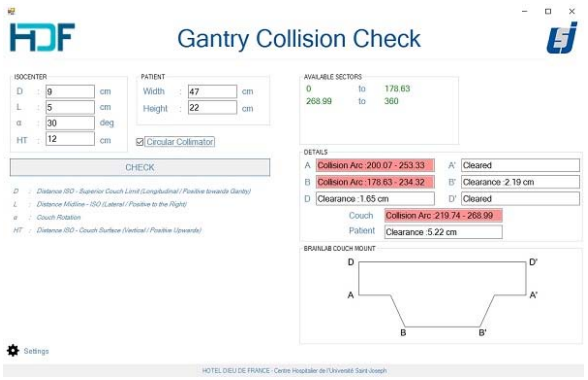
preset height and width, and same formulas were applied for collision detection. A computer code incorporating these formulas was generated. A modifiable "Settings" window including the couch and gantry head dimensions as well as gantry-to-isocenter distance was created. The inputs required are the isocenter coordinates relative to the couch position, the couch rotation angle, the patient dimensions, and the presence or absence of a circular SRS collimator. The software outputs the collision-free gantry angles, and for each point, the shortest distance to gantry or the colliding sector when collision is identified, assuming a full gantry rotation. The software was tested for accuracy on a TrueBEAM equipped with BrainLab accessories for fifteen pretreated plans and ten colliding virtual cases with and without circular collimators.

Results: The software accurately predicted the absence of collision for fourteen of the pretreated plans, and detected collision for one case that required replanning after failing the pre-treatment dry run (difference of 1.7° in colliding gantry angle).The root-mean-square deviation between the measured and predicted gantry angle of collision for the virtual cases was 1.52±0.01° (-3.39°). The largest differences were observed for extreme couch rotations.

Conclusion: This tool accurately predicts gantry-couch collision for linac-based SRS and is easy to implement in any facility without the need for optical imaging or complex tridimensional machine modeling.



EP-1664

Comparison between intensity modulation techniques in prostate cancer treatment

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Purpose or Objective: Volumetric Modulated Arc Therapy (VMAT) is a highly conformed delivery technique. VMAT comparison to other advanced techniques, as IMRT, in terms of plan quality, delivery efficiency and accuracy is great topic discussion in literature. Aims of this work are to assess VMAT dosimetric results compared to IMRT ones on prostate site and to evaluate the acute toxicity profile for patient treated by VMAT techniques.

Material and Methods: A comparison was made between IMRT and VMAT plans elaborated by treatment planning system (TPS) Elekta Monaco® on the first 30 consecutive patients treated with VMAT moderately hypofractionated radiotherapy: 70.2Gy/26 fractions of 2.7Gy. All patients had histologically confirmed prostate cancer; median age was 76 years old; ECOG-performance status value was 0-1; According to the National Comprehensive Cancer Network Criteria patients were stratified into low, intermediate and high risk groups as follow: one patient was low, 8 were intermediate and 16 were high risk. IMRT and VMAT plans were elaborated by TPS Elekta Monaco® using a two-stage constrained optimization based on both biological and physical cost functions. Plans were compared by evaluating D105%, D95%, D93%, D90%, Dmean and D0.5% for the PTV coverage, while for Organs at Risk (OARs), in addition to Dmean and D0.5%, the % of organ receiving 57, 61, 65.8 and 68.4 Gy (rectum), 57, 61, 65.8 and 68.4 (bladder), 35, 39.5 and 43.9 Gy (femoral heads) were considered of interest. Toxicities were assessed according to the RTOG/EORTC scale for acute and late adverse effects.

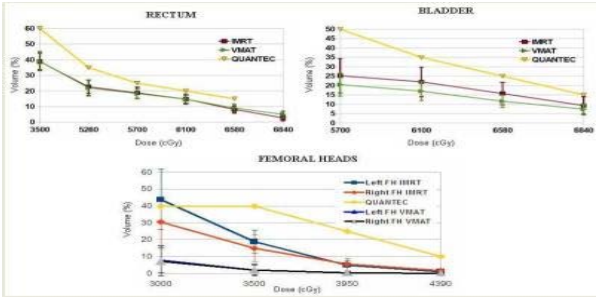
Results: Dosimetric analysis shows that PTV coverage is better with VMAT technique and that PTV Dmean is higher than about 1 Gy in VMAT treatments: median value for the PTV Dmean was 70,6 Gy in VMAT technique vs 69,7 Gy in IMRT (Table 1).

