aperiod of 6 moths, showed results within the acceptance criteria of ±5% in dose for all the cases except one for which the UFP contour was missed.
Conclusions: Our study shows that the attenuations of single beams that intercept the IRSs are not indicative of the mean dose target variations determined over the whole RT plan, but, as expected, the impact of the IRS attenuation is patient's specific. Therefore in our radiotherapy centre all the IRSs are contoured and it takes about 20 minutes per patient. However for those IRSs whose target dose variation is less than 2% we are going to explore two possible protocols: not contouring the IRSs, and enhancing the acceptance criteria of the DVH to 97% of the prescribed dose to 95% of the target volume or auto contouring the IRS with the patient's body accepting some contour artefact.

EP-1221
IRIS and fixed collimators comparison for cyberknife stereotactic radiosurgery of petroclival meningiomas
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Purpose/Objective: Aim of this study is to compare the planning performance of two collimators (fixed and dynamic aperture IRIS) mounted on the cyberknife system.
Materials and Methods: Three treatment plans for each petroclival meningioma patient (average target volume 13.9cc) were optimized for different collimator setups: up to three fixed, free variable aperture IRIS (fIRIS) and IRIS apertures constrained to the fixed plan ones (cIRIS). The prescription dose was 25 Gy in 5 fractions and the reference isodose for each patient was chosen to produced equivalent target coverage for the three plans. The comparison among different collimator setups was performed in terms of OARs sparing (brain stem, cochlea and omolateral acoustic nerve), CI (van't Riet et al.), total MU, treatment time and body volumes receiving 70%, 50%, 30% and 10% of the prescription dose.
Results: Plans for all patients had a mean target coverage of 96.1%, and the mean prescription isodose was 81%. The three collimator setups did not produce significant differences in terms of OARs sparing and CI values. Compared to fixed collimators, both IRIS plans showed improvements in low dose regions, with a reduction of 4.9% and 6.7% for the total volume enclosed respectively by the 30% and 10% of the prescription dose isodoses; no relevant differences were appreciated when 70% and 50% isodoses were considered. Treatment time was reduced by 16.6% when the IRIS collimator setup was used, with a minimal difference between free variable aperture and constrained IRIS (~2 min less for fIRIS). The fIRIS setup also allowed a reduction of the 5.6% and 8.7% of the total MU number, if compared to fixed and cIRIS plans respectively.
Conclusions: The different collimator setups analysed showed nonsignificant differences in terms of OARs sparing for radiosurgery treatment of petroclival meningiomas. Using the IRIS collimator with free variable aperture can reduce the total volume enclosed by medium and low dose isodoses. Moreover, it can also reduce treatment time and total MU number. Finally, using IRIS constrained apertures instead of free ones could be advantageous in terms of treatment planning computation time.

EP-1222
Assessment of EUD as a treatment plan quality parameter
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Purpose/Objective: The aim of this study was to assess the use of equivalent uniform doses (EUD) as a treatment plan quality parameter; searching for a possible relationship with Dose Volume (DV) evaluation criteria and the difficulties encountered in applying EUD to clinical practice. A possible solution to these difficulties using EUD ($D_{98\%}$) is suggested.
Materials and Methods: Ten head and neck tumor cases were optimized using biologically based intensity-modulated radiation therapy (IMRT) optimization for acceptance according to DV criteria and then re-optimized for EUD value acceptability. In all plans the absorbed dose limits of the critical organs at risk were to be complied with.
Results: Considering that a plan is EUD acceptable when its value is within 5% of the prescription one, there is no link between acceptable EUD value and $V_{95\%} \geq 95\%$, which is a DV acceptance criteria. However, there is a relationship between acceptable EUD value and $D_{98\%} \geq 95\%$. Like low absorbed doses has a great impact on EUD, its value can be very influenced with the uncertainty in contouring, the voxel size and the uncertainty of TPS doses calculation. To address this uncertainties, in our center we use a EUD ($D_{98\%}$),which, for calculation, eliminates 2% of points with lower absorbed doses. This allows using the EUD ($D_{98\%}$) as plans acceptance parameter. In plans optimized for EUD evaluation, it has been observed that the TPS attempts to compensate for cold or hot spots by increasing or decreasing the absorbed dose to the PTV. This can cause two opposite undesirable effects that may lead to an unacceptable overdose or low coverage of PTVs.
Conclusions: The main conclusion of this work is that EUD ($D_{98\%}$) may be used as a treatment quality parameter, but should always be complementary to DV criteria.

