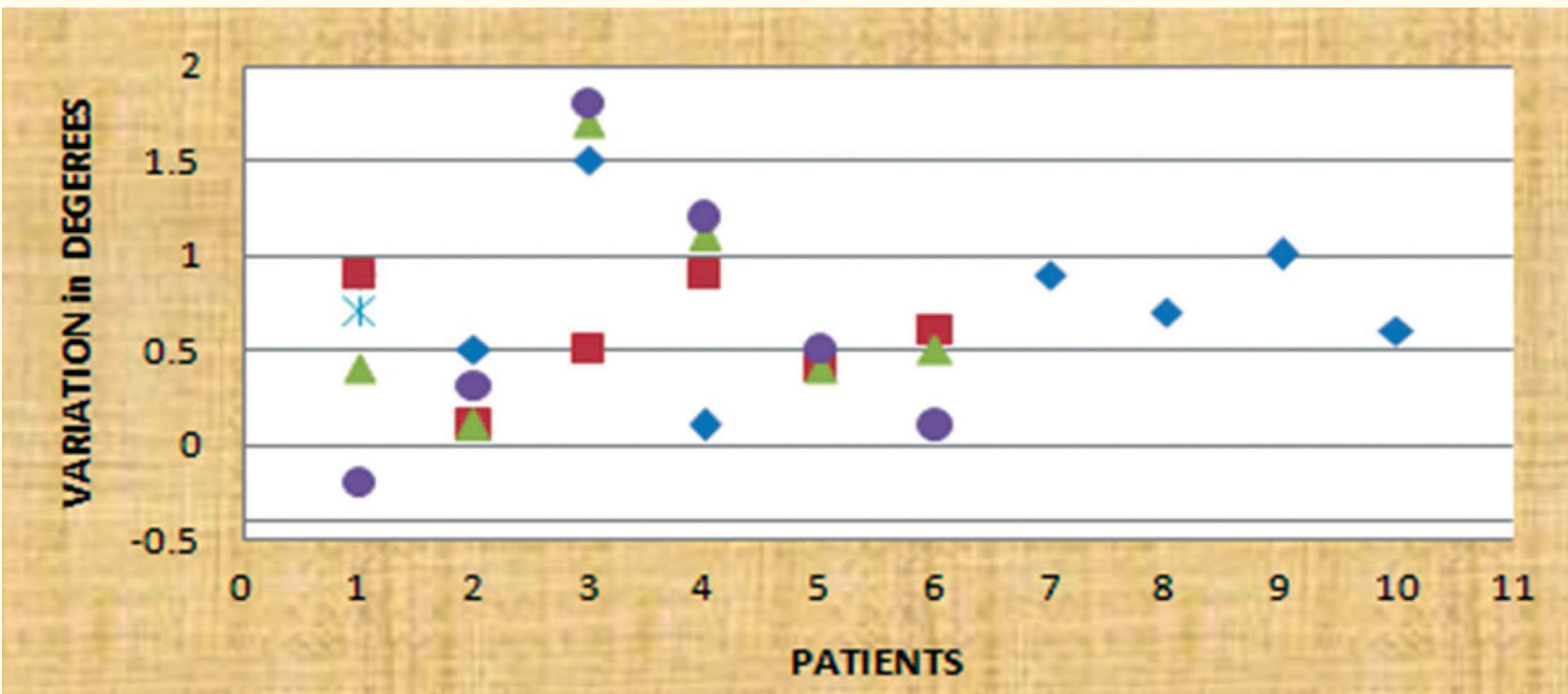
Mean Deviation
0.76 +/-0.52mm

Vertical Deviation



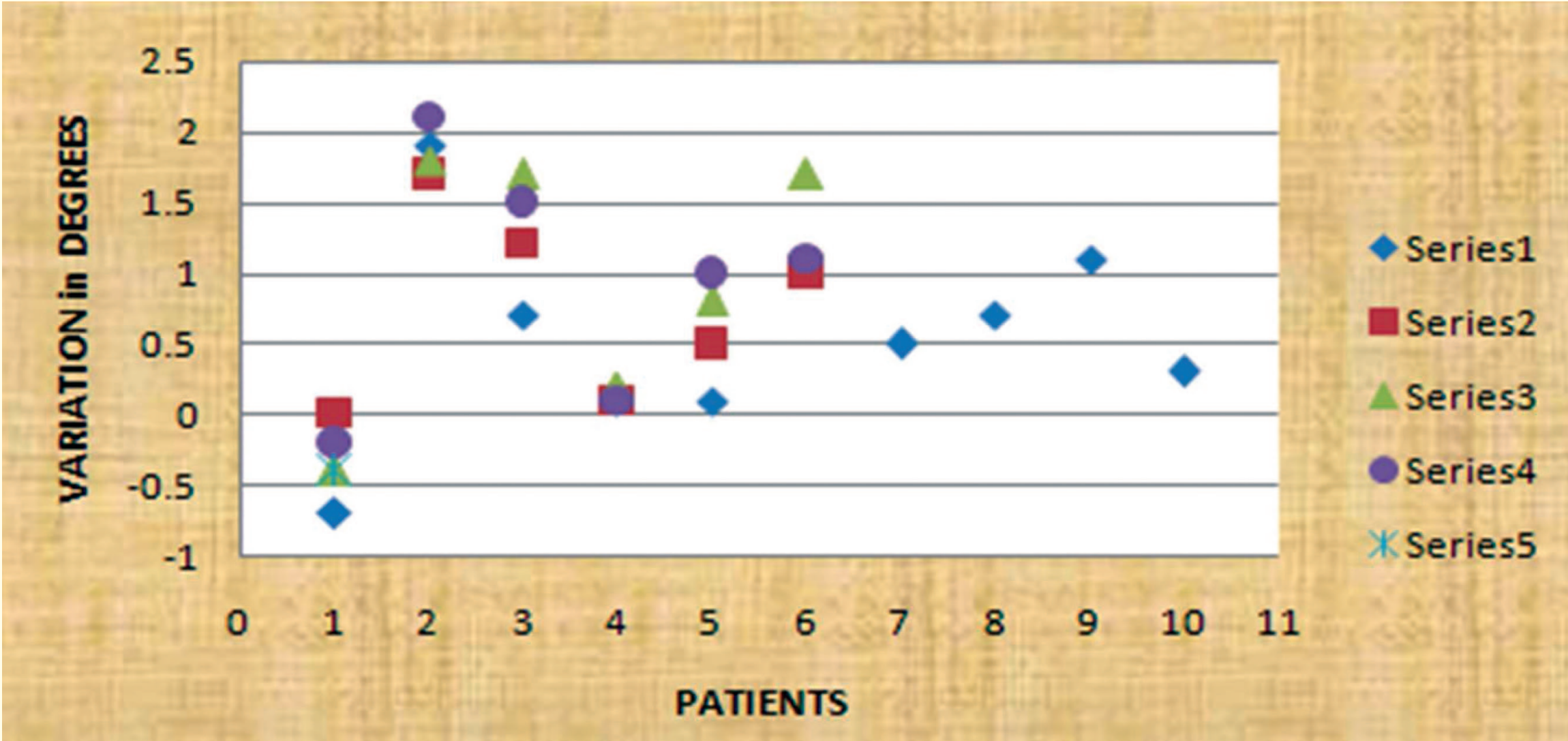
Mean Deviation
0.53 +/-0.34mm

Roll Deviation



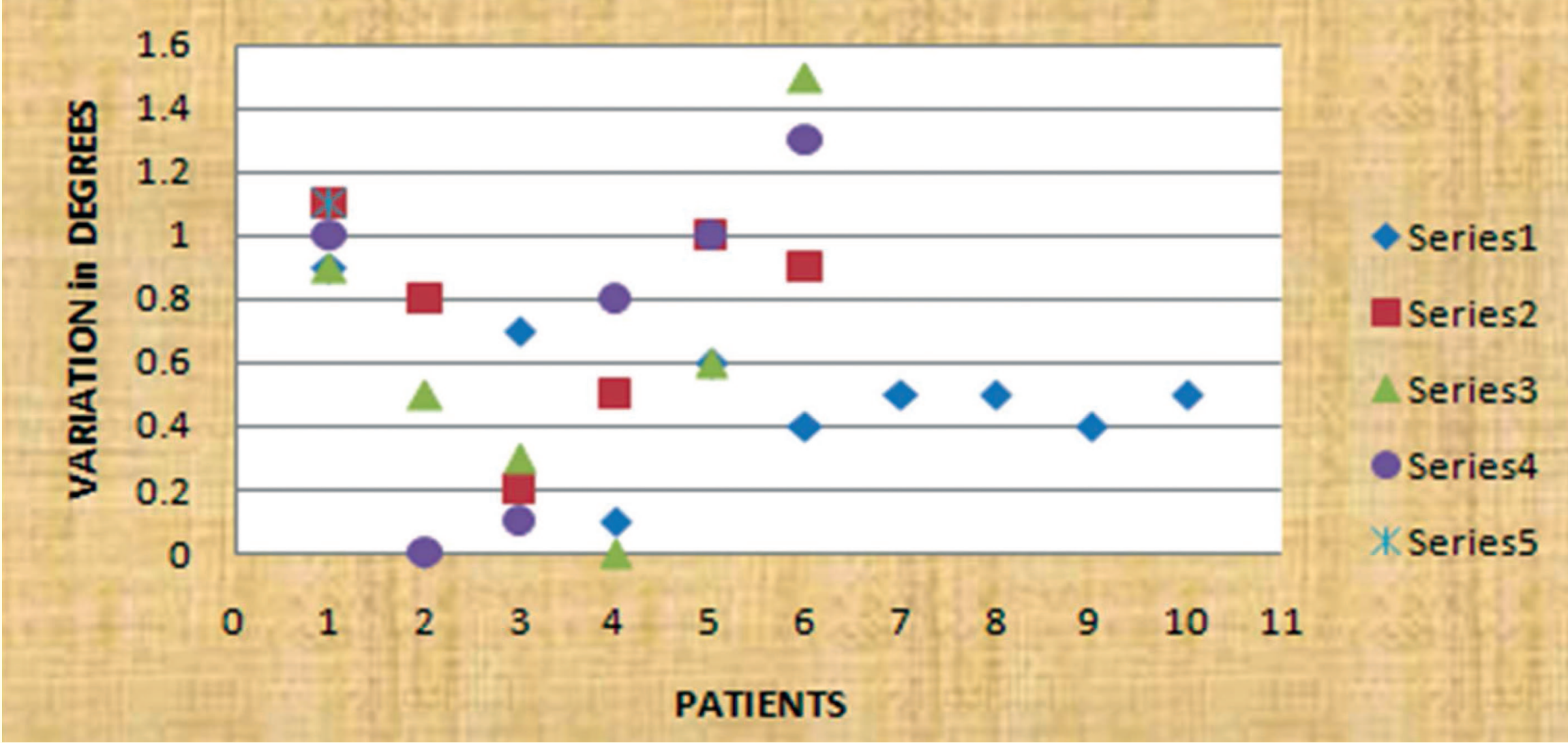
Mean Deviation
0.6 +/-0.3°

Pitch Deviation



Mean Deviation
0.7 +/-0.3°

Yaw Deviation



Mean Deviation
0.6 +/-0.4°

CONCLUSIONS

- Exac Trac X ray verification with 6 degreeof- freedom robotic couch is a robust system to perform frameless radiosurgery of intracranial lesions with high accuracy.
- This is more applicable for fractionated radiosurgery patients to reduce the daily set-up time.

REFERENCES

Jin J Y, et al. Use of the BrainLAB ExacTrac X-Ray 6D system in image-guided radiotherapy. Med Dosim. 2008 Summer; 33 (2): 124-34. Epub 2008 Apr 1.

Takakura T, et al. The geometric accuracy of frameless stereotactic radiosurgery using a 6D robotic couch system. Phys Med Biol 2010 Jan 7;55(1):1-10.

Verbakel WF, at al. The accuracy of frameless stereotactic intracranial radiosurgery. Radiother Oncol. 2010 Dec;97(3):390-4