

TWIN SPIRAL ARRAY MW HYPERTHERMIA APPLICATORS

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The use of twin spiral arrays and potentially similar balanced wire antenna configurations provide a unique capability to make transparent, efficient, and conformal microwave hyperthermia arrays. The use of a de-ionized water bolus with such an antenna array provides a unique directional coupling method. The use of such twin spiral arrays with multiple channel microwave hyperthermia systems can provide independent control of channel power and phase to provide a significant benefit in conformal hyperthermia of superficial chest wall tumors. Large single spiral development for low frequency, small single spirals for higher frequency, and arrays of small spirals for conformal therapy can be used. When arrays of small spirals are used, non-synchronous phase is used for greater independence and uniformity of heating under each spiral. For some operations the non-synchronous phase may be preferred to provide simplification of operation. Synchronous phase operation of large arrays may result in standing field waves in the water bolus region, resulting in regions of maxima and minima. This phenomenon appears to be associated with the thickness of the water bolus between the antennas and the body surface. It is also feasible and possibly preferable in some configurations to consider use of a combination of synchronous and non-synchronous phase operation.

Relative SAR patterns have been obtained from an 8 spiral array and a 24 spiral array. These show a unique ability to control the SAR distribution along the surface area and shape the pattern of heating to conform to the desired region to be heated. The device may consist of multiple antennas mounted to a rigid, transparent, substrate with an attached water-filled bolus.

For a more conformal applicator, the antenna may be individually mounted in an array to a transparent, water-filled, flexible bolus structure that would more easily conform to the body surface, such as the chest wall.