PO-0922
Evaluation of respiratory reproducibility and dose reduction by deep inhalation breath hold for breast irradiation
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Purpose/Objective: Deep inhalation breath-hold (DIBH) for postoperative, left-sided, breast irradiation is known to be an effective technique for reducing the dose to the heart. Respiratory phase reproducibility of DIBH and planning dose reduction were investigated.

Materials and Methods: DIBH was applied to 17 patients for postoperative, left-sided, whole breast tangential radiotherapy with 50 Gy in 25 fractions after breast-conserving surgery between February and August 2012. Respiratory phase reproducibility was assessed by measuring multiple clip position three times on the surface of lesion of planning CT images under DIBH. Immediately before first fraction delivery, an electric portal imaging device (EPID) was used to register the breast position with digitally reconstructed radiography (DRR). During the rest of the fractional deliveries, setup errors were recorded by calculating EPID image isocenter differences between the day and the first day. During dose delivery, EPID cine mode was used to continuously monitor the breast position. Doses delivered to the left anterior descending coronary artery (LAD) were evaluated on the planning CT, and D5, mean dose, V5, and V40 in the heart were calculated.

Results: The standard deviation of the measured clip positions from the three planning CT images under DIBH were 0.40 mm in the lateral direction (RL), 0.85 mm in the anteroposterior direction (AP), and 1.12 mm in the craniocaudal direction (CC). Fig.1 shows the scatter gram of the clip positions for the 17 patients. The measured EPID isocenter shift from the initial EPID verified by DRR image was 2.41±1.64 mm (standard deviation) in CC and 1.93±1.64 mm in AP for the 17 patients. A random error was calculated as a root mean square of the standard deviation in CC and 1.93±1.64 mm in AP for the 17 patients. The LAD D5, mean dose, V5, and V40 were 36.36±12.11 Gy, 13.42±5.5 Gy, 48.31%±8.37%, and 10.85%±12.25%, respectively. DIBH significantly reduced the dose to the LAD compared with free-breathing CT.

Conclusions: It was confirmed that DIBH provided good respiratory reproducibility, and the dose to the LAD was insignificant. DIBH significantly reduced the dose to the LAD.

Fig.1

PO-0923
Patients’ set-up and dose delivery verification for total marrow or lymphoid irradiation with helical Tomotherapy.
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Purpose/Objective: New technology improvements allow to deliver large fields and extremely modulated treatments as total marrow irradiation (TMI) or total lymphoid irradiation (TLI) for a specific subset of onco-hematological patients. These complex treatments need a precise, comfortable and reproducible patient’s positioning. We investigate the feasibility of set-up and dose delivery verification for patients who underwent to TMI and TLI with Helical Tomotherapy (HT).

Materials and Methods: Between March 2009 and April 2012, forty-five patients underwent to TMI (35) and TLI (10). The Clinical Target Volume (CTV) covered all the major lymphatic stations, from the neck to the inguinal region and whole body bones respectively for TLI and TMI. A 4 mm CTV expansion defined the Planning Target Volume (PTV). Set-up was performed with patients in supine position with 3 thermoplastic masks for head, thorax and feet. Three Mega Voltage CT (MVCT) defined the right position for the upper, middle and lower part of the target before every treatment delivery. To measure the in-vivo radiation dose distribution, GafChromatic® films and MOSFET dosimeters were placed on the sternum and abdomen for TMI and on the skin of axilla, inguinal and parotid region for TLI.

Results: The means of the corrections for rotational, longitudinal, lateral shifts respectively for head, thorax and pelvis define the set-up of patients. The shift range never exceeded the PTV margins and the most frequent reported set-up error corrections were lower than 2 mm. The measured point dose of two different kind of dosimeter was compared with the adapted dose recalculated with HT adaptive software. The differences between dose planned with adaptation and measured in-vivo were under 20%. The patients’ compliance was good and ameliorated with an open mask for the head.

Conclusions: Set-up of patients for TMI/TLI HT treatments is feasible and reproducible. Patients can tolerate well long treatment time delivery. Adaptive software should be a good alternative of in-vivo dosimetry.

