Clinical experience with the Resona I9 from Mindray

Dr. Volker Duda (Marburg), Dr. Laura Budau (Hamburg)

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Introduction

The main feature of the hand-held breast ultrasound is that one hand guides the transducer while the other is operating the ultrasound device. Two extremes can be observed here. On the one hand, the focus is on holding and guiding the transducer while [you] hold on to the cable or machine with the other hand. On the other, the focus is so much on operating the device that guiding the transducer becomes less important and although the image information is registered from a technical perspective, applicable findings are not detected at all. Therefore, every option should be welcomed for simplifying the operation of the ultrasound device, improving the generated image and increasing the ability of the examiner to concentrate on the findings.

Focusing

Whereas the frequency used mainly determines the axial resolution in the image, the focusing serves to improve the lateral resolution, i.e., perpendicular to the sound propagation direction. One focus or even several focuses should therefore be placed at the level of the tissue of interest. However, the more focuses selected, the slower the image buildup. Occasionally, you may hear that you do not have to adjust the focus yourself, the ultrasound device does this by itself. This observation is attributable to the fact that in some devices, the focus is automatically first positioned in the center of the image, even with every change in the image size. It is not often realized that such an automatic process can be helpful, but does not have to be. In addition, the multiple adaptations of the focal position during the examination of a breast are definitely perceived as inconvenient.

The so-called **Dynamic Pixel Focusing, the ZoneVue in Resona, is based on the ZST^{+} platform** and renders these circumstances irrelevant. To start with, there is still a focal zone available. However, the change in the level of the same has no apparent influence on the quality of the image (Fig. 1 a-d).

The advantage of this new technical feature in the examination of the axilla is particularly striking. Normally, when the transducer slides down into the axillary region, the image detail is reduced and the focus is shifted to a greater depth than before during ultrasound of the mammary gland. This may then be helpful for detecting the lymph nodes, but it worsens the evaluation of the axillary milk duct tissue, which is much closer to the skin. However, many examiners are amazed by how many women still have evidence of fibroglandular tissue there when they first look for it. This is not surprising, as mammography usually does not come as far or the corresponding tissue cannot be reasonably assessed due to superimposition of the pectoral muscle. This may be considered "terra incognita" for those whom an ultrasound of the axillary region is not part of the routine breast examination. However, especially in breast cancer aftercare, ultrasound is the method of first choice in this regard, because even after surgical procedures such as removal of glands, residual axillary milk duct tissue will still be detected.

Zone Vue [sic: ZoneVue], unlike the usual procedure described, allows unchanged ultrasound behavior at the transition from the main gland body towards the axilla. Due to the continuous focusing, concentration can be directed at both the milk duct tissue and the axillary lymph nodes without any adjustments (Fig. 2).

Sound speed

The fact that ultrasound is 1,540 m/s in human tissue is generally accepted. It is often ignored that this is an average speed. The reality, however, is that only the computer in the device assumes that all ultrasound waves progress at the same speed. However, since this is not correct, many echoes are ultimately positioned in the wrong place in the image and the image is noisy. This may not be as important in organs with relatively homogeneous parenchyma. However, in an organ such as the mammary gland with its very variable mixture of glandular, connective and adipose tissue, this can be very relevant, especially in the detection and differentiation of small structures. Now it is certainly no art to give the computer a different specification. However, it would be very time-consuming to have the examiner test in every case if there is a better image for a different speed specification. **The Sound Speed Compensation** (SSC) method takes over this task and immediately suggests the use of an alternative average speed to the examiner in the form of an image. As a rule, **this automatic adjustment of the sound speed** actually improves the resolution of detail (Fig. 3 a-b).

Image contrast

A review of color-coded sonograms can increase visual acuity by 10 times and intensity perception by 100 times. This was demonstrated by Gebel more than 20 years ago (Gebel, MJ (2000) New ultrasound modifications and procedures and their practical significance. Internist 41: 5-110). However, a gray scale is still often preferred. Yet, regardless of the use of a gray or color scale, other methods can also influence the contrast in the image. For example, the **HD Scope** method increases the contrast as much as possible in a certain ROI, which makes image details but also borders between different tissue types easier to display (Fig. 4 a-b). Again, such an option is available at the press of a button without a time delay.

