

Does applying a 6 Degree of Freedom match improve accuracy in lung radiotherapy?

Sally Roberts¹, Dr Helen Turnbull¹, Dr Mike Kirby², Karen Pilling¹, Rebecca Pickles¹, Rachel Brooks- Pearson¹

¹ The Northern Centre for Cancer Care, The Newcastle upon Tyne Hospitals NHS Foundation Trust, UK

² The University of Liverpool, Liverpool, UK

Contact: sally.roberts29@nhs.net

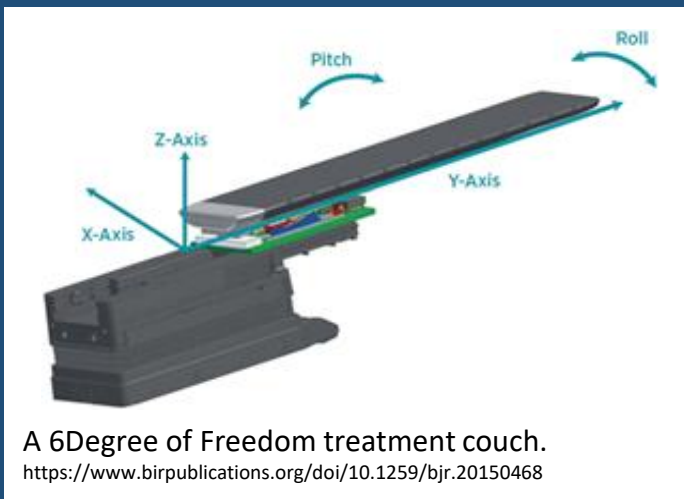


UNIVERSITY OF
LIVERPOOL

NHS
The Newcastle upon Tyne Hospitals
NHS Foundation Trust

Background

- A 6 Degree of Freedom (6DoF) treatment couch allows for correction of patient positioning including rotations in pitch, roll and yaw.
- At The Northern Centre for Cancer Care, standard practice for conventional lung radiotherapy is to correct patient positioning with 3DoF: vertical, longitudinal and lateral shifts.
- The aim of this study was to investigate the use of 6DoF in patients having radical lung chemo-radiotherapy to see if it would improve accuracy of the target match.



An offline image match conducted on 188 CBCTs from 32 patients by a single observer.



Patients sample was 6 months radical chemo-radiotherapy lung patient data where rotations had been recorded as >2 degrees or <-2 degrees on the online CBCT image match.



Four matches were undertaken for each CBCT; 6DoF bony match, 6DoF PTV match, 3DoF bony match and 3DoF PTV match.



Bland-Altman analysis calculated limits of agreement in Microsoft Excel.

Results

- Limits of agreement in all directions were smaller for 6DoF than 3DoF matches.
- This shows that a 6DoF bone match better represents the PTV position than a 3DoF bone match does.
- The 6DoF limits of agreement were 0.13 cm, 0.25 cm and 0.20cm (vertical, longitudinal, lateral) smaller in range than the 3DoF limits of agreement. These values combined demonstrate a significant improvement in treatment accuracy.

cm	6DoF lower limits of agreement	6DoF upper limits of agreement	3DoF lower limits of agreement	3DoF upper limits of agreement	Difference in range of limits of agreement
Vertical	-0.30	0.42	-0.35	0.50	0.13
Longitudinal	-0.42	0.44	-0.55	0.56	0.25
Lateral	-0.26	0.25	-0.33	0.38	0.20

Conclusion

- Applying a 6DoF match would improve accuracy to the PTV for patients that have over 2 degrees of rotation.
- For this to be implemented, personalised immobilisation such as vacbags would need to be used to ensure minimal intrafractional movement.