690

Accession Number

12351306

Author

Wilmink GJ. Rivest BD. Roth CC. Ibey BL. Payne JA. Cundin LX. Grundt JE. Peralta X. Mixon DG. Roach WP.

Author Unabbreviated

Wilmink Gerald J.; Rivest Benjamin D.; Roth Caleb C.; Ibey Bennett L.; Payne Jason A.; Cundin Luisiana X.; Grundt Jessica E.; Peralta Xomalin; Mixon Dustin G.; Roach William P.

Author/Editor Affiliation

Wilmink GJ. Rivest BD. Ibey BL. Payne JA. Grundt JE. Mixon DG. Roach WP. : 71th Human Performance Wing, Air Force Research Laboratory, Brooks City-Base, TX, USA

Roth CC. : General Dynamics Advanced Information Services, San Antonio, TX, USA

Cundin LX. : Conceptual Mindworks, Inc., San Antonio, TX, USA

Peralta X. : University of Texas at San Antonio, San Antonio, TX, USA

Title

In vitro investigation of the biological effects associated with human dermal fibroblasts exposed to 2.52 THz radiation

Source

Lasers in Surgery and Medicine, vol.43, no.2, Feb. 2011, 152-63. Publisher: John Wiley & Sons Inc., USA.

Abstract

Background: Terahertz (THz) radiation sources are increasingly being used in military, defense, and medical applications. However, the biological effects associated with this type of radiation are not well characterized. In this study, we evaluated the cellular and molecular response of human dermal fibroblasts exposed to THz radiation. Methods: In vitro exposures were performed in a temperature-controlled chamber using a molecular gas THz laser (2.52 THz, 84.8 mW cm⁻², durations: 5, 10, 20, 40, or 80 minutes). Both computational and empirical dosimetric techniques were conducted using finite-difference time-domain (FDTD) modeling approaches, infrared cameras, and thermocouples. Cellular viability was assessed using conventional MTT assays. In addition, the transcriptional activation of protein and DNA sensing genes were evaluated using qPCR. Comparable analyses were also conducted for hyperthermic and genotoxic positive controls. Results: We found that cellular temperatures increased by 3degreeC during all THz exposures. We also found that for each exposure duration tested, the THz and hyperthermic exposure groups exhibited equivalent levels of cell survival (>=90%) and heat shock protein expression (~3.5-fold increases). In addition, the expression of DNA sensing and repair genes was unchanged in both groups; however, appreciable increases were observed in the genotoxic controls. Conclusions: Human dermal fibroblasts exhibit comparable cellular and molecular effects when exposed to THz radiation and hyperthermic stress. These findings suggest that radiation at 2.52 THz generates primarily thermal effects in mammalian cells. Therefore, we conclude that THz-induced bioeffects may be accurately predicted with conventional thermal damage models. 2010 Wiley-Liss, Inc. (69 References).