



Geometric Evaluation of Intrafraction Motion during Frameless Intracranial Stereotactic Radiosurgery (SRS)



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Objective

To quantify intrafraction motion during frameless intracranial SRS using the six-degree-of-freedom stereoscopic x-ray imaging system.

Methods

- Patient immobilization
 - Orfit mask system
 - Orfit Industries, Wijnegem, Belgium
- Frameless positioning was based on online 6DOF stereoscopic x-ray (ExacTrac) imaging
- Subsequent online volumetric image guidance (CBCT)
 - Residual error assessment
- At least one mid-treatment ExacTrac acquisition was performed for motion assessment.

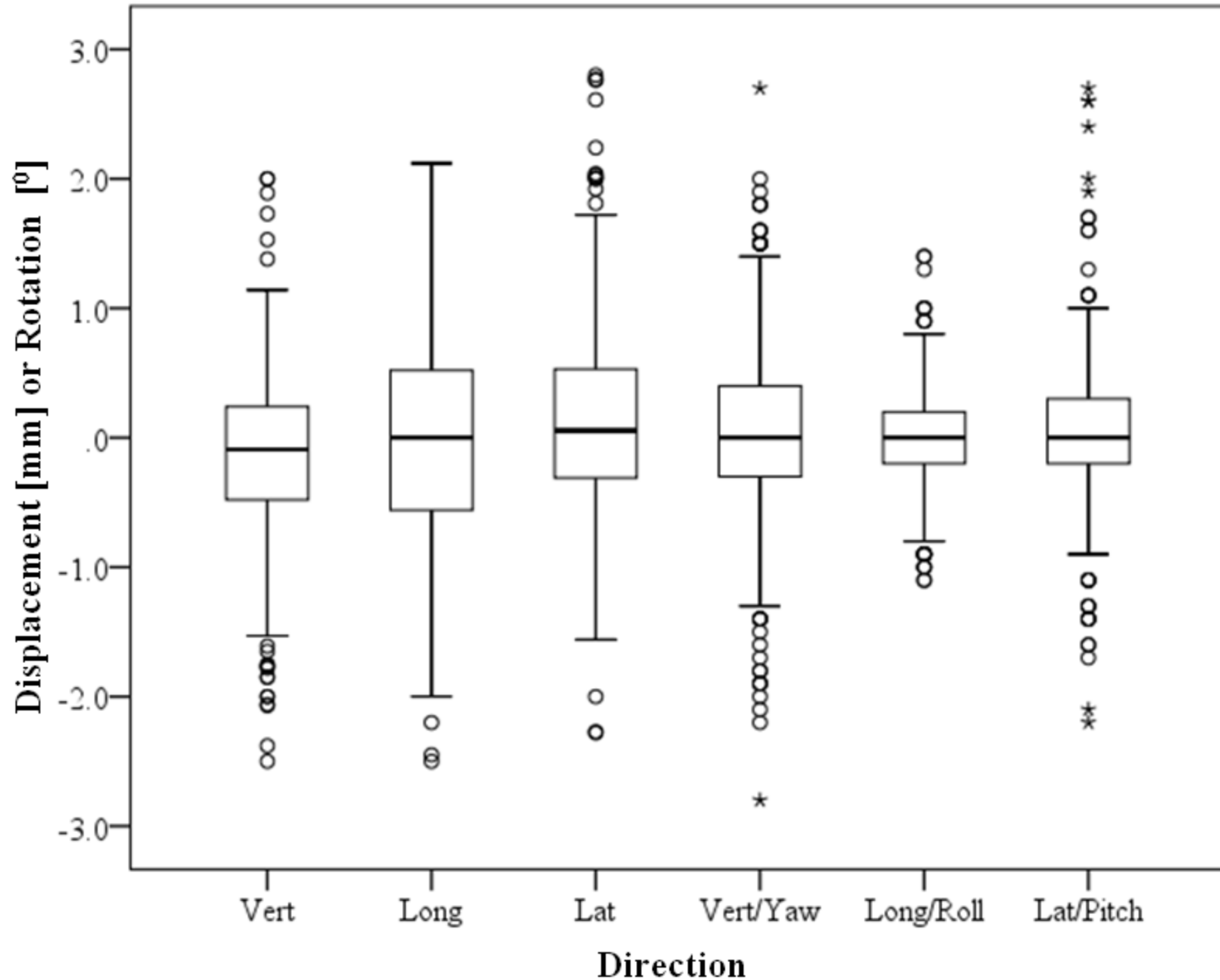
Methods

- Intrafraction motion definition
 - The difference between the patient's position at the time of pre-treatment ExacTrac and at the time of re-assessment
 - Action level was 1 mm

Results

- A cohort of 180 sequential patients
- In total, 350 intrafraction ExacTrac image sets were evaluated
 - Mode 1
 - Range 1-3

Results



Results (Summary)

- Frequency of absolute motion in any direction
 - >1 mm, 33%
 - >1.5 mm, 15%
 - >2 mm, 5%
- Frequency of 3D vector motion
 - >1 mm, 48%
 - >1.5 mm, 25%
 - >2 mm, 10%

Conclusion

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Conclusion

- Intrafraction motion during frameless SRS delivery is typically small, albeit non-negligible
- While motion along one or more room axes and 3D motion vectors >2 mm were observed no more than 10% of times, this finding may provide a rationale for development of planning target volume margins
- Frequent intra-treatment positioning assessment can significantly contribute to the precision of frameless intracranial SRS

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