AbstractID: 6558 Title: Principles and Techniques for Microwave/RF Phased Array Hyperthermia Systems

The purpose of this presentation is to delineate the principles of microwave/rf phase-synchronous arrays. These applicators are used to obtain focused deep heating for hyperthermia by creating standing waves through the superposition of the fields radiated by a group of antennas. Recent phase III randomized clinical studies have been published on this therapy technique [J. van der Zee, et al, The Lancet, 355:1119 (2000)].

The optimum frequency for localized focused heating depends on the absorption and size of the tissues to be heated. Frequencies from 70 to 200 MHz provide both deep penetration and focusing when heating the human torso. The standing wave pattern causes a focal region having a diameter of about one-half wavelength in the medium, with a null located about a quarter wavelength from the focus. Each antenna should have a length of at least one-half wavelength in the adjacent medium for efficient radiation.

Arrays may be used to steer and shape the heating pattern in one, two, or three dimensions. Heterogeneous tissues alter the energy distribution within the body, changing the location and size of the focus. These effects may be predicted in pretreatment numerical modeling, and corrected for in the numerical optimization of the treatment parameters. The operator may adjust the steering parameters during the treatment while determining the heating pattern with invasive and superficial monitoring of the electric field, as well as the temperature.

This work was supported by the BSD Medical Corporation.