Artificial intelligence (AI)

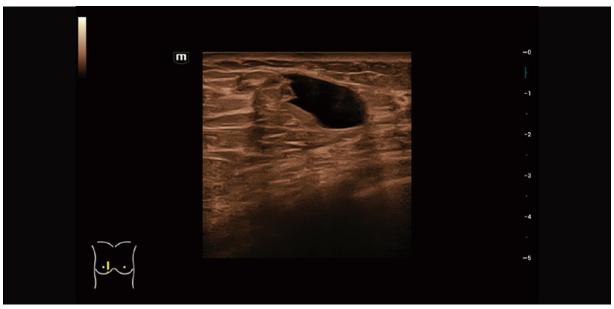
The use of AI in medicine has been and is the cause of diverse discussions. Mammography contributed the first experiences on the subject regarding mammary diagnostics. To date, however, applicable systems have not been accepted as being able to interpret medical findings in a way equivalent to humans. However, for hand-guided breast ultrasound, it is not its use as a search method that is relevant. Using the **Smart Breast** feature, the role of the AI is that questionable focal findings are confirmed as such, and also to see how the Resona I9 differentiates a finding compared to the examiner. If the examiner agrees with the suggestion of differentiation, the device has the ultrasound biometric values available immediately and also provides suggestions for sonomorphology (Fig. 5 a–c).

Conclusion

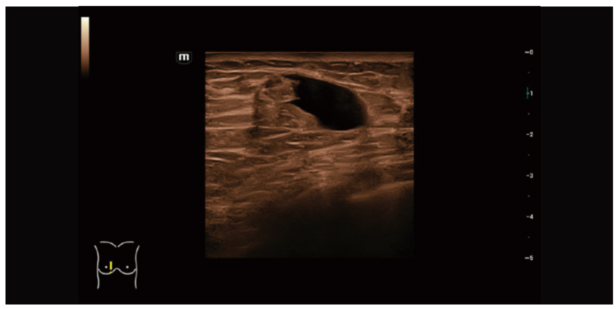
All of the options presented here in the **Mindray Resona System** to take better future advantage of the available flood of images and image data are available almost without any additional time expenditure. Thus, the examiner is able to clarify faster and better whether it is a clinically relevant finding at all and, if so, how they want to further deal with such a finding.

Fig. 1 a-d

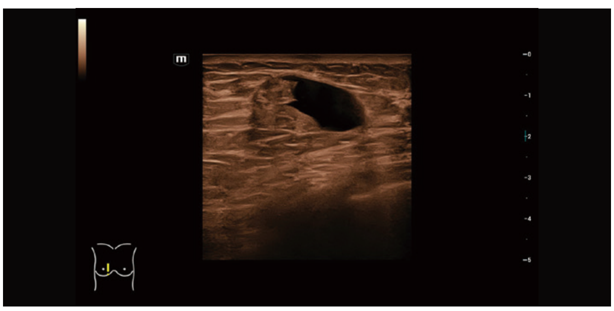
Using the example of a small postoperative adipose tissue necrosis, it becomes clear that a change in the focal position has no effect on the image.



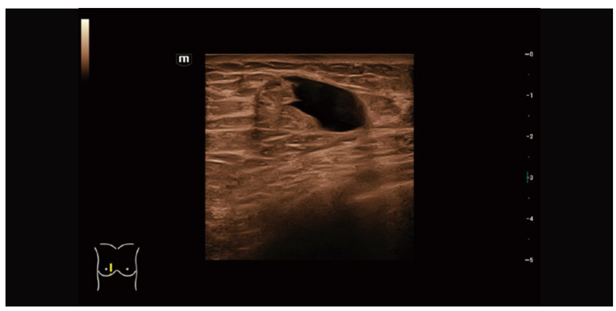
(a) Focus between 0 and 1 on the scale



(b) Focus at 1 on the scale



(c) Focus at 2 on the scale



(d) Focus at 3 on the scale

Fig. 2

The dynamic pixel focusing shows both the sparse milk duct tissue in the upper third of the image and the lymph nodes in the middle third equally well.

