INTRODUCTION

The final step in our analysis of healthy and diseased breast tissue involved reconstruction of three-dimensional images using the data obtained from dynamic measurements. These measurements were performed using a measurement head which directs wavelength optical energy at wavelengths 760nm and 830nm for imaging in a time-multiplexed fashion, such that a complete scan of the breast is accomplished in approximately 400 milliseconds. Measuring heads are available for a single breast measuring head supporting 25 source fibers and 29 detector fibers for a unilateral breast scan. Each breast was measured pre- and post-Valsalva maneuver, satisfying the third and final criterion for derivation of a useful provocation for optical tomographic detection of breast disease.

THE INSTRUMENTATION

Dynamic measurements were performed using a measurement head which directs wavelength optical energy at wavelengths 760nm and 830nm for imaging in a time-multiplexed fashion, such that a complete scan of the breast is accomplished in approximately 400 milliseconds. Measuring heads are available for a single breast measuring head supporting 25 source fibers and 29 detector fibers for a unilateral breast scan. Each breast was measured pre- and post-Valsalva maneuver, satisfying the third and final criterion for derivation of a useful provocation for optical tomographic detection of breast disease.

METHODS

Six female subjects were enrolled in this study; two subjects had unilateral breast cancer, two subjects had unilateral non-neoplastic breast disease, and two subjects were healthy volunteers. Data collection was performed using an adaptable DYNOT optical imaging system. The Valsalva maneuver was used to provoke physiological changes in the breast tissue. Significant changes are expected due to the increased blood delivery to the periphery. This subsequently leads to changes in arterial blood pressure. Phase 1 occurs almost immediately upon provocation and is characterized by a pressure of 40 mmHg against a fixed resistance. The subject was allowed to recover to baseline for at least 500 time points. This was followed by a short period of rest and then the Valsalva maneuver was repeated, and the subject was allowed to recover to baseline for at least 500 time points. This was followed by a short period of rest and then the Valsalva maneuver was repeated.

DATA ANALYSIS AND RESULTS

As in previous work, we analyzed source-detector pairs (SD pairs) for Oxy-Hb, Deoxy-Hb, and Tot-Hb for benign and malignant breast lesions. This relatively new technology differs from modalities currently in use in that it allows for the detection of changes in vessel density, microcirculation, and vascular volume. The Valsalva maneuver is a repeatable provocation that has been validated in previous studies. This work was supported by the National Institutes of Health (NIH) under Grants 5R21HL67387-01, 1R21DK63692 and R41-1012345678910.

CONCLUSIONS

Further analysis was done on the sources-detected time-lapse images for benign and malignant breast lesions. This relatively new technology differs from modalities currently in use in that it allows for the detection of changes in vessel density, microcirculation, and vascular volume. The Valsalva maneuver is a repeatable provocation that has been validated in previous studies. This work was supported by the National Institutes of Health (NIH) under Grants 5R21HL67387-01, 1R21DK63692 and R41-1012345678910.

ACKNOWLEDGEMENTS

This work was supported by the National Institutes of Health (NIH) under Grants 5R21HL67387-01 and R01DK63692; by the Optical Society of America, The Biomedical Optics Society, The Optical Engineering Society, The International Society for Optical Engineering, and The Society for Photo-Optical Instrumentation Engineers; and by the University of Texas Southwestern Medical Center.