EP-1223
Dosimetric comparison between Acuros XB and model-based algorithm for prostate IMRT with implanted fiducial marker
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Purpose/Objective: The purpose of this study is to compare the dosimetric characteristics between Acuros XB and model-based algorithm for prostate IMRT with implanted fiducial markers.
Materials and Methods: CT datasets of 12 prostate cancer patients with implanted fiducial markers were selected for the study. Prostate(PR): GTV, seminal vesicles (SV), CTV: GTV+SV, PTV-PROST, PTV-SV, rectum and bladder were delineated. The PTV-PROST was created by symmetrically expanding the PR by 0.7 cm in all directions except posteriorly,where it was expanded by 0.4 cm. The PTV-SV is derived by expanding the SV 0.5cm in all directions. Treatment plans were computed for SMLC-IMRT based on 7 fields with 6MV (6 datasets) and 10MV (6 datasets) beams using a Varian Clinac iX with a 120-leaf MLC. Dose prescription was set to 76.0 Gy at 2.0 Gy / fraction to the PTV-PROST $D_{95\%}$. At first, all datasets were computed with XiO superposition (SP). And those plans were exported to Eclipse, treatment planning system, and recalculated with anisotropic analytical algorithm (AAA) and Acuros XB (AXB) dose calculation algorithm. All plans were normalized using XiO calculated MU. Calculation grid was set to 0.2 cm in all datasets. AXB was dose to medium calculation. Maximum dose, minimum dose, mean dose, $D_{2\%}$, $D_{50\%}$, $D_{98\%}$ and other dosimetric parameters of the targets and organs-at-risk generated by XiO SP were compared with the other two dose algorithms.
Results: The ratios of mean values of PR minimum dose for SP, AAA and AXB were 1.00, 1.00 and 0.93, respectively. The ratios of mean values of PR mean dose were 1.00, 1.00, and 0.99 for the SP, AAA, and AXB, respectively. The ratios of mean values of PTV-PROST $D_{95\%}$ dose for SP was 1.00, for AAA 1.01, and for AXB 0.99.The mean values of rectum $D_{2\%}$ for SP, AAA and AXB were 74.6, 75.8, 75.6 Gy, respectively. The mean values of bladder $V_{60\%}$ for SP were 19.1%, for AAA 20.0, for AXB 19.5.
Conclusions: Using AXB dose calculation algorithm, implanted fiducial marker in target induces a reduction of the dose homogeneity. However, the clinical effect is restrictive that the change of the PTV-PROST $D_{95\%}$ is small with an average of around 1%. Material-overwrite in prostate is one of the useful methods to improve calculated dose homogeneity.

EP-1224
Dosimetric comparison of Volumetric-Modulated Arc Therapy(VMAT) and IMRT for carcinoma of cervix
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Purpose/Objective: To compare Volumetric-Modulated Arc Therapy (VMAT) with conventional intensity modulated radiation therapy (IMRT) for Carcinoma of Cervix.
Materials and Methods: Ten patients with carcinoma of Cervix under going treatment in our institution were selected for this study. For each patient,plans were generated with the planning CT scan, one using Step and Shoot IMRT,and another plan using the volumetric-modulated arc therapy technique, with 2 arcs. The mean PTV volume was 787.58 ± 162 cc (range, 541-1028) and that of CTV was 456.10 ±

135cc (range, 228-630) respectively. The treatment plan was designed to deliver a dose of 50.0 Gy to the planning target volume at 2 Gy-daily fractions, 5 days a week. The objective for the plans was the coverage of 95% of the PTV with the prescribed dose. Planning Objectives were placed to ensure that no more than 1% of the PTV will receive more than 107%.Planning objectives were also placed for normal structures as per the hospital protocol. Dose-volume histograms (DVH) for the target volume and the organs at risk (Small bowel,bladder, femoral heads, Rectum and healthy tissue) were compared for the 2 different techniques. Monitor units (MU) and delivery treatment time are also reported.
Results: All plans achieved fulfilled objectives. Both IMRT and VMAT resulted in similar coverage of PTV. The difference between the doses to the normal structures for the two techniques was not significant. Conformity Factor ($CF_{95\%}$)for the PTV was 0.9778 ± 0.01 (VMAT), and 0.9805 ± 0.013 (IMRT).Homogeneity Index ($D_{5\%}$ - $D_{95\%}$/ D $_{Pres}$) for PTV was 0.068 ± 0.01 for VMAT and 0.0596 ± 0.01 IMRT.
Conclusions: For patients suffering from Carcinoma of Cervix, VMAT with 2 arcs was able to deliver equivalent treatment plan to IMRT in terms of PTV coverage with marginally inferior homogeneity Index. It provided a similar organ at risk sparing, reduced healthy tissue sparing (V5 and V10) and significant reductions of MU and treatment time per fraction with respect to IMRT. Factors like gamma index, reduction in delivery time and treatment monitor units are also discussed and reported.

EP-1225
Tolerances in patient positioning in IMRT head and neck treatments
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Purpose/Objective: The purpose of this paper is to assess the importance of the variations in daily positioning in treatments of IMRT in head and neck cancer patients, in order to check whether PTVs margins are adequate.
Materials and Methods: Ten consecutive head and neck patients with bilateral lymph nodes, previously treated with the integrated boost technique in 30 fractions (30 x 1.8 Gy to PTV1 and 30 x 2.25 Gy to PTV2), were recalculated using the same IMRT plan with a 5 mm displacement in all directions (longitudinal, lateral and vertical, positive and negative), which gives us a total of 60 cases. Variations in doses to both treatment volumes and organs at risk were evaluated, and for cases exceeding significative values, the same procedure was repeated with 3 mm displacements.
Results: To assess the goodness of the results two parameters were used: the dose to the CTV2, considering invalid cases where the decrease in CTV2 volume coverage was greater than 1%, and the dose in the spinal cord, considering invalid those cases in which the volume receiving 50Gy exceeded 2cc. Thirteen of the sixty cases showed deviations greater than these values. In these cases the same procedure was repeated, now with deviations of 3 mm, and there were still two cases out of range. These two cases (patients 5 and 9) were recalculated with displacements of 2 mm in all directions, and there were no values out of range.

