modulated beams ranged from 0.9 to 4.4 cm$^2$. Differences in the aperture (complete irradiation area outline) of the calculation voxel sizes (1 mm) were used for both systems. Eclipse were retrospectively recalculated using the Mobius3D restricted to small field sizes down to 1x1 cm$^2$. The M3D tool available in the M3D system. Gamma passing rates for the target and organs at risks (OARs: brainstem, chiasm, optic nerves and normal brain tissue) were compared for 3%/1 mm, 3%/2 mm and 5%/1 mm criteria.

**Results:**
1) Differences (M3D vs. measured) within 1 mm were found for the penumbra of the 1x1 cm$^2$ field. 2) Dose differences of 2.7% (SD: 1.6%), 1.5% (SD: 1.9%) and 0.4% (SD: 2.0%) were found for the MLC-collimated field size. 3) Using the optimal DLG correction (-0.5 mm), the target 3D gamma passing rates were: 94% (73-94%), 97% (80-100%) and 100% (97-100%) for the 3%/1 mm, 3%/2 mm and 5%/1 mm criteria, respectively. 100% rates were obtained for all OARs regardless of the gamma criterium.

**Conclusions:** Great agreement was obtained (within 5% and 1 mm) between IMRS plans calculated by the Eclipse and by the independent dose calculation software M3D. Our findings are restricted to small field sizes down to 1x1 cm$^2$. The M3D software may be proposed as an alternative to patient-specific QA based on measurements for IMRS plans

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**EP-1426**

**Target coverage: VMAT vs 3D in the treatment of lung cancer**

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**Purpose/Objective:** To compare the uniformity of the absorbed-dose distribution and the dose conformity of two different radiotherapy treatments for lung cancer: conformal 3D (3DCRT) and double-arc volumetric modulated arc therapy (VMAT).

**Materials and Methods:** 3DCRT and VMAT plans were optimized for 12 lung cancer patients. Treatment planning was performed using two treatment planning systems: XIO 4.80 for 3DCRT plans with superposition algorithm and Monaco 3.30.01, based on the Monte Carlo algorithm, for VMAT plans. For all patients, the target prescription dose was 60 Gy delivered in 30 fractions on an Elekta Synergy Beam Modulator linear accelerator equipped with 40 pairs of opposing leaves with 4mm thickness at isocenter. 3DCRT plans consisted of 3-5 coplanar 6MV fields, while VMAT plans comprised two 6MV 360° arcs.

All the plans were considered to be clinically acceptable when at least 99% of the PTV volume received 98% of the prescribed dose and maximum dose was less than 107%. The constraints for the OAR included: volume of spinal cord receiving more than 45Gy < 1%, volume of heart receiving more than 45Gy < 4% and the V20 of lung minus PTV was set at < 35%. The two techniques were compared in terms of target homogeneity, target conformity and irradiated volume of normal tissues. Target conformity was quantified using the conformity index (CI) defined by Paddick as:
where PI is the whole tissue volume receiving the prescribed dose, TV is volume of PTV and TV_P is the target volume within the prescribed isodose volume. A perfect plan would have TV_P = TV = PI and yield a CI of 1.0. Irradiated volume of normal tissue and dose gradient were analyzed by comparing the Paddick’s gradient index (PGI) defined as

\[ PGI = \frac{V_{50\%PI}}{PI} \]

where \( V_{50\%PI} \) is the volume irradiated at 50% of the prescribed dose.

The homogeneity index (HI) describes the dose uniformity within a target volume. Two definitions of HI were used: the definition suggested by ICRU Report 81 and the definition reported in the MONACO planning system.

\[ HI_{ICRU81} = \frac{D_{95\%}}{D_{50\%}} \]

\[ HI_{MONACO} = \frac{D_{9\%}}{D_{95\%}} \]

An HI_{ICRU81} of 0 y HI_{MONACO} of 1 indicates that the absorbed-dose distribution is almost homogeneous.

**Results:** Table 1 summarizes the result of each index (mean ± standard deviation (SD)). VMAT plans had a better conformity (p < 0.001) and produced the best dose homogeneity compared with 3D CRT plans (p < 0.01 for HI_{ICRU81} and p < 0.001 for HI_{MONACO}). In addition, the volumes of normal tissues irradiated with a moderate dose (50% of the prescribed isodoses) were slightly lower in VMAT plan (p < 0.001)

<table>
<thead>
<tr>
<th></th>
<th>3DCRT</th>
<th>VMAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI_{Paddick}</td>
<td>0.52 ± 0.15</td>
<td>0.83 ± 0.04</td>
</tr>
<tr>
<td>HI_{ICRU81}</td>
<td>0.136 ± 0.051</td>
<td>0.088 ± 0.018</td>
</tr>
<tr>
<td>HI_{MONACO}</td>
<td>1.09 ± 0.02</td>
<td>1.07 ± 0.01</td>
</tr>
<tr>
<td>PGI</td>
<td>5.0 ± 0.8</td>
<td>4.3 ± 0.4</td>
</tr>
</tbody>
</table>

Conclusions: The quality of the absorbed-dose distribution, illustrated with two independent specifications, dose homogeneity and dose conformity, in a radiotherapy treatment for lung cancer, is better with a VMAT plan than with a conventional 3D plan. Utilizing conformity, homogeneity, and gradient index is very important in evaluating patient plans and should be used during planning.

**EP-1427**

VMAT vs. dynamic conformal arc technique in radiosurgery. A comparison of absorbed dose in the healthy brain tissue

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**Purpose/Objective:** The aim of this study was to evaluate and compare the Volumetric Modulated Arc Therapy (VMAT) and the Dynamic Conformal Arc (DCA) techniques for the treatment of brain metastasis and their influence on the absorbed dose by the healthy brain tissue (HBT).

**Materials and Methods:** Fourteen patients with one or two brain metastasis were treated using a Monacotreatment planning system with Monte Carlo Algorithm (version 3.30.01), using 6MV photon beams generated from Elekta Synergy Beam Modulator Linac. 10 patients (71 %) had one target. VMAT and DCA treatment plans were created for every patient using a single isocenter and multi-arc non-coplanar technique. The prescription doses ranged from 12-22 Gy in a single fraction. All planning objectives for PTV and organs at risk (OAR) were in accordance to those used in QUANTEC protocol for a single dose of radiation. Each plan was normalized to deliver 100% of the prescription dose to 100% of the target volume.

In each patient PTV, OAR and HBT were contoured in order to evaluate the received doses.

Treatment plans were compared to know the biological equivalent doses (BED) received in the HBT: \( V(5\text{BEDGy}) \) and \( V(10\text{BEDGy}) \). Conformity Index (CI_{RTOG}), Homogeneity Index (HI_{RTOG}), the maximum absorbed doses to OAR, the numbers of arcs, total monitor units (MU) and delivery treatment time (DTT) were also compared.

**Results:** \( V(5\text{BEDGy}) \) and \( V(10\text{BEDGy}) \) were lower for VMAT compared with DCA plan (difference of 20.5%, p<0.001 and 20%, p<0.005 respectively). There were no significant differences between both techniques for OAR sparing (p>0.1). VMAT plans showed a lower mean CI_{RTOG} and HI_{RTOG} compared with the DCA plans (difference of 25.5%, p<0.001 and 20%, p<0.001 respectively). The numbers of arcs were also lower in VMAT plans compared with DCA plans. Although mean MU per fraction was higher for VMAT (an increase of 35%, p<0.001), the mean DTT using VMAT was slightly shorter than using DCA (2.2 min on average for 12 Gy prescription).

(Table 1).