Abstract #5584: Title: Determination of TG-43U1 recommended parameters for elongated RadioCoil™ brachytherapy sources 1.0 to 6.0 cm in length using experimental and Monte Carlo simulation Techniques

Purpose: In this project TG-43U1 recommended dosimetric characteristics of newly designed elongated RadioCoil™ brachytherapy sources(1 to 6)cm in length have been determined following experimental and Monte Carlo simulation techniques. Monte Carlo simulated dose profiles have also been calculated for sources 1 to 6cm in length.

Materials and Methods: TG-43U1 recommended dosimetric characteristics (Λ, g(r), F(r,θ) ,ϕ_{an}) of RadioCoil™ sources have been determined using experimental(TLD) and Monte Carlo(MCNP5) simulation techniques. MCNP5 simulations were performed in spherical Solid Water™ and water phantoms 20cm in diameter for 10^8 histories. F(r,θ) of RadioCoil™ were determined for angles 0^o to 90^o for $r \geq L/2$(where L=active length), and angles $5^o \leq \theta \leq 90^o$ for $r \geq L/2$, with 5^o increment. TLD measurements were performed in solid Water™ using same geometric arrangement as that of Monte Carlo simulations. Measured and calculated dose profiles along the longitudinal axis of these sources were utilized to validate the dose calculation with commercially available treatment planning systems.

Results: Results of these investigations indicate good agreement between MCNP5 simulated and TLD determined values for RadioCoil™ sources. Upon the good agreement between these two methodologies, confirming the accuracy of our simulation geometry, dosimetric parameters of these sources have been determined in liquid water for their clinical applications. It has been found that in order to achieve a good agreement between the treatment planning dose distribution, the F(r,θ) of these sources have to be determined at radial distances ranging from 0.5 to 5.0cm with 0.5cm increment and L/2 ±0.2cm.

Conclusion: Dosimetric characteristics of newly designed RadioCoil™ have been determined following TG-43U1 recommendations using experimental and Monte Carlo simulation technique. In these determinations it has been found that the dose profile can be closely reproduced if the 2D anisotropy function is determined at 0.5 cm increments for radial distance ranging from 0.5 cm to 5cm, and L/2 ± 0.2cm.