

Microwave Mild-hyperthermia for the Chemo-thermotherapy of the Breast

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According to statistics from the National Cancer Institute, an increasing rate of breast cancer in the US makes the treatment of cancers more important. Besides conventional treatments, chemotherapy (CT) and radiation therapy (RT), different techniques are also being used to increase the efficiency of CT and RT for breast cancer. Hyperthermia, also called thermotherapy, is an adjunctive therapy that can be paired with conventional treatments. This method exposes electromagnetic energy into the targeted tissue to raise the temperature up to 45 °C, which increases perfusion and drug delivery inside the cancerous cells. However, high input power, screening room requirements with long application time prevents hyperthermia from applying in all clinics. Therefore, mild hyperthermia is experimented to make the process more applicable for patients. In this study, the goal is to observe the effect of low input power on tissue temperature at different depths of the breast in shorter time compared to current systems. Tissue temperature can be increased by 2-3 °C using this method. This technique will be applied by using a flexible microwave (MW) antenna applicator, which consists of 9 microwave antennas integrated in a circular-shaped PDMS, that is designed and fabricated. So, it can be given a shape on the breast. The breast can also be heated homogeneously with the located multiple antennas on the applicator. The antennas on the applicator are powered through feeding circuit, then it is attached on the breast mimicking gel. After that, fiber optic temperature sensors are placed at the depth of the gels and just under the surface. Firstly, measurements are taken of the temperature increase at the depth of 1 cm with 1W power at 1.6 GHz without time limits. Then, gradually increased power up to 5W is applied at 1cm depth. Thereafter, the depth is increased and the measurements are repeated at 2.5cm and 4cm depths for all power levels again with a limited time to 10 minutes. We show that the proposed applicator is very efficient for mild-hyperthermia for chemo-thermotherapy of the breast.