Ultrawideband Microwave Ablation Therapy (UMAT)

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Despite many advantages, there are major problems associated with the current microwave ablation systems. These problems are mainly due to the narrowband nature of the antennas used in these systems. Our data show that although at the start of the ablation procedure more than 90% of the power is transmitted into the tissue due to good antenna-to-tissue impedance matching, as the temperature increases in the tissue, power transmission efficiency drops down to as low as 20%. Such degradation in power delivery creates *three major problems:*

- Most of the power is reflected back to the device causing extreme heating and creating unwanted ablation zones beyond the region of interest. Currently, this problem is addressed by cooling the antenna shaft which complicates the probe design and increases the cost. We discuss this issue in detail and provide references in the "background and significance" section.
- More power from the generator is needed to create the desired ablation zone. Currently, the power levels are as high as 100Watts (W). Our preliminary data suggest that even 20W is enough to create the desired ablation zones with UMAT.
- Unnecessary increase in ablation time. Total ablation time suffers because of the inefficient power delivery into the tissue.

In this study, we introduce an alternative microwave ablation therapy, UMAT. One unique and innovative feature of UMAT is its ability to manipulate ablation zones by changing the frequency of operation. We provide ex-vivo liver experimental data that UMAT decreases the ablation time, increases the ablation efficiency, eliminates the potential need for cooling of the probes, and provides adjustable ablation zones.