changes are observed in terms of mean dose to parotids or maximum dose to mandible, while oral mucosa and thyroid result better spared with TAV techniques. Though smallest for IMRT, the mean HTID is not significantly different from the other techniques. Finally, MUs for all TAV techniques are significantly lower than for IMRT; no reduction is observed when using one partial arc instead of 3 full arcs.

Table 1: Planning objectives and planning comparison among 7-field IMRT and plans for SRS. Results are averaged over 126 patients of the sample. Statistical significance of Axess vs. Elekta Agility (p value) is reported in the last column.

<table>
<thead>
<tr>
<th>Planning Objective</th>
<th>Planning System</th>
<th>IMRT</th>
<th>3F</th>
<th>7F</th>
<th>FFF</th>
<th>Axess vs. Elekta Agility</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTV50</td>
<td>DOA (% of CT V50)</td>
<td>1.00 ± 0.00</td>
<td>1.00 ± 0.00</td>
<td>1.00 ± 0.00</td>
<td>1.00 ± 0.00</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>NTCP</td>
<td>0.5%</td>
<td>0.5% ± 0.5%</td>
<td>0.5% ± 0.5%</td>
<td>0.5% ± 0.5%</td>
<td>0.5% ± 0.5%</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Dmin</td>
<td>0.1%</td>
<td>0.1% ± 0.1%</td>
<td>0.1% ± 0.1%</td>
<td>0.1% ± 0.1%</td>
<td>0.1% ± 0.1%</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>MU</td>
<td></td>
<td>1.5 ± 0.5</td>
<td>1.5 ± 0.5</td>
<td>1.5 ± 0.5</td>
<td>1.5 ± 0.5</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

Conclusions: TAV techniques allow same PTV coverage and OAR sparing as 7-field IMRT, with one third of MU’s and better dose homogeneity. HTID results lowest in IMRT, but differences are not significant. As for the optimal TAV configuration, ZF90 including one partial arc with a 90° collimator angle seems to spare spinal cord and brainstem significantly better than 3F or ZF90 techniques.

EP-1685
Influence of flat, flattening filter free beam model and different MLC’s on VMAT based SRS/SRT

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Purpose or Objective: Linear accelerator (Linac) based stereotactic radiotherapy (SRT) and stereotactic radiosurgery (SRS) using Volumetric modulated arc therapy (VMAT) got a wide spread application for treating intracranial lesions. In recent time linacs were facilitated with flattening filter free beam and miniature MLC’s. This development was intended to facilitate a superior dose conformity and quicker therapy delivery. This study was designed to study the dosimetric outcomes and monitor unitsof the stereotactic treatment plans attributed to different commercially available MLC and beam models.

Material and Methods: Ten patients having twelve target volumes, who received the stereotactic treatment in our clinic using Axesse linear accelerator (reference arm), were retrospectively considered for this study. The test arms includes plans using Elekta Agility with FFF, Elekta APEX with flat beam, Elekta APEX, Varian Millennium 120, Varian Millennium 120HD and Elekta Synergy in Monaco treatment planning system. Calculation grid size and planning constraints were not altered in the test plans. To objectively evaluate the efficacy of MLC-beam model, the resultant dosimetric outcomes were subtracted from the reference arm parameters.

Results: Figure 1 represent total seven (one reference arm and six test arm) plans for an evaluated patient. Maximum dose and mean dose of PTV GTV V105%, V100%, V95%, D1%, showed a maximum inter MLC beam model variation of 1.5% and 2% for PTV and GTV respectively. Average PTV heterogeneity index and conformity index shows a variation in the range 1.08-1.11 and 0.56-0.63 respectively. Mean dose difference (excluding reference arm) for all organs varied between 1.7cGy - 194.5cGy (mean dose 16.1 cGy SD=57.2 cGy) and 1.1cGy-74.9cGy (Mean dose was 6.1 cGy SD=26.9 cGy) for multiple and single fraction respectively.

Conclusion: The dosimetry of VMAT based stereotactic treatment plan yield minimal dependency on beam characteristic (model) and MLC width. All tested MLC and beam model could fulfill the desired PTV coverage respecting OAR dose constraints. The only notable difference was the halving of the MU for FFF beam as compared to plane beam. This has the potential to reduce the total patient on couch time by 15% (approximately 2 minutes).

