

Breast lesion markers for 3D ultrasound examinations of the breast.

Poster No.: C-2956
Congress: ECR 2018
Type: Scientific Exhibit
Authors: L. de Jong¹, M. K. Welleweerd², J. van Zelst¹, F. J. Siepel²,
S. Stramigioli², J. J. Futterer¹, R. M. Mann¹, C. L. de Korte¹;
¹Nijmegen/NL, ²Enschede/NL
Keywords: Image registration, Screening, Observer performance, Ultrasound,
Breast
DOI: 10.1594/ecr2018/C-2956

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org

Aims and objectives

One of the advantages of 3D ultrasound is the possibility to have the whole breast scanned by technicians with batch or remote reporting by a dedicated breast radiologist [1,2]. However, feedback on concurrent focal abnormalities (e.g. palpable lesions) is lost. We therefore aimed to develop skin markers for 3D ultrasound that can be used for marking focal abnormalities without disturbing the interpretation of the 3D ultrasound dataset.

Methods and materials

Marker production:

Markers were molded using a mold that was designed and 3D printed in a rubber-like material, allowing for removal of the resulting markers. Spherical, conical, circular, and disk-shaped variants were molded in different sizes (Figure 1). The material used for the marker is EcoFlex-Gel® (Macungie, Pennsylvania USA), which is a commercially available Room Temperature Curing (RTC) silicon. This silicon proved suitable for US imaging and can also be used as phantom material [3]. After mixing the two components the silicon mixture is poured into the mold and is left to cure for two hours in a vacuum chamber for air removal. When the silicon is fully cured the markers can be removed from the mold for application.

Image acquisition:

3D ultrasound examinations were performed with the patient in supine position using a Siemens Acuson S2000 automated breast volume scanner (ABVS) system (Siemens, Erlangen) (Figure 2). In 5 patients undergoing 3D ultrasound examinations for clinical reasons the same 3D volume was imaged twice, once with and once without a marker in place. Ultrasound acquisition parameters were the same as used in clinical practice and varied between patients based on cup size. Acquisition settings between the scans with and without a marker in place were identical in each patient.

Image assessment:

Markers were assessed by an experienced breast radiologist for ultrasound compatibility using qualitative parameters; detectability, shadowing-, enhancement-, and displacement artifact. Interpretability of the images with and without markers was compared.

Usability assessment:

For application in clinical practice parameters on usability were evaluated. Application and removal of the marker, adhesion to the skin during scanning and material safety were taken into account for evaluation.

Images for this section:

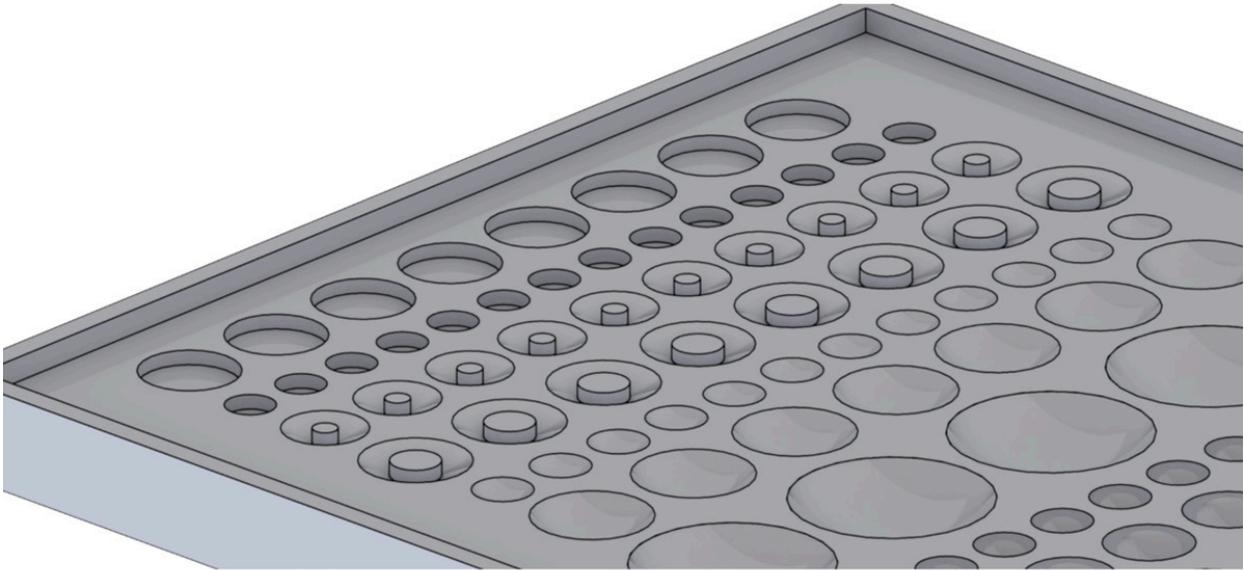


Fig. 1: Mold design used for pouring different sizes and shapes of markers.

