

Investigation of the Dosimetric Accuracy of Treatment Planning for Total Body Irradiation Using Extended Distance Technique

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INTRODUCTION

Total body irradiation (TBI) machine commissioning as well as in-vivo measurements during treatment is challenged because of the deviation of measurement conditions from the standard calibration condition. Hence treatment planning system (TPS) dose prediction can be problematic.

AIM

In this work we study the dosimetric accuracy of the TBI treatment planning process and all sources of discrepancy in the in-vivo verification procedure.

METHOD

An in-house developed and commercial TPS (1 and 2, respectively) were used in our study. In-vivo results for 50 patients measured at six different body locations were analyzed.

Experimental measurements were conducted using both anthropomorphic and solid water phantoms.

The effects of photon scattering and electronic disequilibrium due to missing build up tissue and low density material in the beam path were studied.

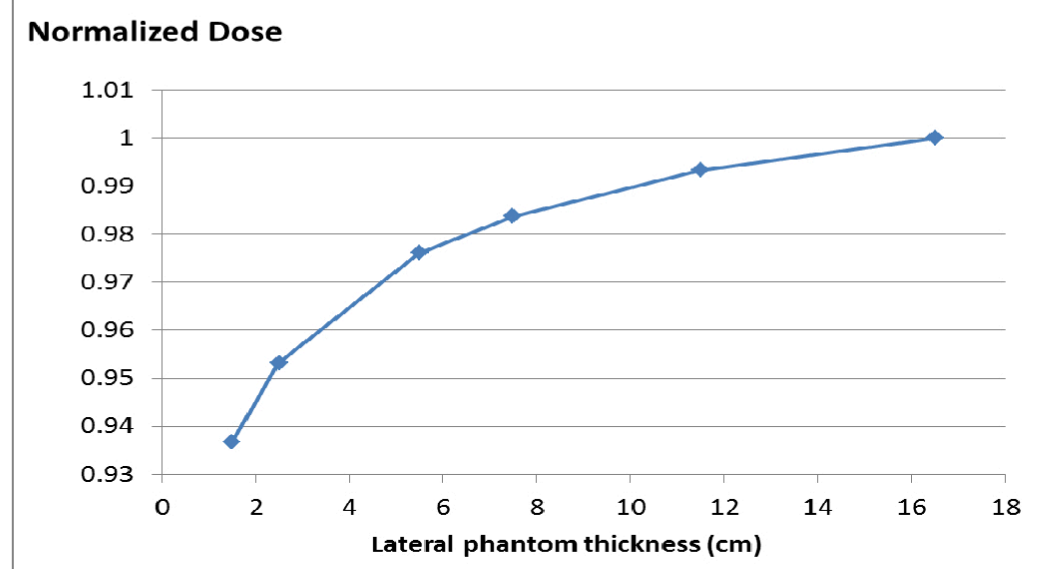
An approach implemented in the in-house TPS utilizing conventional methodology of irregular field calculations was also tested. Additionally, the change in off axis beam energy spectrum and its influence on the attenuation coefficient of brass compensator blocks was evaluated.



