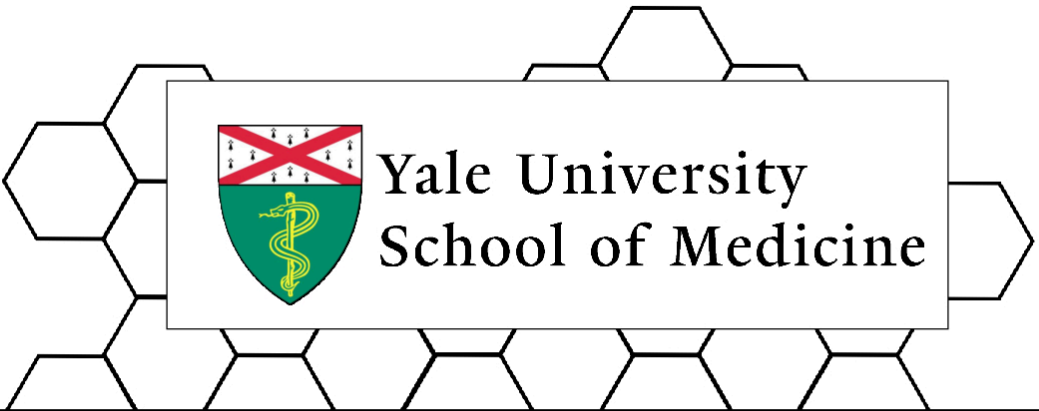


# Validation of OSLD in-vivo dosimetry for total body irradiation

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## INTRODUCTION

Validation is needed prior to using OSLDs for in vivo dose verification. Publications related to the validation of OSLDs with diodes are often carried out using standard treatment distances and techniques<sup>1,2,3</sup>. However, special techniques, such as total body irradiation (TBI), are carried out at extended treatment distances with extremely large fields, resulting in different photon characteristics on the detector.

If OSLDs are to be used for in vivo dosimetry of TBI treatments, validation under TBI conditions is needed to ensure the accuracy of the in vivo measurement technique. The aim of this study was to provide data comparing OSLDs to diodes under TBI treatment conditions.

## METHOD

In vivo dosimetry for TBI treatments in our clinic involves the use of diodes (without bolus) taped directly to the patient's skin at varying distances from the umbilicus (Figure 1). The diode system was commissioned at 600 cm SSD without bolus. The OSLD system was commissioned by comparing readings to diode measurements at 100 cm SSD with bolus over both detectors.

For this study, OSLD and diode readings were compared for:

- 6 MV photons
- 100 cm, 200 cm, 400 cm, and 600 cm SSD
- 10x10 cm<sup>2</sup> field size at 100 cm SSD and 39.5x39.5 cm<sup>2</sup> for all other SSDs
- 1.5 cm bolus used for OSLDs, either 1.5 cm of bolus or no bolus used for diodes
- Measurements completed along central axis and off-axis (60 cm)

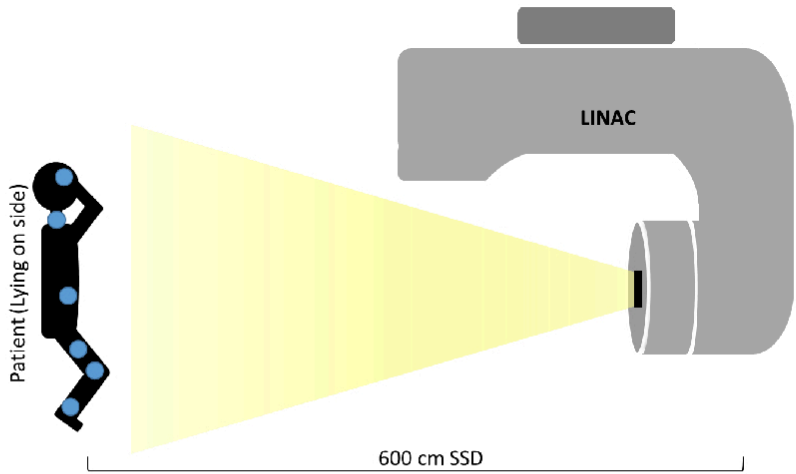


Figure 1: Illustration of the TBI treatment technique used in our clinic. The patient lies on their side with the linac rotated to 87.2° at an SSD of 600 cm. Blue dots represent where in vivo dosimetry measurements are taken to verify dose.

## RESULTS

At 100 cm SSD, there is excellent agreement between bolus diodes and OSLDs (within 0.2%) but larger variation (2.3%) is seen between non-bolus diodes and OSLDs.

Additional measurements were taken at 100 cm SSD with a gantry angle of 10° to simulate the angular offset of the actual TBI field. Agreement between bolus diodes and OSLDs is still reasonable (within 2.5%), while there is large disagreement between non-bolus diodes and OSLDs (7.3%).

At extended SSD, the readings become closer between non-bolus diodes (within 2.1%) while bolus diodes differ by > 2%.

On the central axis, OSLDs give readings within 1.2% of those produced by the non-bolus diodes, while off-axis values are within 3.3% of those produced by non-bolus diodes.

Table I: OSLD readings compared to diode readings for several SSDs and field sizes

SSD	Field Size	MU	Gantry	OSLD (bolus)	Diode (no bolus)	% Diff	Diode (bolus)	% Diff
100 cm	10x10	100	0	100.75	103.07	2.3%	100.90	0.1%
100 cm	10x10	100	+/- 10	98.04	105.50	7.3%	100.50	2.5%
200 cm	39.5x39.5	100	75.1	26.24	26.80	2.1%	26.62	1.4%
400 cm	39.5x39.5	100	85.1	7.06	7.10	0.6%	6.90	2.3%
600 cm	39.5x39.5	300	87.2	9.41	9.30	1.2%	9.25	1.7%
600 cm (off-axis)	39.5x39.5	300	87.2	10.23	9.90	3.3%	9.80	4.3%



Figure 2: Setup for diodes and OSLD irradiation at 100 cm SSD with (top left) and without (top right) bolus. Extended SSD diodes setup without bolus (bottom left). Setup for OSLD irradiation (bottom right)

## CONCLUSIONS

OSLDs tend to report lower doses along the central axis at shorter SSD compared to diodes, and higher doses at extended distance. Central-axis values from both systems are still within 1.5%. Off-axis at 600 cm SSD, OSLDs tend to report higher doses (~4%) compared to diodes. These differences are likely due to the energy, SSD, and field size dependence of the diode system. However, further study is needed to determine exactly why these differences are occurring. OSLDs and non-bolus diodes, which are used clinically for in vivo dosimetry, are still within 1.2% under TBI conditions, indicating that it is acceptable to use OSLDs for in vivo dosimetry for TBI.

## REFERENCES

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