© Department of Robotics and Mechatronics, University of Twente - Enschede/NL



Fig. 2: Siemens Acuson S2000 with ABVS arm used for acquisition of 3D ultrasound imaging.

© Radiology and nuclear medicine, Radboudumc, Radboudumc - Nijmegen/NL

Results

Production and application:

Production complexity of the silicon markers is low. Curing time allowed for effective degassing of the silicon. The markers are safe and easily applied to the skin. Adhesion is sufficient to prevent dislocation during the 3D ultrasound acquisition, multiple sequential acquisitions did not dislocate the marker.

Ultrasound compatibility:

Markers are clearly visible at skin level, presenting as small black circles in the coronal plane (Figure 3). In the transversal and reconstructed sagittal plane marker presence is more subtle (Figure 4 and 5). There is only minimal shadowing at the edges of the marker. This did not affect image interpretability.

Images for this section:

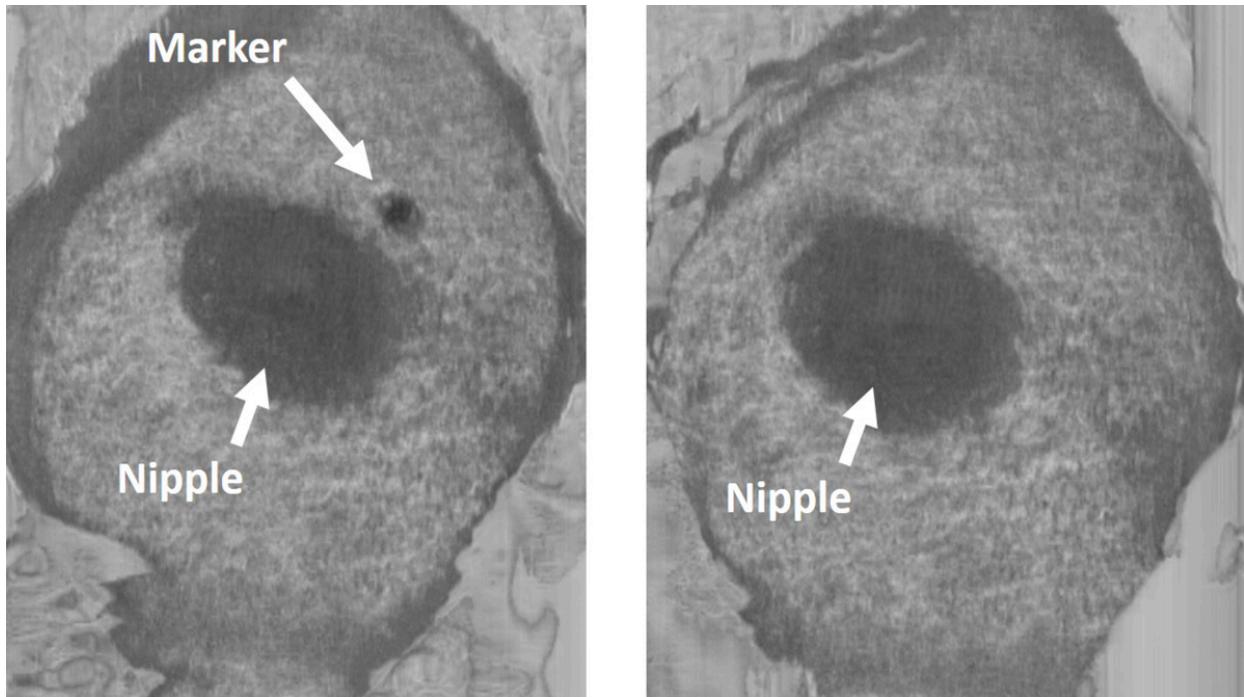


Fig. 3: Reconstructed coronal plane of scans with (left) and without (right) marker.

