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 against 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 3D 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 robotic couch on a routine basis to further improve patient positioning, while minimizing the workload, patient dose and time slot lengths.

Conclusions: The delivery of the 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 against 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 needed for not increasing the superficial dose.

EP-1257
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 rectal 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: Ten patients treated for menigomia 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 CBCTs 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 (SD), 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 over all fractions varied between -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 online protocols.
Conclusions: Local 3D changes of rectal shape show an anisotropic motion of rectum for both supine and prone pts and larger margins for prone pts when considering the second half of treatment, although it could be due in part to a different gender distribution in the two groups. Daily imaging combined with 3D local shape quantifications permits to fully include deformation into local margin assessment.

EP-1258
Impact of the spinal cord position uncertainty on the dose received during head and neck helical tomotherapy
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Purpose/Objective: To establish the optimal planning risk volume to the spinal cord (SC) for oropharyngeal cancer patients during adaptive radiation therapy with concurrent chemotheraphy (CRT).

Materials and Methods: Prospective study based on the 875 observations from 25 oropharyngeal cancer patients was performed. Geometrical uncertainties of the SC were evaluated. Differences between planned and delivered maximum doses to four parts of the SC (C1-C2, C3-C4, C5-C6, C7-Th1) were established for every fraction between planned and delivered maximum doses to four parts of the SC. The importance of the dose uncertainty (IDG) was established for each part of the SC as the ratio of the maximum dose received in a part of the PRV corresponding to the analysed part of the SC to the maximum dose in a whole PRV. The relative risk (RR) was defined as a ratio of the maximum delivered dose in selected part of the SC (Ddelivered) to the maximum dose in the whole PRV (DDelivered) multiplied by IDG: (RR=DDelivered/Ddelivered x IDG).

Results: The C1-C2 part of the SC is most exposed to risk of overdose during chemoradiation for patients with oropharyngeal cancer due to its proximity to the CTV. Doses received by other parts of the SC are smaller, with the lowest dose delivered to the C7-Th1. For patients treated with the individual headrest the average dose increase during the course of treatment (given dose minus planned dose) up to 6.0 and 3.6 Gy were found for the ipsi- and contralateral parotid glands, respectively. For the spinal cord, doses increased up to 2.9 and 2.3 Gy in the case of no and off-line position corrections. The average dose increase was smaller using the individual headrest for the high-dose-CTV and -PTV and all investigated OARs, except for the contralateral parotid glands. However, the average dose differences between both headrests with and without position verification were smaller than the SDs.

Conclusions: For patients treated with the individual headrest the average dose increase during the course of treatment (given dose minus planned dose) was smaller than with the standard headrest. The smaller dose increase was observed both in the target volumes and the ipsilateral parotid gland and the spinal cord. For the investigated cohort of 9 patients, with relatively small field sizes, the differences between the two headrests with and without position verification were not significant.

EP-1259
Influence of the type of headrest (individual or standard) on the actual given dose in target volumes and organs at risk
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Purpose/Objective: In head and neck radiotherapy, headrests and masks are used to immobilize the treatment region. The type of headrest used, e.g. individual or standard, can have an impact on the positioning reproducibility e.g. the flexion of the neck. It is expected that a better positioning reproducibility will result in less deviation of the actual given dose in relation to the planned dose. The purpose of this study was to investigate the influence of the type of headrest on the spinal cord dose in target volume (TVs) and organs at risk (OARs) in head and neck cancer patients in case of no and off-line position corrections.

Materials and Methods: Planning-CT scans (pCT) before treatment and repeat-CT scans (rCT) in the last week of treatment were acquired in 9 head and neck cancer patients, using an individually moulded and a standard headrest. All patients could be treated with fields sizes smaller than 16 cm x 21 cm. All TVs and OARs were delineated on the pCT for both headrests by a head and neck radiation oncologist. Treatment plans were optimized in Pinnacle Research 9.1 using similar criteria for both pCTs. Contours from the pCT were deformed to the corresponding rCT with a fast symmetric demons algorithm, and manually adjusted if necessary. The actual given dose was estimated by the dose calculated on the rCT. Two different situations were simulated: 1) no position corrections; 2) off-line position corrections according to the Shrinkin Action Level (SAL) protocol. The average dose to the high-dose-CTV and -PTV, ipsi- and contralateral parotid glands and the maximum dose to the spinal cord in a 2 cm3 volume were determined for the two situations.

Results: Irrespective of the use of position corrections, doses increased (given dose minus planned dose) up to 6.0 and 3.6 Gy were found for the ipsi- and contralateral parotid glands, respectively. For the spinal cord, doses increased up to 2.9 and 2.3 Gy in the case of no and off-line position corrections. The average dose increase for the 9 patients between the rCT and the pCT with the corresponding standard deviations (SD) for different regions of interest and both headrests with and without position corrections. The average dose increase was smaller using the individual headrest for the high-dose-CTV and -PTV and all investigated OARs, except for the contralateral parotid glands. However, the average dose differences between both headrests with and without position verification were smaller than the SDs.

Conclusions: For patients treated with the individual headrest the average dose increase during the course of treatment (given dose minus planned dose) was smaller than with the standard headrest. The smaller dose increase was observed both in the target volumes and the ipsilateral parotid gland and the spinal cord. For the investigated cohort of 9 patients, with relatively small field sizes, the differences between the two headrests with and without position verification were not significant.