PO-0924
Investigation of shrinkage effect and reproducibility of thermoplastic cast for head region
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Purpose/Objective: The purpose of this study is to investigate the differences in set up accuracy in terms of shrinkage effect and reproducibility between the thermoplastic casts from two manufacturers: Orfit and CIVCO, in the head region.

Developments: Two sets of thermoplastic casts, a male and a female, were made for each of the patients. A different manufacturer was used every time. A total of 24 sets were made. A thermoplastic mask was made for the head, thorax and pelvis. The patients set-up was performed in three different positions: supine, left lateral, and prone. The shrinkage effect and reproducibility were evaluated for each of the positions using a thermoplastic mask made by each manufacturer. The results were compared with the original thermoplastic mask. The differences between the two manufacturers were statistically analyzed.

Results: The differences between the two manufacturers were statistically analyzed. The results showed that the differences were significant in terms of shrinkage effect and reproducibility. The differences were higher for the male casts than for the female casts. The differences were also higher for the supine position than for the left lateral and prone positions. The differences were higher for the Orfit casts than for the CIVCO casts. The differences were higher for the Orfit casts than for the CIVCO casts. The differences were higher for the Orfit casts than for the CIVCO casts.

Conclusions: The differences between the two manufacturers were statistically significant in terms of shrinkage effect and reproducibility. The differences were higher for the male casts than for the female casts. The differences were higher for the supine position than for the left lateral and prone positions. The differences were higher for the Orfit casts than for the CIVCO casts. The differences were higher for the Orfit casts than for the CIVCO casts. The differences were higher for the Orfit casts than for the CIVCO casts.
Materials and Methods: Displacement analysis was performed in 16 trial cases with the use of the head region of a Rando Phantom; thermoplastic casts from Orfit (n=8) and CIVCO (n=8) cases were compared. The model of casts used were Hybrid masks for head (Part no.: 33740/NH) from Orfit and IMRT reinforced thermoplastics Head only (Part no.: MT-APUIR-20-32) from CIVCO. A set of three radiopaque markers were placed on the surface of the phantom at the isocentre level before making the casts, i.e. under the casts. An anterior marker was placed on the midline and two lateral markers were placed at the approximate level of anterior tragal notches. Each cast was then made according to the guideline from corresponding manufacturer with the Rando Phantom. Another set of radiopaque markers was fixed on the same location but on peripheral side for each cast. Each cast was re-positioned and a set of Cone beam computed tomography (CBCT) images were taken at different time intervals: 10 minute, 30 minutes, 4 hours and 5 hours. Each re-position procedure was done repeatedly for five times. The displacements between the underlying markers and the peripheral markers were then calculated by registering the CBCT imaging acquired at different time intervals and the reference planning CBCT.

Setup errors were then analyzed to investigate the reproducibility of thermoplastic casts of both Orfit and CIVCO.

Results: The displacement differences between 10 min and the average of 24hr to 72hr were 0.3mm and 0.6mm for CIVCO and Orfit respectively. This indicated that the shrinkage effect of the two vendor was not significantly different (p=0.05). The average three-dimensional displacement of CIVCO and Orfit were 1.1mm and 0.9mm respectively. It was also not significantly different (P=0.05).

Conclusions: There was no statistically significant difference in the aspects of shrinkage effect and reproducibility with the thermoplastic casts from CIVCO over casts from Orfit. This study has demonstrated as the novelty of directly comparing the two non-invasive SB sparing methods, considering the tolerable dose of SB. BB group maintained the tumor bed or anastomosis site. Before adoption of BB, we used SBD which was constructed by sculpting a piece of Styrofoam into the bladder is necessary to augment statistical reliability. Depending on the result, SBD may be suggested as an alternative in centers without BB.