© Radiology and nuclear medicine, Radboudumc, Radboudumc - Nijmegen/NL

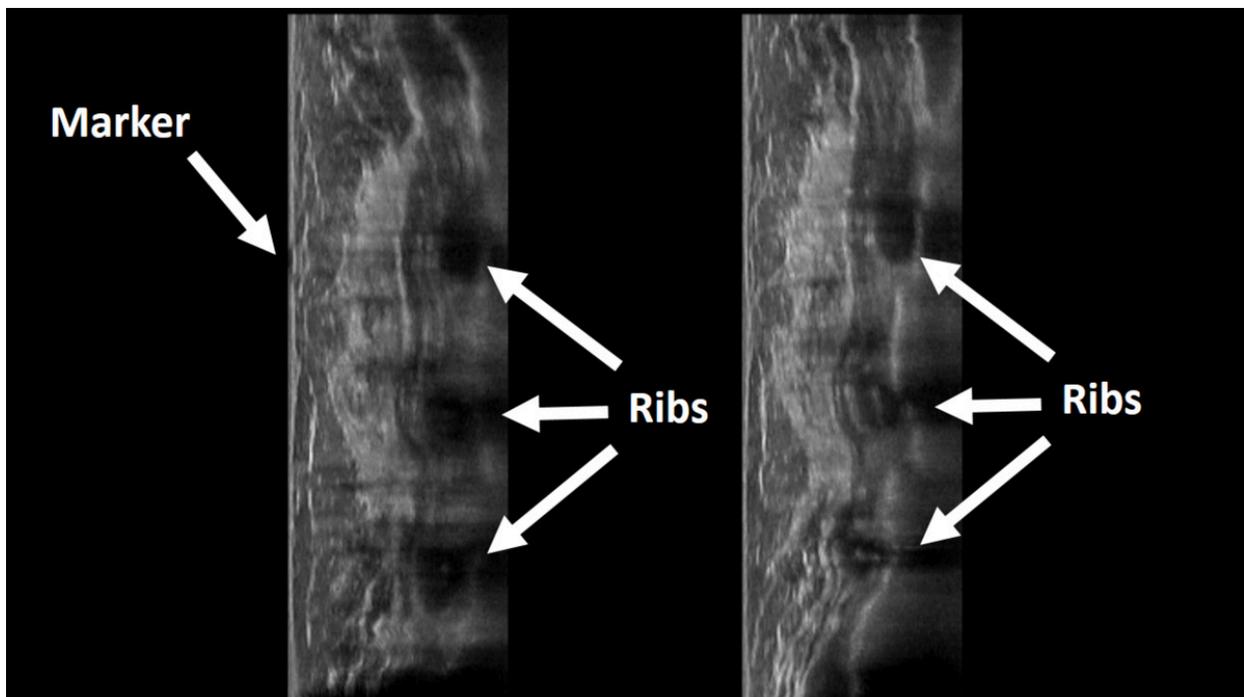


Fig. 4: Reconstruction of sagittal plane of scans with (left) and without (right) marker.

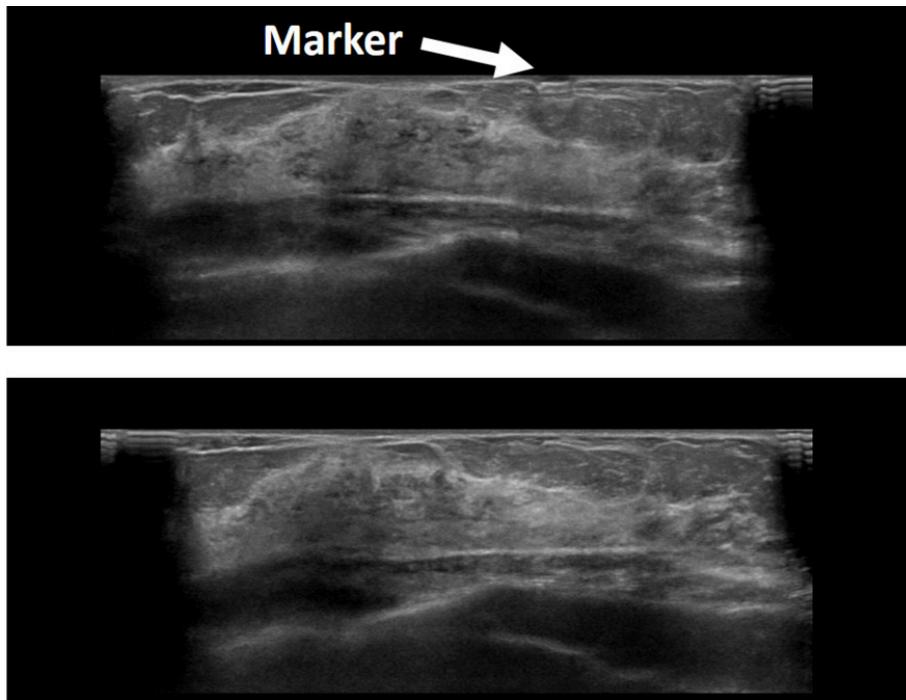


Fig. 5: Transversal plane of scan with (upper) and without (right) marker.

Conclusion

Inexpensive, easy producible RTC silicon markers can be used for lesion marking in 3D ultrasound without affecting image interpretability.

References

[1] Van Zelst, J. C., Platel, B., Karssemeijer, N., & Mann, R. M. (2015). Multiplanar reconstructions of 3D automated breast ultrasound improve lesion differentiation by radiologists. *Academic radiology*, 22(12), 1489-1496.

[2] Giuliano, V., & Giuliano, C. (2013). Improved breast cancer detection in asymptomatic women using 3D-automated breast ultrasound in mammographically dense breasts. *Clinical imaging*, 37(3), 480-486.

[3] Ceha, D., Petersb, T. M., & Chenb, E. C. (2015). Acoustic characterization of polyvinyl chloride and self-healing silicone as phantom materials. *Liver*, 1595, 0-5.