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A pilot study on evaluating the breast reproducibility of Chabner® XRT Radiation Bra using MRI

S.T. Chiu, S.Y. Man, G. Chiu.
Hong Kong Sanatorium & Hospital, Department of Radiotherapy, Happy Valley, Hong Kong SAR China.

Purpose or Objective

Adjuvant RT is a main treatment regime for breast cancer patient. Immobilisation of breast is difficult because its softness and deformity. Chabner® XRT radiation bra ("the bra"), a FDA-approved immobilization support for breast cancer patient during radiotherapy has been recently introduced into the market. The bra has 13 sizes and is compatible to all radiologic procedures, e.g. CT and MRI. This pilot study aims to evaluate the breast reproducibility of the bra using MRI.

Material and Methods

A total of 10 female subjects, with healthy breast tissues, were recruited in this study. All subjects first underwent a bra fitting session. A fitting bra was selected based on the measurement of the upper chest, bust and band. The shoulder straps and band were adjusted in order to support like a normal bra. The straps' position and closure of the band were marked on the bra.

All subjects underwent T2W 3D TSE MRI scans on the 1.5T Philips Ingenia with the bra. All subjects were scanned initially in a supine position with both arms supported by the breastboard to mimic the treatment position as patients. The scan was then repeated after refitting the bra. All images were sent to MIM® software for analysis.

Left breast tissue, with reference to the RTOG Breast Cancer Atlas, was delineated for each volunteer. The two sets of MRI images were superimposed manually by rotation and translation to best match the breast tissue. The translational and rotational shifts were recorded. The volumetric overlap was evaluated using DSC with the equation $\frac{V1 \cap V2}{\frac{1}{2}(V1+V2)}$, where V1 is the left breast tissue in the initial MRI and V2 is the volume of the refit MRI. A DSC value of 1 represents a perfect overlap of the left breast tissue between the MRI images, hence a perfect reproducibility. Pearson correlation coefficient (ρ) was calculated to analyse the correlation between the breast volume and its associated shift.

Results

Table 1 shows the subject demographics. The lateral, longitudinal and vertical mean shift (mm) and values were 0.8±0.6, 1.4±0.9, 0.6±0.75 and -0.14 (p=0.67), 0.36 (p=0.3), 0.36 (p=0.31) respectively. The mean 3D vector was 0.7±0.63 with a of 0.53 (p=0.114).The mean rotation correction and ρ values were 0.91°±1.19, 0.03°±1.1, 0.43°±2.0 and 0.47 (p=0.18), -0.25 (p=-0.49), -0.56 (p=0.09) for pitch, roll and yaw respectively. The distribution of translational and rotational corrections is shown in Figure 1. The average DSC was 0.95±0.03 with =0.26 (p=0.46).

Age	25-40
Breast Volume	109.22-1284.19cc (mean: 594.51cc)
Chabner® XRT Radiation Bra Used	Size 1 (34"-36", B/C) x 4 Size 2 (34"-36", D/DD)x 3 Size 3 (38"-40", B/C) x 1 Size 7 (42"-44", F/G) x 1 Size 8 (46"-48", D/DD) x 1

Table 1. The demographic of subjects

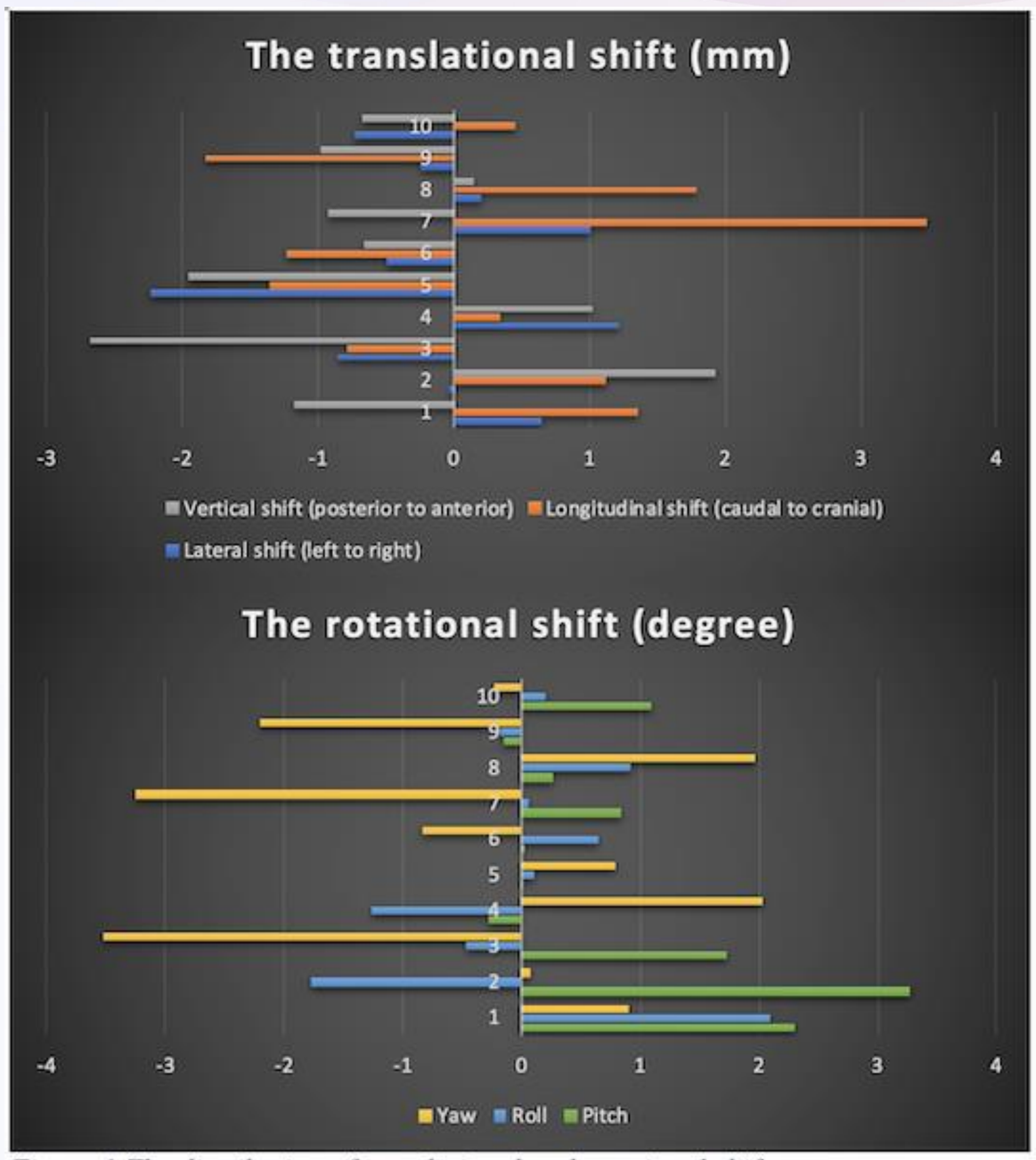

Figure 1 The distribution of translational and rotational shift

Conclusion

In this preliminary study, the bra gives a promising reproducibility with a mean translational and rotational displacement of only about 1mm and 1° for all directions. All DSC values were above 0.9. It seems more deviation was found on larger breast size, especially in lateral and longitudinal direction, however no statistical difference was found. A future study on comparison between the reproducibility with and without bra with larger sample size on patients are needed to give a more concrete evaluation.

For further information

Ms. Chiu Sin Ting, Radiation Therapist II
Department of Radiotherapy,
Hong Kong Sanatorium & Hospital, Hong Kong.
sinting.chiu@hksh.com

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