PO-0926
Pre-clinical symptom evaluation of a dedicated couch for prone breast radiotherapy
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Purpose/Objective: There is growing recognition that prone setup for whole breast radiotherapy (RT) can reduce the amount of lung being irradiated as compared with supine setup, as confirmed in our experience (Fargier-Bochaton et al., abstract 2nd ESTRO Forum 2013). There are however challenging issues for implementation of prone breast RT in daily practice. One of the issues is the choice of a device for prone positioning. In the present study, we aimed to evaluate a dedicated couch, the kVue™ Access 360® Prone Breast Insert, as compared with an add-on device used with conventional couches, the Bionix Prone Breast Board.

Materials and Methods: Healthy volunteers were installed and remained prone during 10 minutes on either the Access360 couch or the Bionix board. A skin mark was drawn on the projection of lateral laser cross-lines on the thorax at the end of setup. Timer started when skin marking was completed. The displacement between laser crosslines and skin mark was measured at the end of the elapsed 10 minutes. Pain, discomfort, and instability symptoms were recorded by the volunteers using a visual analogue scale, ranging from 0 (absence of symptom) to 10 (intolerable symptom). Other recorded data were age, sex, weight and height, and computed body mass index (BMI).

Student’s t-test and linear regression were used for the data analyses.

Results: The Access360 couch was evaluated by 4 males and 4 females. The Bionix board was evaluated by 3 males and 6 females. Characteristics of the volunteers were: mean age 37.3 years (range 25 - 61), weight 62.8 kg (50 - 112), height 170 cm (160 - 191), BMI 23.5 (19.5 - 34.2). The overall symptom evaluation, regardless of the type of prone device, indicated a mean pain score of 1.3 (range 0-6), discomfort 2.8 (1-7), instability 0.9 (0-7). Increased weight was significantly associated with pain (P=0.010) and with discomfort (P=0.012), but not with instability (P = 0.215). Similarly to weight, increased BMI was associated with pain and discomfort but not with instability. There was a trend in the association between male gender and pain (P = 0.08), Age and height were not significantly associated with any of the three symptom scores. In an analysis taking into account the type of prone device, there were no significant differences between the Access360 couch and the Bionix board regarding pain, discomfort, or laser displacement. There was a non significant increase of instability associated with the Bionix board as compared with the Access360 couch (P = 0.115). In an analysis of subgroup effects, the relationship between pain and weight was found to be more significant within the Bionix board’s group (P=0.001), but not within the Access360 couch’s group (P=0.643). The relationship between discomfort and weight was of comparable order with the Bionix board (P=0.070) and with the Access360 couch (P=0.051). The relationship between instability and weight approached significance within the Bionix board’s group (P=0.061), but was not significant when analyzed within the Access360 couch’s group (P=0.381).

Conclusions: The Access360 couch compared favorably with the Bionix board. We have started implementing the Access360 in daily practice.

PO-0927
3D-CRT whole breast irradiation: flat couch versus angulated breast board position
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Purpose/Objective: In a nationwide survey it became apparent that for breast conserving radiotherapy some institutions treat the patients

Mean volume ± SD (cm³) SBD BB P value

| V1  | 116 ± 30.24 | 99.28 ± 35.88 | 0.982 |
| V2  | 20.19 ± 24.17 | 24.85 ± 31.27 | 0.711 |
| V3  | 14.65 ± 20.39 | 16.70 ± 24.82 | 0.842 |
| V4  | 10.03 ± 13.40 | 12.58 ± 19.58 | 0.740 |
| V5  | 7.24 ± 11.19 | 10.60 ± 11.28 | 0.606 |
| V5,4 | 4.93 ± 7.79 | 9.05 ± 16.47 | 0.470 |
| Vtot | 174.83 ± 146.61 | 189.05 ± 124.01 | 0.183 |
| Vrel | 92.29 ± 146.34 | 10.67 ± 66.77 | 0.442 |
| Vrela | 224.51 ± 179.40 | 195.00 ± 154.44 | 0.702 |

The mean V1, V2, V3, V4, V5 and V5,4 were smaller in patients using SBD. The mean %V in SBD was 42.08 ± 43.74 vs. in BB 35.89 ± 42.20, respectively.