Pulse duration and the dynamics of infrared tissue ablation

Duke File (IDF) Number

IDF #:T-002070

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Value Proposition

Laser-based ablation procedures are being investigated as a minimally invasive form of surgery to treat several forms of cancerous as well as non-cancerous lesions in neuro-, ophthalmic-, and cardiothoracic-surgery. While several different types of lasers can be used to create “hot” or “cold” ablations, this invention relates to methods and apparatuses used for tissue ablation that employ free electron laser (FEL) as well as table top laser systems. It provides the theoretical framework to describe the thermal, chemical, and mechanical transformations that take place in tissue as a result of exposure to optical energy in the form of an FEL or table top lasers. These models could be used to design improvements to existing laser-based ablation systems or develop novel applications based on the interaction of tissue and optical lasers.

Technology

The invention described herein relates specific pulsing parameters of laser irradiation (i.e., pulse length, pulse repetition frequency, and pulse energy) as well as tissue composition and geometry to the efficiency of tissue ablation procedures. It also describes the independence of the ablation effect and pulse structure – thereby providing the basis for performing ablation procedures with table top laser systems (as well as FEL systems).

Advantages

Tissue ablation procedures using FEL or table top laser systems do not require the use of chromophores.

While FEL systems require significant space and thus are cumbersome and expensive to set up, table top laser systems are much more portable. The ability to perform comparable ablations with table top laser systems can greatly enhance the accessibility of ablation procedures and perhaps expand the types of surgery they are used for.