	5 mm displacements		3 mm displacements	
	Spinal Cord	CTV2	Spinal Cord	CTV2
Patient	Max(V50) (cc)	Max(ΔV95) (%)	Max(V50) (cc)	Max(ΔV95) (%)
1	0	-1.34	---	-0.90
2	0	0.00	---	---
3	0	-0.41	---	---
4	2.08	-2.97	0.66	-0.79
5	0	-3.93	---	-1.69
6	1.24	-2.46	---	-1.00
7	0.02	-1.05	---	-0.38
8	0.01	-0.08	---	---
9	0.08	-5.85	---	-2.74
10	0	-0.06	---	---

Table 1: Cases of each patient with the maximum spinal cord volume receiving 50Gy and the maximum decrease in CTV2 volume coverage. (5mm displacements and 3 mm displacements only cases out of tolerance)

Conclusions: We can conclude that with less or equal 2 mm displacement in any direction, IMRT treatments in patients with head and neck tumors are properly administered, and it is not necessary to correct the deviations up to 2 mm that can be observed in daily checks with the portal images.

EP-1226
SmartArc-based VMAT for endometrial cancer: a dosimetric comparison with tomotherapy and IMRT
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Purpose/Objective: To investigate the feasibility of volumetric modulated arc therapy with SmartArc (VMAT-S) for endometrial cancer to achieve equivalent plan quality with higher delivery efficiency, against with intensity-modulated radiotherapy (IMRT) and helical tomotherapy (HT).
Materials and Methods: Nine patients with endometrial cancer were retrospectively studied. Three plans were generated with VMAT-S, IMRT and HT for each patient. The dose distribution of planning target volume (PTV), organs at risk (OARs) and normal tissue were compared. The monitor units (MUs) and treatment delivery time were also evaluated.
Results: The average homogeneity index was 1.06, 1.10 and 1.07 for VMAT-S, IMRT and HT plans. The V_{40} of rectum, bladder and pelvis bone decreased 9.0%, 3.0%, and 3.0% in VMAT-S compared with IMRT, respectively. The target coverage and OARs sparing were comparable between VMAT-S and HT. The average MU was 823, 1105 and 8403 for VMAT-S, IMRT and HT. The average delivery time was 2.6 minutes, 8.6 minutes, and 9.5 minutes.
Conclusions: VMAT-S provided comparable plan quality with significant shorter delivery time and less MUs compared with IMRT and HT for endometrial cancer. In addition, more homogeneous PTV coverage and superior OARs sparing in the medium to high dose region were observed in VMAT-S over IMRT.

EP-1227
Increasing the dose inhomogeneity in the prostate PTV reduces dose delivered to the adjacent OARs
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Purpose/Objective: RT treatment-planning techniques may result in a *uniform* dose delivery to the PTV in prostate plans well within the homogeneity criteria as specified by the ICRU 83 ($D_{98\%}$> 95% and $D_{2\%}$ < 107%). However, increasing the inhomogeneity of the target dose to the PTV allows for a steeper dose gradient and subsequently reducing the dose delivery to the adjacent rectal wall and anal sphincter, and potentially reducing toxicity.
Materials and Methods: A selection of 9 clinical prostate RT plans with substantial homogeneous target coverage was re-planned. For the new plans, conformity and OARs sparing were improved, at the cost of homogeneous target coverage. The inhomogeneity was kept within the ICRU 83 criteria. The target dose homogeneity in the PTV: $HI=(D_{2\%}-D_{98\%})/D_{50\%}$, the parameter V_{64Gy} for the rectal wall and the D_{mean} in the anal sphincter were determined. A comparison of these parameters is made between the original and the inhomogeneous plan. Additionally, the change in the underlying DVH-curves was monitored.
Results: The homogeneity index in the PTV dose distribution HI_{PTV} *increased* in all re-planned RT plans ranging from 51% to 105% compared to the original plan ($HI_{orig\ avg}$=0.056, σ=0.006). The values of the parameters V_{64Gy} for the rectal wall and D_{mean} for the anal sphincter *decreased* in all inhomogeneous plans. For the rectal wall the V_{64Gy} parameter *decreased* down to -16%, and for the anal sphincter the D_{mean} *decreased* down to -7.6Gy, see figure. Out of the 9 plans, 4 showed an overall drop of the DVH curve for the rectal wall, while the others showed some *increase* in the high dose regime. An increase in the inhomogeneity of the dose delivery to the PTV creates local hotspots, which is reason for concern when considering target position inaccuracy during treatment.