AbstractID: 14023 Title: Numerical Simulations of the SonoKnife's Acoustic Edge

Purpose: A numerical parametric study was performed to characterize the acoustic edge of the SonoKnife applicator for the selection of optimal design parameters for non-invasive thermal ablation of advanced head and neck tumors and neck malignant nodes. **Method and Materials**: SonoKnife is a novel thermal therapy concept: a cylindrical ultrasound transducer composed (single element array). This geometry generates a line-focus (acoustic edge) instead of the typical ellipsoidal focus generated by spherical radiators. Potential advantages of line-focusing, in contrast to spot-focusing, are lower peak intensities, which minimize nonlinear propagation and cavitation effects, and shorter treatment times. Acoustic simulations were performed varying the following parameters: transducer size and f-number, line-focus depth, frequency, and SSD. Simulations were generated using the free access software FOCUS (http://www.egr.msu.edu/focus-ultrasound). **Results**: Dimensions (FWHM) and depth of the focal volume as a function of design parameters were calculated. Minimum transducer surface area to ensure sufficient energy for ablation (52-60°C for several seconds) was determined for several tumor sizes and locations. Results showed the acoustic edge size decreases and its average intensity increases with increasing frequency and increasing aperture. Simulations also indicated that increasing the radius of curvature increases the size of the acoustic edge and decrease its average intensity. SonoKnife's spatial peak intensities were compared to spherically focused radiators of equivalent radiating area. **Conclusions**: Simulations showed that thermal ablation with the SonoKnife is feasible and designed parameters must be selected depending on tumor size and location. Peak intensities for equivalent area transducers were lower for Sonoknifes than for spherical radiators. Further characterization will include nonlinear effects and thermal simulations. Finally, FOCUS software was a useful and efficient tool for this initial characterization of the SonoKnife's acoustic edge.