EP-1686
Frameless radiosurgery in brain metastasis with Tomotherapy: a comparison toward dosimetric index
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Purpose or Objective: Effectiveness of stereotactic radiosurgery (SRS) in treatment of brain metastasis have been demonstrated. In this work we have, retrospectively investigated dosimetric features of frameless SRS delivered with Tomotherapy and compared with reported result in literature in term of Paddick Conformity Index (CI), Homogeneity Index (HI) and Gradient Score Index (GSI).

Material and Methods: 68 patient treated between 2008 and 2013 in our institution with frame-less set-up (only thermoplastic mask) have been enrolled. 89 Lesions have been stratified for dimension (lower or greater than 5 cc) and for prescription strategies. ICRU62 (D95%>95%, D100%-10%) guidelines were utilized for 40 patients while ICRU83 (D50%-Prescription, D98%-95%, D107%-2%) recommendations were utilized in the remaining 28. Dosimetric index for describing Target Coverage, Target Homogeneity and Organ at Risk (OAR) sparing were selected among the most used in similar studies (Pubmed Line, keyword: “Dosimetric Index”, “Radiosurgery”, “Tomotherapy”, “Brain”).

Results: CI, HI and GSI are the most cited feature for describing respectively Target Coverage (21 studies), Target Homogeneity (12 studies) and OARs sparing (5 studies). Mean and standard deviation of CI, HI and GSI in the cohort were, respectively, 1.59 ± 0.38, 1.06 ± 0.04 and 51 ± 16. A multivariate logistic regression analysis of the PTV volume showed significant influence (p<0.05) on CI while prescription strategies influenced GSI. ICRU83 recommendations seems to
guarantee a better sparing of normal tissue. Obtained index are aligned with reported results in analogous studies with Tomotherapy. Gammaknife perfexion seems to be the technique able to guarantee better results in term of CI. OARs sparing in case of no co-planar beam delivered by LINAC exhibit worse performance than modulated technique.

Conclusion: Treatment of brain metastasis with Tomotherapy showed encouraging results in term of dosimetric outcome. Lesion size and prescription strategies showed a statistically significant influence on dosimetric distribution. Clinical outcome with frameless immobilization has proven feasible, well tolerated and able to increase patient compliance as exclusive treatment of brain oligo-MTS.

EP-1687
Improving target dose homogeneity in intensity-modulated radiotherapy for sinonasal cancer
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Purpose or Objective: It is challenging to achieve homogeneous target dose distribution in intensity-modulated radiotherapy (IMRT) for sinonasal cancer (SNC). To overcome this difficulty, we proposed a base-dose-compensation (BDC) planning technique, in which the treatment plan is further optimized based on the original plan with half of the prescribed number of fractions and finally the number of fractions of treatment plan was restored from a half to the total.

Material and Methods: CT scan data of 13 patients were included. Generally acceptable original IMRT plans were created and further optimized individually by (1) the BDC technique and (2) a local-dose-control (LDC) planning technique, in which the original plan is further optimized by addressing hot and cold spots. We compared the target dose coverage, organ-at-risk (OAR) sparing, total planning time and monitor units (MUs) among the original, BDC, LDC IMRT plans and additionally generated volumetric modulated arc therapy (VMAT) plans.

Results: The BDC technique provided significantly superior dose homogeneity/conformity by 23%-48%/-6%-%9 compared with both the original and LDC IMRT plans, as well as reduced doses to the OARs by up to 18%, with acceptable MU numbers. Compared with VMAT, BDC IMRT yielded superior homogeneity, inferior conformity and comparable overall OAR sparing. The planning of BDC, LDC IMRT and VMAT required 30, 59 and 58 minutes on average, respectively.

Conclusion: The BDC planning technique can achieve significantly better dose distribution with shorter planning time in the IMRT for SNC.

EP-1688
Evaluation of automatic brain metastasis planning for multiple brain metastasis
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Purpose or Objective: Recently Automatic Brain Metastasis Planning (ABMP) Element [BrainLAB] was commercially released by BrainLAB. It covers multiple off-isocenter targets at a time inside a multi-leaf collimator field and enables stereotactic radiosurgery (SRS) / stereotactic radiotherapy (SRT) with a single group of linear-based dynamic conformal multi-arc for multiple brain metastases. In this study, dose planning of ABMP (ABMP-single isocenter dynamic conformal arc [ABMP-SCDA]) for stereotactic radiosurgery of small multiple brain metastasis was evaluated in comparison with those of conventional multi-isocenter DCA (iPlan [BrainLAB]-MIDCA) and Gamma Knife [Elekta] SRS (GKRS).

