Abstracts

Low-Frequency RF Twin-Dipole Applicator for Intermediate Depth Hyperthermia

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In studies on heating deep-seated tumors, various attempts have been made to develop radiofrequency applicators and to confine the controlled volumes into limited sizes at variable useful depths. Results of the present investigation show that the conduction-current mechanism dominates the heating with magnetic dipoles working at frequencies as low as 27 MHz, and that two single-magnetic dipoles forming a loosely coupled pair (twin-dipole applicator) fed by low-frequency, in-phase currents, give a better performance than a single dipole of the same size, due to the phase coherence of the superimposing fields. A number of single-dipole and twin-dipole applicator working at 27 MHz have been developed and given the fundamental tests on phantoms simulating muscle and fat tissues. The results obtained show the feasibility of the proposed applicator to produce a penetration depth up to 7 cm and a power deposition pattern showing a well-defined maximum, which may undergo a controlled shift of a few centimeters in depth. Moreover, the surface overheating may be easily controlled. A circuit design is described that improves the matching and the uniformity of the power deposition pattern. A preliminary calculation in the quasi-static-fields approximation of the electric field induced by the twin-dipole applicator in air is also described.

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