Table 1

PTV	VMAT	IMRT
D_{mean} (Gy)	70.6	69.7
$D_{0.5\%}$ (Gy)	74.5	72.9
$D_{90\%}$	99.8 %	99.8 %
$D_{93\%}$	98.6 %	98.6 %
$D_{95\%}$	95.9 %	95.4 %
$D_{105\%}$	5.8 %	1.6 %

Regarding OARs sparing, VMAT technique offers a higher sparing of bladder (of about 5% of volume at 57,61 and 65Gy) and femoral heads (of about 15% of volume at 30 Gy) (Figure 1).

Figure 1



VMAT treatments were completed in all patients without interruptions: average overall treatment time was 38 days. During RT, acute genitourinary toxicity was recorded as Grade 1 in 13 patients (52%) and Grade 2 in 7 (28%); acute rectal toxicity was recorded as Grade 1 in 4 patients (16%) and Grade 2 in 3(12%).

Conclusion: Respect to IMRT, VMAT offers higher plan quality with a better PTV coverage. Regarding OARs, VMAT offers higher sparing of bladder and femoral heads. Besides, VMAT is able to provide a considerable reduction in treatment time

offering a better delivery efficiency. Acute toxicity profile assessed by hypofractionation schedule VMAT treatments was safe.

EP-1665

Scalp-Sparing focal radiotherapy for gliomas using VMAT or Helical Tomotherapy: a feasibility study

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Purpose or Objective: Both transient and permanent alopecia have a huge psychological impact on patient's quality of life. Sparing the scalp during focal cranial RT for gliomas is a challenging issue during the treatment planning process due to the fact that the scalp is often strictly adjacent to the cortical or subcortical target. In addition, clear constraints for this structure to be used during the inverse planning are not available in literature, most of them being very strict. We report our preliminary experience with scalp sparing technique for patients with high grade gliomas.

Material and Methods: Five patients previously treated with focal RT were reviewed. During the contouring process, the scalp volume was defined as a ring region of interest (ROI) including the tissue between the skin and the skull, up to a maximum thickness of 5 mm. The hairless skin of the face and the neck was excluded from the scalp ROI. The gross tumor volume(GTV) included the surgical bed plus any contrast enhanced lesion on a postoperative T1-weighted MRI scan. The clinical target volume (CTV) was obtained by adding an isotropic 2-cm margin to the GTV. CTV was then edited according to the anatomical barriers (meninges, ventricles, tentorium and midline except for lesion near to the corpus callosum). CTV was expanded by 2 mm to get the planning target volume (PTV). For the inverse planning, primary constraint for the scalp was Dmax≤16 Gy, secondary constraint was Dmax≤25 Gy, tertiary constraint was Dmax≤35 Gy. Tomotherapy and VMAT plans were generated for a prescription dose of 60 Gy in 30 fractions. Other intracranial organs at risk (optic chiasm, brainstem, cochlea, pituitary gland and hippocampus) were contoured.

Results: The primary constraint (Dmax≤16 Gy) for the scalp was unachievable. The secondary constraint (Dmax≤25 Gy) was met only in a case both with Tomotherapy and VMAT. The tertiary constraint (Dmax≤35 Gy) was met in all the cases with Tomotherapy (the scalp volume receiving > 35Gy was always < 0,1cc) but only in two cases out of 5 with VMAT. Target coverage and sparing of the other organs at risk were acceptable in all the treatment plans.

Conclusion: Meeting the constraints for the scalp is not always feasible for cortical or subcortical targets that need to be treated with a total dose of 60 Gy. We are enrolling patients with gliomas treated with the above-mentioned scalp sparing technique in a prospective study in order to assess the clinical results in terms of transient and permanent alopecia.

