AbstractID: 9662 Title: Hyperthermia treatment for a patient with two shank sarcomas treated by a fast pre-treatment optimization method

Purpose:
Cancerous cells are infiltrative and can invade neighborhood and/or distant body. While hyperthermia shows promising synergistic effects being used with radiation and/or chemotherapy, current microwave/radiofrequency power focusing techniques only focus one target at a time. Therefore, patients with multi-sarcoma need to perform multi-treatment in different days since a hyperthermia treatment requires maintaining tumor temperature >= 43^{o}C for 60 minutes. Thus we investigate the feasibility of determining an optimal antenna setting that simultaneously elevates temperatures at two near-by shank sarcomas so that patient comfort is enhanced and treatment times and costs are reduced.

Method and Materials:
A patient with two sarcomas was chosen to numerically validate our approach. Patient shank was surrounded by a 10-antenna mini-annual-phased-array (MAPA) operating at 138 MHz. A water bolus was placed between patient and MAPA to provide electric coupling and thermal cooling. A set of antenna settings were determined with a goal of maximizing averaged tumor temperature and were determined from the patient. The first few best antenna settings were chosen as virtual source (VS) basis vectors to span the reduced subspace. Magnitudes and phases of all 10 antennas were projected into this reduced subspace and then a set of temperature response functions for tumor and normal tissues were determined in this subspace. Numerical optimization was conducted to determine the optimal antenna setting that simultaneously elevates tumor temperatures and maintains safe normal tissue temperatures.

Results:
Results showed that we can use the 10-antenna MAPA to simultaneously heat two sarcomas, and leave normal tissue undamaged. Furthermore, by comparing optimized temperatures when all 10 antennas were activated with that when only 4 VSs were used, we found these optimized temperatures are very comparable.

Conclusion:
Therefore, we presented an algorithm that allows physicians to treat patients with multi-sarcoma and it also improves treatment planning efficiently.