Optimal Microwave Source Distributions for Heating Off-Center Tumors in Spheres of High Water Content Tissue (Short Papers)

A surface distribution of electric dipoles can be used to represent a multi-element microwave hyperthermia applicator for non-residue invasive heating of off-center targets within a spherical high-water-content tissue volume--such as the head. This paper presents a method for finding the optimal surface distributions for delivering maximum power for arbitrarily located deep tumors in such a uniform spherical volume. The resulting focused power dissipation pattern for any tumor location has a global maximum at the tumor, and also is the largest spherical volume for which no healthy tissue is overheated. The optimization uses spherical field harmonics, centered at the tumor target, summed with suitable complex weights to iteratively minimize surface power. Once the best field distributions are derived, the current sources which generate these distributions are determined. The resulting excitations represent the theoretically ideal spherical microwave hyperthermia configuration for which no physical applicator system can surpass.

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