

Antenna Configuration and Transmission Medium to Optimize Malignant Cell Destruction

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The most observable effect of non-ionizing RF radiation on the human body is the thermal change on living tissue. If properly applied and monitored, it is the supposition of this paper that those potentially harmful properties of the electromagnetic spectrum can be applied in a beneficial, medicinal effect.

This paper examines methods of a controlled implementation of this thermal effect. If an area of tissue containing malignant or otherwise undesirable cells is heated above a certain threshold then the malignant tissue will be destroyed. The intention of this application of RF energy on the human body would be to minimize or ideally eliminate, destruction of healthy tissue surrounding the malignant cells. To achieve this there must be minimal heating of the surrounding tissue and this can be modeled within commercial RF simulation software. The type of antenna, frequency, transmission medium, mutual coupling, and the positioning of the elements in an antenna array are vital to the success of this simulation profile. The antenna used must have as a minimum a half-power beamwidth as the practical design will allow. A smaller beamwidth is vital to this design as a larger distribution of energy across the surface of the simulated tissue would cause an unwanted amount of topical heating. Instead, a small beamwidth operating at a frequency that would allow maximum penetration into the target is optimal. By using this method several antenna elements would be focuses at a known point, with maximum penetration, and minimal heating of surrounding tissue.

Another design characteristic that is examined, and simulated, is that of what the transmission medium is that the antenna array is contained within. Since the dielectric constant of the transmission medium greatly impacts the dimensions of an antenna two different mediums are simulated based on practical, real-world applications. Both free air and an aquatic transmission medium are examined as both would be feasible in a medical environment.