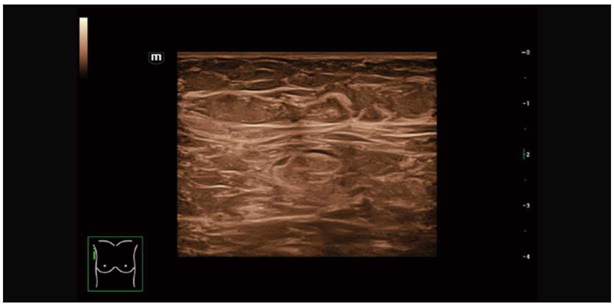
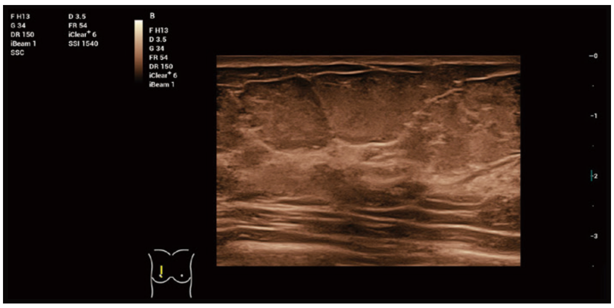
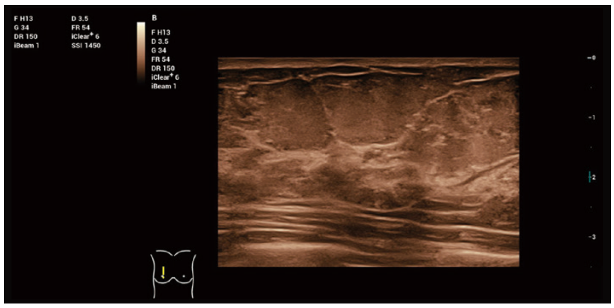


Fig. 3 a-b

Sound speed compensation.



(a) At the conventional 1,540 m/s, it is assumed that the image becomes somewhat more blurred at a greater depth

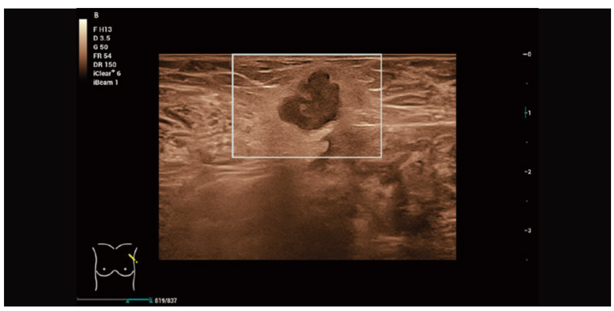


(b) At 1,450 m/s, a sharper detail can be seen in comparison to (a), especially in the area of the fibroglandular tissue

Fig. 4 a-b

A small invasive breast cancer on the left in the direction of the axillary offshoot was so dense subcutaneously that the sound speed compensation did not provide any recognizable advantage here.

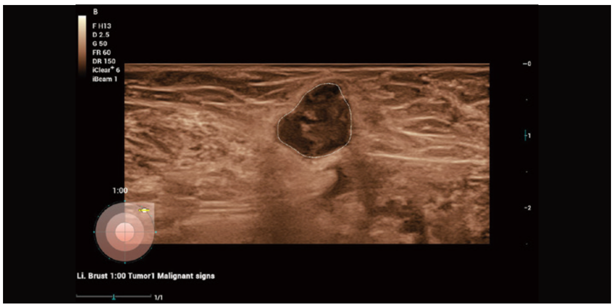
(a) The normal B-image shows the microlobulated lesion in a blurred area with a blurred echo-dense margin



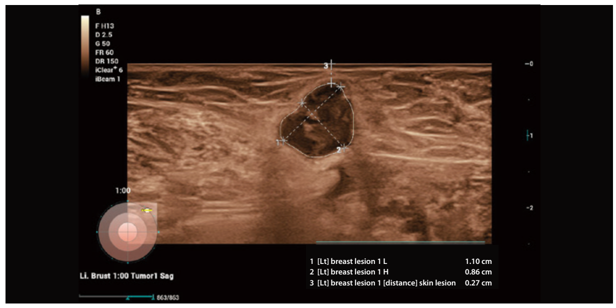
(b) With HD Scope, the borders of the hyporeflective focal portion are significantly clearer against the echo-dense margin, which can also be better detected

Fig. 5 a-c

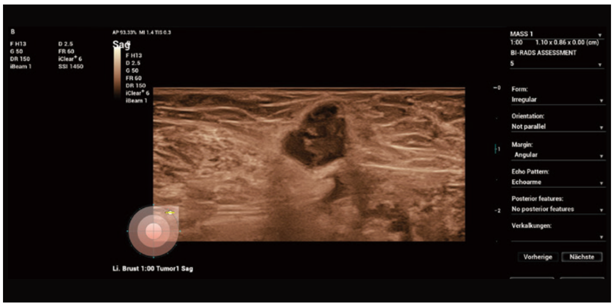
The carcinoma from Fig. 4 is analyzed using AI.



(a) The delimitation suggestion is accepted



(b) Ultrasound biometry is automatically provided



(c) The ultrasound biometry information (top right of the image) is automatically offered suggestions for sonomorphology

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