

The Effect of Temperature on Antenna Return Loss for Microwave Ablation Antennas

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Although microwave ablation offers unique advantages over RF ablation, there are still issues with current microwave ablation devices. This is because the current microwave ablation devices use either dipole or slot antennas to deposit electromagnetic energy into the tissue. Such antennas are known to be very narrow band. During the design process, these antennas are matched to the tissue impedance at the frequency of operation (existing devices work at 915 MHz or 2.4 GHz). However, as soon as the microwave power is turned on, the electrical properties of the tissue (dielectric constant - ϵ_r and conductivity - σ) change due to increased temperature in the tissue. As a result, the power transmission characteristics of the entire system deteriorate. This temperature increase can be as high as 60 °C raising the local tissue temperature up to ~100 °C. In order to understand the overall ablation device treatment efficiency, there is a need to explore the effect of the temperature on power delivery into the tissue. Therefore, in this study, we investigate the power transmission characteristics of a printed dipole antenna within liver, lung and heart tissues. Two microstrip dipole antennas designed for both 915 MHz and 2.4 GHz. The liver, lung and heart tissues along with antennas and temperature probe, is placed on a heating element to increase the temperature of the tissue. The return loss was measured at 5 °C (indicated by the temperature probe) intervals from 25 °C to 80 °C. We will present results regarding the effect of temperature on power transmission efficiency.