An Audit to Assess Electronic Portal Imaging (EPI) and Cone Beam CT (CBCT) Image Verification Methods in 16 Breast Patients

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Purpose/Objective
To investigate the use of EPI and CBCT verification methods for implementation into the standard breast radiotherapy treatment pathway.

Materials/Methods
16 breast patients receiving whole breast radiotherapy (tangential beam arrangement with matched supra clavicular fossa SCF if required) were imaged on treatment fractions 0, 1 and 8 and 12 (fraction 0 being a pre treatment verification appointment). Patients were supine and immobilised on a Sinmed Posiboard with ipsilateral arm raised only. CBCT was acquired and assessed online, consisting of an automatic bone match in comparison to the planning CT. EPIs were taken of both tangential fields. One patient had SCF irradiation and EPIs were acquired of this region. Offline CBCT assessment consisted a manual tumour bed match compared to the planning CT. The EPI image registration method consisted of a bony match compared with digitally reconstructed radiographs (DRR). The bony registrations of the CBCT and EPI methods were evaluated. All data was transformed into the U/V co-ordinate system as carried out by Topolnjak et al(1). U refers to the lateral field placement error and V refers to the longitudinal position.

Results
Figs. 1 shows the CBCT (clip-box) results plotted against the corresponding EPID results for the medial projections. A positive correlation is observed between CBCT and EPID results in the U direction for both projections. However, this correlation is not apparent in the V direction. The differences between CBCT results and the corresponding EPID results were calculated and the mean difference along each axis for each projection was evaluated. The agreement between CBCT and EPID (based on a 95% confidence interval) was ≤6mm in the U direction (i.e. laterally and vertically) and ≤9mm in the V direction (i.e. longitudinally). It is unclear why there appears to be a larger discrepancy between CBCT and EPID along the V-axis.

Conclusions
- EPI verification is suitable for patients receiving whole breast irradiation due to planning margins. For conformal treatments with smaller planning margins CBCT verification is essential.
- The largest disagreements between CBCT and EPID were found to be for patients who exhibited movement during treatment and specifically between CBCT and EPID image acquisition.