Material and Methods: Simulation planning was performed with ABMP-SCDA and GKRS was made in a case of multiple small brain metastasis (9 tumors of 0.2 to 0.7 ml in volume) which were originally treated with iPlan-MIDCA. First, dosimetric comparison was done between ABMP-SCDA and iPlan-MIDCA in the setting with PTV (planned target volume) margin of 2mm and D95=95% dose (19 Gy). Second, dosimetry of GKRS was compared with that of ABMP-SCDA with PTV margin of 0, 1mm, and 2mm, and D95=100% dose (20 Gy).

Results: First, CI (1/Paddick’s CI) and GI (V[prescription dose] / V[prescription dose]) in ABMP-SCDA (mean, 1.36 and 5.12) were compatible with those of iPlan-MIDCA (mean, 1.53 and 4.84). Second, PIV (prescription isodose volume) of GKRS (mean, 0.23 ml) was between that of no margin- and 1mm-margin ABMP-SCDA (mean, 0.10 ml and 0.28 ml). Considering dose gradient, the same tendency was observed. The mean of V[prescription dose] of GKRS, no margin-, and 1 mm-margin-ABMP-SCDA were 0.87 ml, 0.60 ml, and 1.37 ml respectively.

Conclusion: The conformity and dose gradient with ABMP-SCDA was as good as those of conventional MIDCA by each lesion. If the conditions permit minimal PTV margin (1mm or less), ABMP-SCDA might provide excellent dose fall-off compatible with GKRS and enable a short treatment time. The author has no COI. However this study was performed by use trial of ABMP Elements provided by BrainLAB (Tokyo).

EP-1689
Which technique is dosimetrically superior in the treatment of breastcancer: VMAT or Fixed Field IMRT
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2Sheffield Hallam University, Dept. of Allied Health Professions, Sheffield, United Kingdom

Purpose or Objective: To determine in terms of target coverage and organ at risk (OAR) doses which concomitant boost technique is superior in the treatment of breast cancer; VMAT or fixed field IMRT.

Material and Methods: 30 previously treated breast patients (15 Left, 15 Right) were re-planned with both VMAT and fixed field concomitant IMRT techniques. A two dose prescription was used similar to previous planning studies (1-3) using the same dose constraints as per the IMPORT HIGH trial (1). 40Gy in 15 fractions was planned to the whole breast while boosting the tumour bed to 48Gy in 15 fractions. A base plan consisting of the existing forward planned tandem fields delivered approximately 38Gy to the whole breast while the tumour bed was boosted with approximately 10Gy using an inverse planned IMRT option. A single partial arc starting and finishing at the tandem angle was formed the VMAT portion and the ff-IMRT trial used the 2 existing tandem beam angles followed by 3 further equally spaced beams. Target coverage, heart, ipsilateral lung, contralateral lung and contralateral breast dose was measured. A Two-tailed t-Test sample for means was used to compare the dosimetric differences between the techniques using excel software. Statistical significance was defined as P<0.05.

Results: Maximum dose D2% was statistically lower for VMAT; 103.2% vs. 103.7% for ff IMRT whereas minimum doses were equivalent. No differences were found with ipsilateral lung mean and V5Gy doses, contralateral breast mean dose, heart mean dose, heart V5Gy and V10Gy doses. VMAT demonstrated statistically lower V2Gy doses to the contralateral lung (0.7% vs.1.6%) and heart for both left (19.0%/22.6%), and right (5.5%/8.8%) sided patients respectively. Whereas ff-IMRT boasted significantly lower ipsilateral lung V2Gy, V18Gy and V10Gy doses (7.9/8.6/13.1 vs. 8.1/8.8/13.4%) with VMAT respectively.

Conclusion: Despite both VMAT and ff-IMRT plans reaching statistical significance in a number of OAR and target parameters there is no clear superior option and whether the differences are clinically significant is a different question. Both techniques met all mandatory dose constraints and the