Purpose: To dosimetrically evaluate the effects of improper patient positioning in the junction area of a VMAT cranio-spinal axis irradiation technique consisting of one superior and one inferior arc.

Methods: Five (n=5) cranio-spinal axis irradiation patients were planned with 2 arcs: one superior and one inferior. The plans were then recalculated with inferior isocenter shifted, in order to mimic patient setup errors, eight times: 1mm, 2mm, 5mm, and 10mm superiorly, and 1mm, 2mm, 5mm, and 10mm inferiorly. Plans were then compared to the original, non-shifted arc plan based on target metrics of conformity number and homogeneity index, as well as several normal structure mean doses.

Results: Percent differences were calculated in order to compare each of the eight shifted plans to the original arc plan without shifts, which would be the ideal setup of patient without error. The conformity number was on average 0.87%, 2.74%, 5.75%, and 9.10% lower for the 1mm, 2mm, 5mm, and 10mm inferiorly-shifted plans and 0.41%, 0.82%, 2.75%, and 5.99% lower for the respective superiorly-shifted plans. The homogeneity indices were, averaged among the five patients, 0.03%, 0.26%, 0.97%, and 2.84% for the inferior shifts and 0.23%, 1.17%, 6.31%, and 15.29% worse, or less homogenous for the superior shifts. Overall the mean doses to the organs at risk were less than 2% different for the 1mm, 2mm, and 5mm shifted plans. The 10mm shifted plans, however, showed percent differences from original plan of up to 5.6% on average.

Conclusions: Setup errors when shifting isocenters should be minimized in order to provide the patient with the best treatment possible. Errors of 1 to 2mm can negatively affect patient treatment, most notably in the arc junction area, but are not as problematic as larger errors of 5 to 10mm.