AbstractID: 12887 Title: Determining RBE values for a new miniaturized X-ray source

Purpose: To quantify the Relative Biological Effectiveness (RBE) of the Xoft Axxent Electronic Brachytherapy® (XAEB) system for MCF7 human breast cancer cells in vitro. **Method and Materials:** MCF7 cells were irradiated with 0, 2, 4 and 6Gy using a Theratron1000 Co-60 machine or the XAEB system (at 3cm in air). After irradiation, cells were plated in triplicate and cultured in complete medium. Three weeks later, the cultures were stained and viable colonies enumerated. A survival curve for cells treated with each radiation source was generated. Data from two separate experiments were combined and RBE values were calculated. A third experiment is currently underway. **Results:** XAEB system RBE values were calculated using Co-60 as the standard. The RBE for 37% survival was determined to be 2.2 based upon 37% survival doses of 2.8Gy versus 1.3Gy for Co-60 versus the XAEB source, respectively. The RBE for 10% survival was determined to be 1.9 (5.4 Gy vs. 2.8 Gy, respectively). The RBE for 1% survival was determined to be 1.6 (8.8 Gy vs. 5.5 Gy, respectively). The current clinical recommendation for the XAEB system lists the theoretical RBE as 1.2 based on Monte Carlo simulations. **Conclusion:** Our results demonstrate that the RBE of the Xoft Axxent Electronic Brachytherapy® system can be up to 83% higher than the theoretical value quoted in the system's literature. Due to significant low-energy components of the 50kVp XAEB system output, treatment filtration has a large effect on the x-ray spectrum, which may account for the pronounced discrepancy in empirical and theoretical RBE values. Other possible factors include cell type and endpoint used for assessment. Our study, therefore, underscores the importance of defining and understanding the effects of the therapeutic setup to achieve optimal outcome.

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