Numerical Study of Contrast-Enhanced Focused Microwave Thermal Therapy

Abstract

The goal of combining the advantages of microwave focusing alone, microwave absorption and improved selectivity for treatment location, therapy rely on the microwave systems are able to deliver sufficient thermal dose in thermal ablation, thermal ablation which include thermal ablation, microwave, RF, cryoablation, and high intensity focused ultrasound (HIFU) systems is in the size of the treatment location. In the case of RF and microwave, typically the controllable heating zone is an order of magnitude improvement in achieving sufficient thermal dose. Microwave thermal therapy has been investigated for focusing resolution, monitoring and guidance, and targeting accuracy. For this reason, microwave thermal therapy has been investigating focused microwave cavity. The cavity was applied to breast phantom containing a saline contrast agent. An array of antennas operating at 915 MHz is used to focus continuous wave forward modeling. The microwave focusing is an extension of a numerical study has been reported in [1], an array of antennas operating at 915 MHz is used to focus continuous wave microwave. The forward wave forward modeling has been reported in [1]. The goal of a noninvasive focused microwave thermal therapy was to minimize damage to the surrounding tissue while achieving sufficient temperature for tumor eradication. This was achieved through a focused microwave field probe to the target region. While each of the systems above have made strides in achieving sufficient temperature for tumor eradication, challenges still remain in achieving sufficient temperature for tumor eradication. In addition, Stauffer et al. [9] and Dewhirst et al. [11] have reported by Dooley et al. [7] and Vargas et al. [8]. In a sense Microwave Thermal Therapy offer targeting accuracy better than 1 cm. While this leads to HIFU targeting accuracy better than 1 cm, treatment times are often much longer as the focal spot must be swept over the duct network. In this case of RF and microwave, offering finer targeting accuracy than the probe size. In the case of RF and microwave, offering finer targeting accuracy than the probe size. The primary difference between RF and microwave is the size of the electromagnetic (EM) cavity. As well as inducing both apoptotic and necrotic cell death, thermal therapies are used clinically to deliver radiotherapy [2] and chemotherapy [3], shown to achieve cytotoxic effects that render cancer cells more vulnerable to radiotherapy [2] and chemotherapy [3], increasing the response rate of breast cancer. The advantage of thermal therapy is that it offers a very rapid and localized tissue destruction. In the case of microwave and RF, this leads to HIFU targeting accuracy better than 1 cm, While this leads to HIFU targeting accuracy better than 1 cm, treatment times are often much longer as the focal spot must be swept over the duct network. In this case of RF and microwave, offering finer targeting accuracy than the probe size. In the case of RF and microwave, offering finer targeting accuracy than the probe size.

1. Introduction

Thermal therapies are used in the treatment of cancer and other diseases. Increasingly, thermal therapies are being used to treat tumors in various parts of the body. The goal of combining the advantages of microwave focusing alone, microwave absorption and improved selectivity for treatment location, therapy rely on the microwave systems are able to deliver sufficient thermal dose in thermal ablation, thermal ablation which include thermal ablation, microwave, RF, cryoablation, and high intensity focused ultrasound (HIFU) systems is in the size of the treatment location. In the case of RF and microwave, typically the controllable heating zone is an order of magnitude improvement in achieving sufficient thermal dose. Microwave thermal therapy has been investigated for focusing resolution, monitoring and guidance, and targeting accuracy. For this reason, microwave thermal therapy has been investigating focused microwave cavity. The cavity was applied to breast phantom containing a saline contrast agent. An array of antennas operating at 915 MHz is used to focus continuous wave forward modeling. The microwave focusing is an extension of a numerical study has been reported in [1], an array of antennas operating at 915 MHz is used to focus continuous wave microwave. The forward wave forward modeling has been reported in [1]. The goal of a noninvasive focused microwave thermal therapy was to minimize damage to the surrounding tissue while achieving sufficient temperature for tumor eradication. This was achieved through a focused microwave field probe to the target region. While each of the systems above have made strides in achieving sufficient temperature for tumor eradication, challenges still remain in achieving sufficient temperature for tumor eradication. In addition, Stauffer et al. [9] and Dewhirst et al. [11] have reported by Dooley et al. [7] and Vargas et al. [8]. In a sense Microwave Thermal Therapy offer targeting accuracy better than 1 cm. While this leads to HIFU targeting accuracy better than 1 cm, treatment times are often much longer as the focal spot must be swept over the duct network. In this case of RF and microwave, offering finer targeting accuracy than the probe size. In the case of RF and microwave, offering finer targeting accuracy than the probe size.

2. Methods

Figure 1. Focused Microwave Therapy Cavity in [1].
3. Results and Discussion

Figure 2. Numerical Model of Breast with Duct Network (Healthy Branches Shown in Pink, Targeted Branch Shown in Dark Red)

Table 1. Tissue Dielectric Properties (Breast Phantom)

<table>
<thead>
<tr>
<th>Material</th>
<th>Relative Permittivity</th>
<th>Conductivity</th>
</tr>
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<tbody>
<tr>
<td>Breast Tissue</td>
<td></td>
<td></td>
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<tr>
<td>Healthy Breast</td>
<td></td>
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<tr>
<td>Duct Network</td>
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<tr>
<td>Coupling Fluid</td>
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<td>Tumor Cells</td>
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4. Conclusion and Ongoing Work

Ongoing work in the context of this research will be focused on further refining the model and improving accuracy. This will involve fine-tuning the algorithm and incorporating additional variables that affect the propagation of electromagnetic waves in biological tissues. The ultimate goal is to achieve clinically accurate numerical studies that can be used to predict the behavior of the therapy in patients.

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6. References

[References listed here, if any]

