Conclusions: Delivery of IMRT plans with IE provided sufficient photon fluence extending beyond the breast skin surface proving the sufficiency of the 8mm margin in the AL direction. However, comparing the IMRT plans with and without IE increased all the SR and PTV doses for uncorrected setup errors. Moreover, for the plans with extended fluence, the maximum values near the skin were found to increase, especially for higher setup errors >8mm. Therefore, daily image guidance and consistent patient repositioning was warranted for not increasing the superficial dose.

EP-1256
Offline correction protocols for rotational errors when using a robotic 6D couch
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Purpose/Objective: Cone beam CT scanners (CBCT) provide accurate 6D displacement information (translation and rotation) relative to the planning CT scan. However, clinically 6D vectors are often converted to a 3D vector since fully integrated 6D couches operating without manual input are lacking. Furthermore, a daily CBCT for patients treated with 30 or more fractions requires more treatment time and adds significant dose to the patient. For only translations, off line protocols like SAL (Bel, R&O, 1993) and eNAL (de Boer, IJROBP, 2007) have been developed which require less imaging. These are widely used. In Arnhem we are developing methods to use the 6D couch on a routine basis to further improve patient positioning, while minimizing the workflow, patient dose and time slot lengths. Especially for patients treated in the head and neck area we often observe significant rotations (typically up to 3°). In cooperation with CIVCO (Iowa, USA), we therefore developed software to fully integrate a 6D couch (Protura) with an Elekta linac (Stockholm, Sweden); patient selection and import of the 6D vector is automated and the linac is interlocked when irradiation is attempted prior to applying the 6D correction. We present a method for offline 6D corrections, which requires 70% less scans thereby reducing workload and patient dose.

Materials and Methods: Ten patients treated for meningioma in 28 or 30 fractions were 6D corrected using a daily CBCT. These 6D positioning results were compared with a simulation of two offline protocols: NAL and eNAL. The NAL protocol uses the mean 6D displacement of the first three treatment fractions as a setup correction in all subsequent fractions. The initial setup correction of eNAL is the same. However, in eNAL, additional weekly follow-up measurements are performed. The setup correction is updated after each follow-up measurement. Patients were immobilized using a hybrid three-point mask and aligned using lasers. 6D correction was determined by an automatic grey value mask registration of the daily CBCT and the reference CT. The 6D correction was applied using a 6D couch. Furthermore, an average of eight post treatment CBCT’s per patient were obtained to verify the residual error after the 6D positioning. Residual errors of the various protocols are compared in terms of their standard deviation ($\sum E_{\text{mean}}$), as is common practice for translational errors.

Results: Before correction, rotational errors up to 3.2° were observed and the mean rotational error per patient was lower for all fractions compared to -1.7° and +1.2°. In the graph is shown that all protocols improve patient position. The amount of CBCT images required is considerably less for the offline protocols.

Conclusions: Significant rotations were observed. 6D couches can accurately correct these rotational errors. The offline eNAL protocol is only slightly less accurate than the online protocol, while requiring 70% less scans thereby reducing workload and patient dose.

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Rectal motion during radio-chemotherapy of rectal cancer assessed by daily MVCTs and 3D local shift measurements
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Purpose/Objective: To assess rectal motion for neo-adjuvant trectal cancer patients (pts) irradiated in prone and supine positions in two Institutes (A,B) with image-guided Tomotherapy (TOMO), aiming at estimating optimal margins for adaptive radiotherapy with concomitant boost of the residual tumor in the last fractions.

Materials and Methods: Pre-treatment CTs and 197 daily MVCTs were acquired for 8 pts treated with 25x2 Gy TOMO in prone position at Institute A. The cranial two thirds of the rectum was contoured on all MVCTs and then split into an upper and lower part and, both divided into 4 sectors (anterior, posterior, left and right). 3D local rectal displacements were quantified by the distance between daily contours and 4 different reference contours: 1st and 13th (midpoint RT) fraction, whole and second half of treatment median contours. ‘Sectors’ Van Herk margins were computed from the global average deviation ($\sum \Delta$), the systematic(\$\sum \Delta\$) and random ($\sum \Delta$) standard deviations of the average local changes. Then, the contours granting a coverage probability for all rectum positions of 90% and 100% were assessed. For each sector and patient, the mean values of local average distances between the 90% and 100% and the 4 references were regarded as local margins: the largest value among the pts was taken as the 100% population coverage margin (for both 100%/90% local coverage, respectively M(100,100) and M(90,100)). Results were compared against supine pts data assessed with the same methods on 10 pts previously treated with 18x2.3 Gy TOMO at Institute B.

Results: Table I shows ‘sectors’ Van Herk margins and M(90,100) for both groups. Supine pts showed the largest variation in the anterior part while lower motility was found in the posterior sector. Upper anterior and lateral M(90,100) decreased in the second half of treatment (p<0.1, for median and median 2nd part). Prone data led to a larger presence of female prone pts (4/8) compared to supine (1/10) may have influenced the results.