

4DCT EVALUATION OF THE RESPIRATORY-RELATED MOVEMENT OF THE BREAST USING SURGICAL CLIPS AS FIDUCIALS

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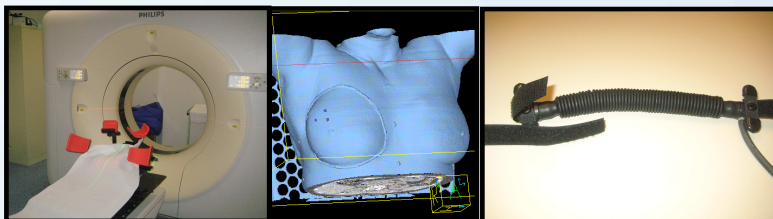
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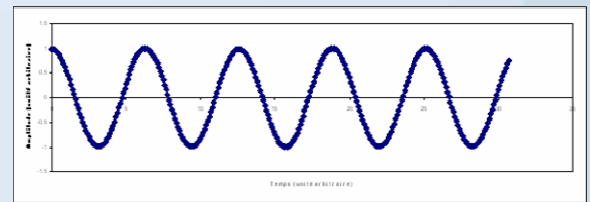
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Purpose: To explore the respiratory-related displacement of the tumour bed in patients undergoing breast conserving surgery followed by external-beam radiotherapy, by using respiratory correlated imaging and surgical clips as fiducials.

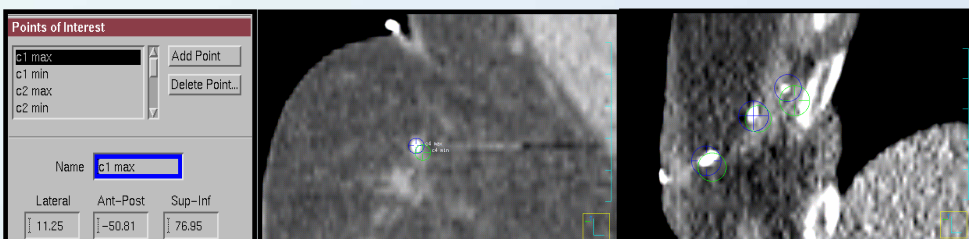
Material and methods: The 4DCT images acquired in supine position in a manner 4D in a free breathing set up for 14 breast cancer patients presenting with 2-9 titanium surgical clips were evaluated. A system composed of a CT simulator (Philips Brilliance-CT Big Bore Oncology®), an equipment for respiratory signal capture (Philips Bellows Device®) and the Philips Tumor L.O.C.® software was used to acquire 10 separate series of CT images of the thorax corresponding to 10 phases of the respiratory cycle. The CT image datasets were then transferred to the Philips Pinnacle® treatment planning software, and 2 series, the one related to the complete inspiration (phase max) and the one related to the complete expiration (phase min) were selected. The x (left-right), y (sup-inf), z (ant-post) coordinates of the surgical clips were recorded in both phases. The mean spatial displacement vectors (3D vector) were calculated for each clip. The patients were subdivided in groups according to the localization of the tumour bed as lateral (6), central (5) or medial (3).



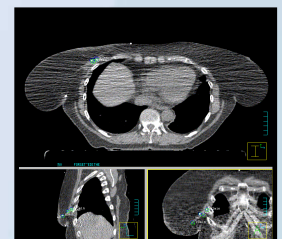
1. Acquisition of 4D CT images using a special "belt": the Philips Bellows Device® and the Philips Tumor L.O.C.® software



2. Breathing curve

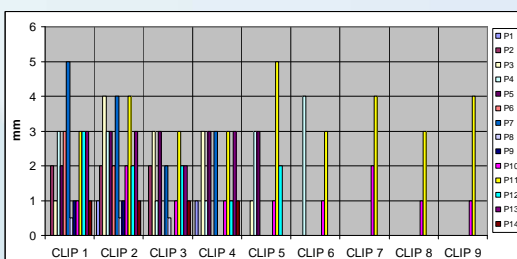


4. Definition of the coordinates of the center of each clips in end-inspiration and end-expiration phases

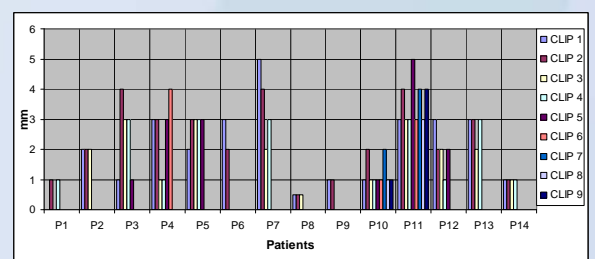


3. Obtention of 10 CT scans in sequential breathing phases. Images are exported to Pinnacle TPS.

Results: All displacement values were less than 5 mm. The overall mean displacement vector was 2.1 ± 2.4 mm (2SD). The mean values were similar for the different subgroups: 2.1; 1.6; 2.5 mm for the lateral, central and medial tumour bed groups, respectively.



Maximum 3D vectorial displacements of surgical clips due to respiration



Clip displacements by Clip number. CLIP: 1 the most medial, CLIP 9: the most lateral

Conclusion: The maximal respiratory-related clip displacement was 5 mm in free-breathing conditions for patients simulated for adjuvant breast radiotherapy. We intend to check whether prone vs supine patient position does change significantly the spatial displacement vector.