



Testbed and Experiments for Focused Microwave Thermotherapy

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Thermotherapy is a medical treatment based on the specific lesion exposure to high temperature. In the case of therapeutic levels of hyperthermia, moderately elevated temperature to a supra-physiological level (typically 43°C - 45 °C) provides effect of cellular cytotoxicity that causes tumor necrosis. For many musculoskeletal disorders, the moderately elevated temperature could be useful for the treatment of pathology. The mild thermotherapy provides physiological benefits as increasing blood flow and pain relief [1].

The thermotherapy for the medical applications have developed by using infrared, ultrasound and microwave (MW). The MW can provide a heat at deep-seated tissue and overcome the electrical reflections on the bone structure. Motivated by this knowledge, the thermotherapy by using the MW has increased use in the non-invasive medical treatments as the killing cancer cells and the musculoskeletal disorders. The MW focusing at the targeted location in a human body is a great interest in the medical applications. Our study about MW focusing for thermotherapy aims at realizing the elevated temperature at the targeted tissue while maintaining ordinary temperature in healthy tissue.

In this paper, a testbed of a MW focusing system for non-invasive thermotherapy is presented. The proposed system provides a thermal dose at localized and deep-seated tissue for musculoskeletal disorder treatment applications. The proposed system operating at 915 MHz consist of 16 channel array antennas, a cylindrical shaped imaging tank which is filled with distilled water and a high power microwave transmitter. For focus at the targeted position, time-reversal technique is employed to find exiting parameters in proposed system [2]. To verify the proposed system, experimental results to focus at targeted location in tissue-mimicking gelatin phantom is shown.

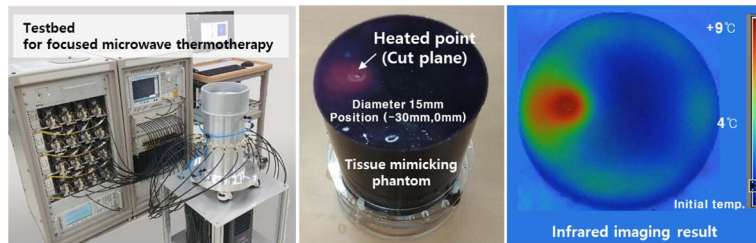


Figure 1. The Testbed system and experimental results for focused microwave thermotherapy

As can be shown, the thermal dose is well focused on the targeted point. The proposed testbed for MW focusing is very selective, as the elevated temperature above +9 °C which provide therapeutic benefits is achieved in an area surrounding the targeted point not larger than 20 mm. Also the thermal dose can be localized at the targeted position while unwanted hot-spots are avoided. It shows that the proposed system is to moderately elevate the temperature above 46°C from 37°C at the targeted tissue while maintaining ordinary temperature below 42°C in normal tissue.

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2. J. Y. Kim et al., "Computational study of focused microwave thermotherapy for knee pathological treatment", *IET Microw., Antennas. & Propag.*, 2018. doi 10.1049/iet-map.2017.0924