EP-1666

A modified left-sided breast cancer irradiation in Tomotherapy: comparison to hybrid-IMRT technique

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Purpose or Objective: In order to reduce heart and ipsilateral lung dose, a modified left-sided breast planning technique in TomoTherapy was introduced and compared to Hybrid-IMRT technique.

Material and Methods: A modified planning technique in Tomotherapy was designed for left-sided breast cancer patients. It was based on Limited-Tomotherapy planning technique [An-Cheng Shiau et al., 2014] but applying optimal pitches [Mingli Chen et al., 2011] to achieve better conformity and lower heart and ipsilateral lung dose. First, the optimized off-axis distance was determined. Then the optimal pitches were chosen according to the optimized off-axis distance. The last thing was applying optimal pitches with Limited-Tomotherapy planning technique, which had several artificial contours like Complete-block, Directional-block for near PTV area and the virtual bolus, on the optimized process of the left-sided breast Tomotherpy planning. Hybrid-IMRT plans were designed by tangential-fields and IMRT fields combined. The prescription dose was 50 Gy in 25 fractions to PTV. The lung and heart dose volume were measured and analyzed in Beam's-eye-view of tangential-fields with field heart volume (FHV) and field lung volume (FLV).

Results: The maximum volume of FHV and FLV are 15.49c.c and 84.27c.c. The modified planning technique could reduce 12.44% dose in Dmean of heart and 11.36% in lung and both techniques had similar coverage of PTV. The modified planning technique could increase the minimal dose of PTV (37.35 ± 3.87Gy vs. 29.52 ± 6.75Gy) and the homogeneity index (HI=PTVm95%-PTVm107%) was better (0.9877 ± 0.0053 vs. 0.9632 ± 0.0565). The Dmean of heart in Hybrid-IMRT technique was higher than in the modified planning technique (3.01 ± 2.29Gy vs. 2.40 ± 2.07Gy). The Dmean of lung was higher in Hybrid-IMRT technique than in the modified planning technique (5.72 ± 1.44Gy vs. 5.04 ± 1.47Gy).

Conclusion: The modified planning technique showed better dose reduction in heart and lung. It was because of there were more flexibility in the optimized planning process. It should be useful in left-sided breast irradiation in TomoTherapy.

EP-1667

Dose fall off patterns and the OAR effect - experience of Linac based frameless radiosurgery

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Purpose or Objective: Sharpness of fall off of dose beyond the PTV edge is one of the key parameters of efficient cranial stereotaxy. This study presents the dosimetric data and dose fall off patterns of consecutive patients treated for cranial SRS on a linear accelerator.

Material and Methods: Thirty patients of brain lesions underwent frameless SRS at our centre between March 2013 and December 2014. All patients underwent radiotherapy planning contrast CT scan with 1 mm slices. VMAT planning was done for all cases(4mm MLC leaf size). From the center of the PTV volume, straight lines were drawn in the axial plane in anterior, posterior, medial, lateral, superior, inferior directions and in the direction of nearest organ at risk (OAR). Along each line the distance of the 80%, 50% and 20%. isodoses from the edge of the PTV were measured. The distance required for dose fall of from 100% prescription dose (PTV edge) to 80%, 50% and 20% were noted. The final readings were converted to dose fall off percentage per mm (%/mm)

Results: OAR doses were validated according to TG-21 specified limits. The mean±SD fall (% per mm) for 100%-80% was 7.5±2. For 100%-50% the fall rate was 5±1.3 and for 100%-20% it was 4.2±1.6. The mean of sharpest fall off rate (% per mm) was 10.6+5.8 for 100-80%, 6.6+3.6 for 100-50 % and 5.9+7.5 for 100-20%.For an OAR distance > 2 cm from PTV edge (12 patients), the dose fall off pattern remained unaffected. For rest of the eighteen patients with OAR distance < 2 cm from PTV edge, the dose fall off became sharper in the direction of OAR.