Effects of Single Dose and Fractionated X-ray Radiation on Differentiated Cells and Stem Cells

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Each year, cancer takes the lives of over 595,000 Americans, making it the second leading cause of death in the United States. As a result, cancer has been put in the crosshairs of the research community. Radiotherapy has risen as one of the top treatments for cancer, with its ability to penetrate tumors and induce DNA damage in cancer cells. However, radiotherapy also exposes normal cells to radiation, raising questions over its potential side-effects. This study investigated those concerns by testing the effects of radiation on two different types of normal cells: mesenchymal stem cells and smooth muscle cells. First, both types of cells were exposed to 3.5 Gy of X-ray radiation. One subset of cells was exposed to all 3.5 Gy of radiation in one dose, while another subset of cells was exposed over 7 days, 0.5 Gy per day. After the radiation exposure, the cells were tested for DNA damage using immunoblotting for y-H2AX, RT-PCR for telomerase, and a comet assay. Cells that were exposed to single dose radiation exhibited more DNA damage than cells exposed to fractionated radiation, while no significant differences in DNA damage were found between mesenchymal stem cells and smooth muscle cells. The results of this pilot study will allow the Fan lab to design and implement more comprehensive studies in the future.