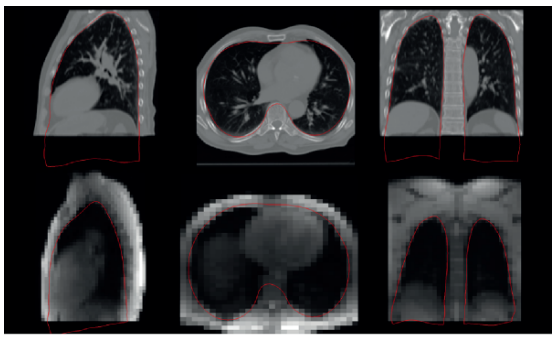

Figure 2: Motion model fitting results. Leave-one-out result (top) and motion-model-based MR image reconstruction (initial, coarsest resolution, bottom). The motion maks (red) delineates the sliding surface.

Conclusion

The method presented here allows good and robust delineation of sliding surfaces in CT and low-resolution MR images and has potential application in registration and motion modelling of images showing breathing motion.

EP-2136 Assessing the stability of MRI geometric distortions on multiple scanners

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Purpose or Objective

To assess the stability of geometric distortions on 3 MRI scanners over a period of a year, using a large field of view (FOV) phantom. This assessment is of importance for MRI-only radiotherapy implementation.

Material and Methods

Large FOV GRADE phantoms (Spectronic Medical AB, Helsingborg, Sweden) were scanned on 3 MRI scanners at 3 institutions over consecutive months for a year; a 3T Siemens Prisma, a 3T GE Signa PET-MRI and a 1.5T Siemens Espree. The phantoms contained around 1200 MRI-contrast filled spheres, covering the entire FOV of the scanners. Scanning was performed using a 2D multi-slice fast spin echo and a 3D fast gradient echo sequence, with vendor 3D distortion correction applied. 5 test-retest measurements were also acquired for each scanner and sequence.

Results were analysed using the GRADE software, returning the centroids of the scanned (distorted) marker positions, as well as the corresponding modelled marker positions (based on CT images of the phantom). Python code was written determining the distortion and distance to isocentre (DTI) for each identified marker.

For each scanner and sequence, the range and standard deviation (SD) of the distortion of each marker over the 5 test-retest measurements were calculated. The same were also calculated for measurements acquired over 5 months. The two results were compared for each scanner and sequence combination. It was determined whether there was a statistically significant difference using paired samples tests ($p<0.05$ considered significant).

The absolute change in marker distortions between the first and last month (over a 12 month period) were calculated.

Results

Geometric distortion was found to increase with DTI for all scanners and sequences.

For the Siemens Espree, no significant difference was observed for the range or SD of distortions between measurements acquired over consecutive months and test-retest measurements for either sequence.

For the Siemens Prisma and GE Signa no evidence of a significant difference was observed for the 3D sequence. However for the 2D sequence, both marker distortion range and SD were significantly larger over 5 months compared to the test-retest measurements on both scanners. Figure 1 shows the distortion ranges for the GE Signa for the 2D sequence for both sets of measurements.

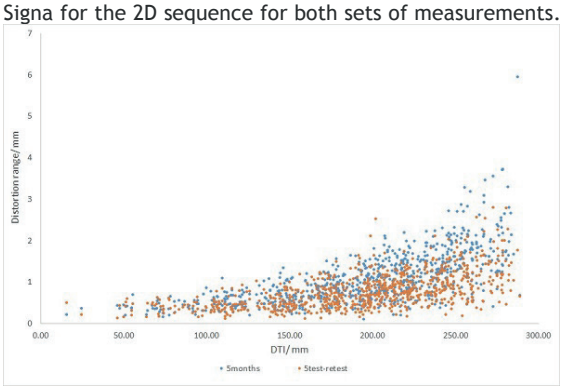

Figure 1.

The changes in marker distortion between the first and last month generally increased with DTI. Table 1 demonstrates the changes in distortion observed (as the Espree has a short bore, no results are given above 250mm DTI for this scanner).

Scanner/ Sequence	Changes in marker distortions/ mm			
	Within 150mm DTI	Within 200mm DTI	Within 250mm DTI	Within 300mm DTI
Espree/2D	<1.5	<2.0	<2.0	N/A
Espree/3D	<1.5	<2.0	<2.0	N/A
Prisma/2D	<1.5	<2.0	<2.0	<3.5
Prisma/3D	<1.5	<1.5	<1.5	<2.0
Signa/2D	<1.0	<1.5	<1.5	<17.0
Signa/3D	<1.0	<1.5	<1.5	<1.5

Table 1.

Conclusion

Although the majority of changes in marker distortions over a year are small (<1.5mm), large differences can be seen at DTI>250mm. The significant difference in distortion variability over 5 months, compared to the test-retest measurements, for 2 sequence/ scanner combinations warrants further investigation and demonstrates the need for regular full FOV distortion measurements in MRI-only radiotherapy.

EP-2137 Development of a modular MRI processing workflow for volumetric analysis of healthy brain tissue

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