

Negative Pressure Fixation Device to Reduce Motion Artifacts on Contrast-Enhanced MR Imaging of the Breast

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Introduction: Although there is no universally accepted standard for MR imaging of the breast, there is a minimum requirement for lesion detection. Contrast-enhanced MR is a technique used to elucidate the tumor by intravenous injection of contrast agent. However contrast-enhanced lesions may be iso-intense to fat. Image subtraction is a method to elucidate contrast changes. Displacement of the breast between the pre-contrast and post-contrast images gives rise to misregistration artifact on subtraction images. Displacement is usually caused by respiration and patient motion owing to anxiety and discomfort. Slight bulk motion of the prone patient can propagate to the pendulous breast. Artifact may result in loss of conspicuity of the lesion and shadowing or blurring of margins. In the case of contrast enhanced (CE) dynamic images, the time-intensity curves may become less reliable for lesion diagnosis.

Methods: Nine patients, two of which had been previously diagnosed with breast cancer, were positioned prone in a breast coil (MRI Devices, Milwaukee, WI). They were imaged with T2-w TSE and 3D SPGR contrast enhanced dynamic MR imaging in a 1.5T Siemens Symphony (Erlangen, Germany). Pre-contrast images were subtracted from the dynamic images. Subsequently, a device consisting of two stiff plastic domes was placed on the breasts of each patient. Negative pressure of 27 to 37mmHg within the domes was maintained. The patient was re-imaged. One of the nine patients was also imaged supine to establish feasibility for this positioning.

Results: With the use of the negative pressure fixation device in the breast MR coil, a reduction in misregistration artifact has been demonstrated in six of the nine patients. Misregistration was primarily visible at the skin interface, and in the one patient with implants, misregistration at the tissue-implant interface was decreased. An example of the misregistration is shown in Figure 1. Patients reported improved comfort with the device. Contrast enhanced MR imaging of the breast was found to be valuable in the assessment of the nipple-areolar complex on several patients in the study. The negative pressure device stretched the underlying

parenchyma enabling improved imaging of the subareolar ducts and nipple complex. Feasibility of placing a patient supine and imaging with the device was also demonstrated.

Conclusion: The negative pressure device was shown to be MRI compatible. Feasibility of integrating the device into a breast MRI coil has been demonstrated. The pilot study has shown a reduction in misregistration of subtracted images, and improvements in imaging the nipple-areolar complex. Supine positioning for breast imaging makes possible better access for biopsy and intervention. For the device to reduce artifact in the prone position, modifications must be done to anchor the device to the patient table in order to limit motion.

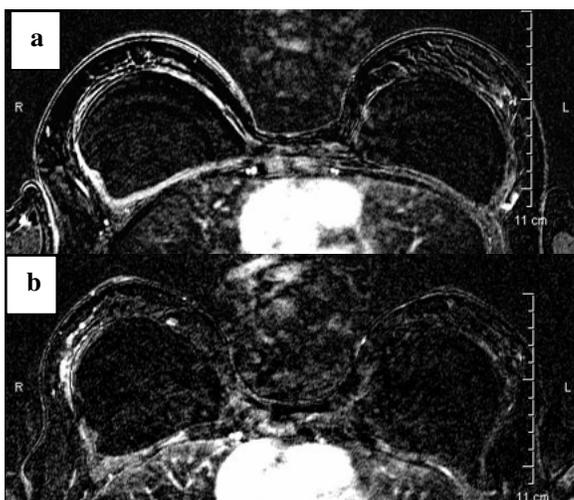


Figure 1: Dynamic CE subtraction images of patient with saline breast implants lying prone. (a) Without the device, a double line at the skin surface of the breast as well as the saline implant-tissue interface is noted (b) With the device, this artifact is ameliorated