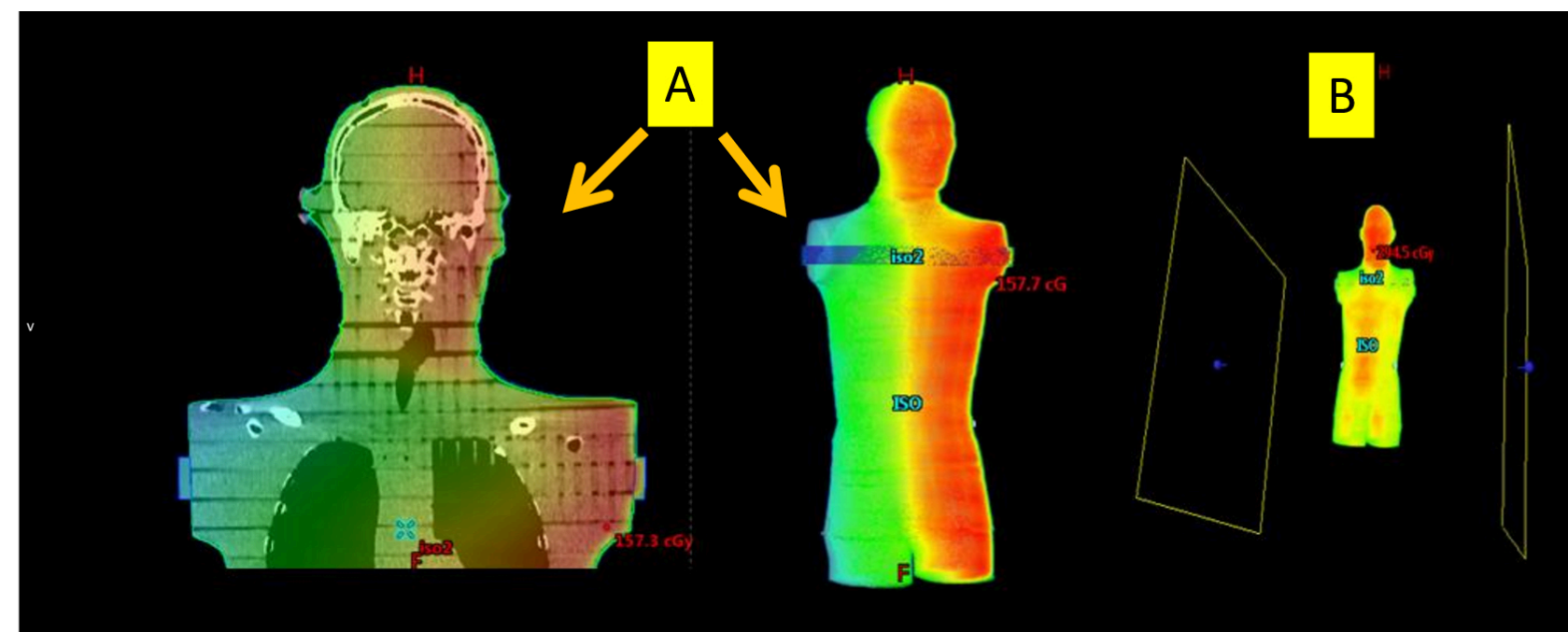
RESULTS

The TPS over predicted in-vivo measured dose at the patient's head. Measured dose in the head area was lower in 94% of the cases with a mean measured to planner dose ratio of 0.93, while in the range of 0.95-1.00 for other body sites. This could be ascribed in part due to lack of sufficient lateral build up.

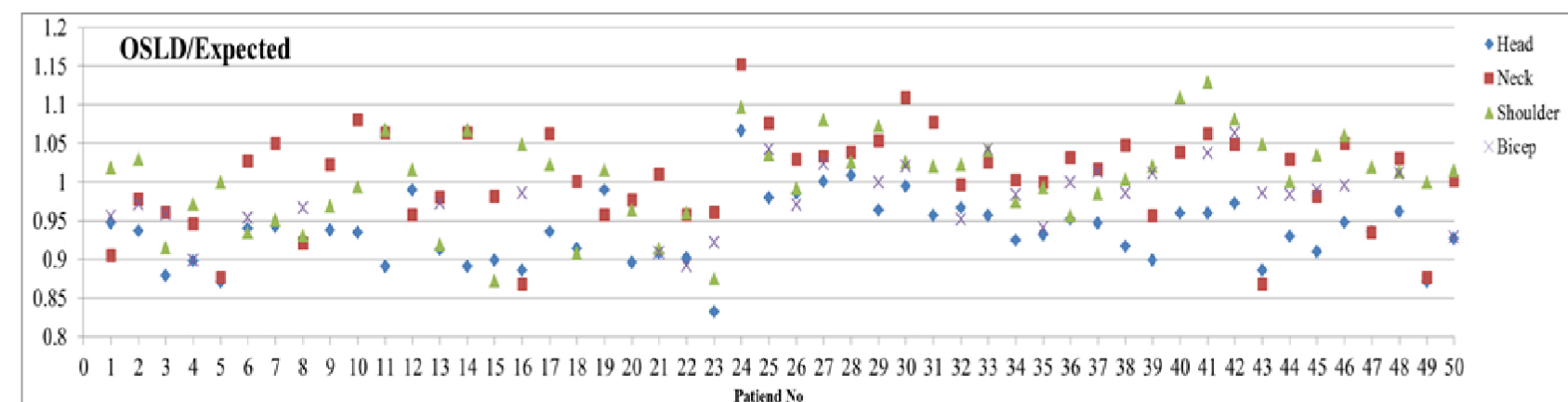
Phantom measurements showed a difference up to 4.7% when comparing 16.5cm to 2.5cm of lateral build up. For lower density materials in the beam path, TPS1 was within 1% agreement with TPS2 and within 2% agreement with in-vivo measurements. Brass transmission was found to be 1.3% lower, 45cm off axis distance.



In-vivo results showing OSLD measured to expected dose ratio for 50 patients



Dose distribution resulting for one lateral field. A circle is drawn to show the location where OSLD will be placed for comparison with measurement. B) Dose distribution resulting for two lateral opposed fields with no head compensator



In-vivo results showing OSLD measured to expected dose ratio for 50 patients

CONCLUSIONS

Precise measurements to account for deviation of various physical parameters under TBI condition can be a crucial step to insure accurate TBI planning.

REFERENCES

Van Dyke J, Galvin JM, Glasgow GP, Podgorsak EB. The physical aspect of total and half body photon irradiation, AAPM Report No. 17. 1986.

CONTACT INFORMATION

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