

Comparison of Ocular Radiation Exposure Utilizing Three Types of Lead Glasses

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Introduction

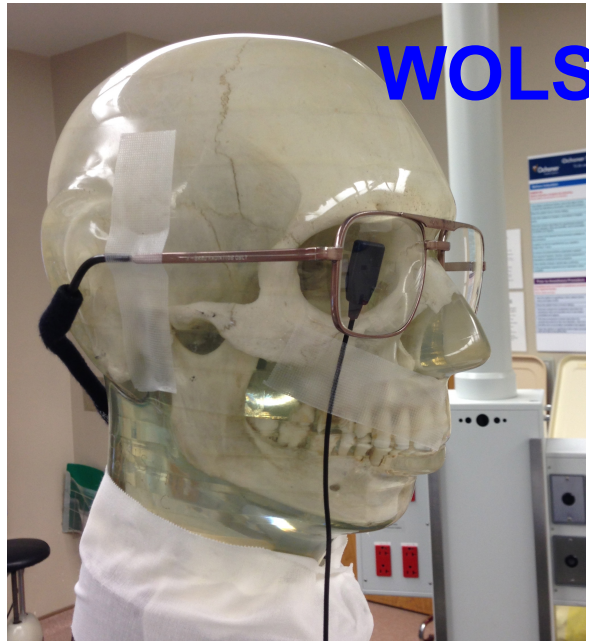
Minimally invasive spine (MIS) surgery has an increased reliance on fluoroscopic x-ray. Lead eye protection can reduce ocular radiation exposure. We evaluate the efficacy of three types of leaded eyeglasses during typical views of MIS spinal surgery.

Methods

Utilizing anthropomorphic patient and surgeon phantoms, radiation exposure to the lens of the surgeon phantom was measured. Four groups were analyzed: Group 1 – no glasses (NO); Group 2 – Lead lens without leaded sides (WOLS); Group 3 – Lead lens with lead sides (WLS); Group 4 – Sport wrap around leaded glasses (Sport). All glasses were 0.75 mm lead equivalent. Fifteen individual 20-second exposures in the AP and lateral x-ray positions with phantom head positions at 0, 45, and 90 degrees were performed. Radiation dose was measured using a solid-state dosimeter (Unfors EDD-30; Billdal, Sweden). Average radiation dose for each position, total radiation dose and percent reduction to the lens was calculated for each pair of glasses. Student's t-test was used to calculate significance.

Results

All three glasses (WLS, WOLS, Sport) had significant reductions in ocular radiation versus no glasses at all individual head positions ($p \leq 1.31 \times 10^{-34}$). Sport had a significantly lower ocular radiation dose than WLS at all positions except at 90 degrees AP (0.323 vs 0.334, $p=0.001$). Sport also had a significantly lower ocular radiation dose than WOLS in all cases except 0 degrees AP (0.376 vs 0.285, $p=0.0003$) and 90 degrees lateral (0.988 vs 0.862, $p=7.38 \times 10^{-28}$). WOLS had a significantly lower radiation dosage at all positions over WLS except at 45 degrees AP (0.286 vs 0.279, $p=0.303$). Average total radiation dosage was 36.47 μ gray without glasses, 3.13 μ gray for WOLS, 4.134 for WLS and 3.32 μ gray for Sport. All glasses resulted in a significant reduction in total radiation dose over no glasses ($p \leq 8.37 \times 10^{-32}$). There was no statistical difference in the total radiation dosage of WOLS versus Sport ($p=0.6$) and both Sport and WOLS were significantly lower than WLS ($p=0.009$ and 0.003 , respectively).



Discussion

Our study demonstrates a significant reduction in radiation exposure to the eye with all three types of leaded glasses. This study confirms other reports showing varying degrees of exposure with different angles and x-ray views. Furthermore, we show that contrary to intuition, leaded glasses with lead sides (WLS) may have adverse effects by possibly trapping radiation and increasing ocular radiation exposure. Based on our results, we recommend the use of Sport-wrap type leaded glasses or those without lead sides (WOLS).

References

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