**Evaluation of the Incise2**™ **multileaf collimator for stereotactic radiotherapy on Cyberknife®**

J. Bellec1, C. Limoges1, N. Delaby1, M. Perdrieux1, F. Jouyaux1, C. Lafond1,2,3

1 - Centre Eugene Marquis, Rennes, France.

2 - INSERM, U 1099, Rennes, France.

3 - University Rennes 1, LTSI, Rennes, France.

**Introduction:** The CyberKnife® (Accuray) is a stereotactic robotic system using historically circular collimators to define the beam apertures. A new multileaf collimator (MLC) is now available on the Cyberknife® M6 version. The purpose of this study was to evaluate the quality of treatment plans using MLC compared to treatment plans using a variable circular aperture collimator IRIS™ for radiosurgery (SRS) and stereotactic body radiotherapy (SBRT).

**Methods:** The study was performed on a Cyberknife® M6™ v10.6. A total of 17 cases including cranial, liver, spinal and prostatic cases were investigated. For each case, two treatment plans were generated with Multiplan® v5.3 treatment planning system: one plan using the Incise2™ MLC associated with the Finite Size Pencil Beam (FSPB) dose calculation algorithm and one using the IRIS™ collimator associated with Ray Tracing or Monte Carlo dose calculation algorithm. The dose was prescribed near the 80 % isodose level relative to max dose. Plans were normalized to have the same target coverage at ± 0.5 %.

The quality of the MLC and IRIS™ treatment plans was assessed using two criteria:

- Dose distribution by reporting the conformal index (COIN), Homogeneity Index (HI) and dose gradient index (GI)

- Efficiency by reporting the number of delivered monitor units (MUs) and the treatment time.

To evaluate the accuracy of dose calculation algorithm within heterogeneity, a typical lung treatment plan for each collimator was created on a QUASAR™ Respiratory phantom (Modus Medical Inc) with a lung target insert. Calculated planar dose was compared with measurements by radiochromic EBT3 films (Ashland). The analysis was done using gamma analysis 3% (local) / 2 mm (threshold: 30% of the max dose)

**Results:** Results are summarized in Table 1. Dose conformality and homogeneity were equivalent for both collimator systems (mean differences less than 3 %) except for targets with volumes smaller than 2 cm3 for which dose conformality was better of 14 % on average with the IRIS collimator. The dose gradient index was improved by 10.5 % on average with the MLC and up to 26 % on average for volume larger than 100 cm3 .

The number of MUs decreased by 25 % on average (up to 70 %) and the treatment times were systematically reduced with a mean reduction of 28 % (max 54 %) with the MLC.

The comparison between calculated and measured dose in lung phantom showed a gamma passing rate of 51.6 %, 45.5 % and 98.7 % for FSPB, Ray Tracing and Monte Carlo respectively.

**Conclusion:** The MLC Incise2™ on Cyberknife® allows a significant reduction of MUs and treatment time compared to circular collimators while maintaining a high degree of conformality and a steep dose gradient. For treatment of target volumes smaller than 2 cm3, circular collimators should be still used. The use of MLC for SBRT of lung targets should not be recommended currently due to the absence of type B dose calculation algorithm.

**Keywords:** stereotactic radiotherapy, MLC, Cyberknife

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|  | MLC | IRIS | Ideal value |
| COIN | 1.20 ± 0.15 | 1.16 ± 0.07 | 1 |
| HI | 1.33 ± 0.23 | 1.36 ± 0.25 | 1 |
| GI | 2.98 ± 0.48 | 3.38 ± 0.59 | Lower as possible |
| Total MUs | 15 797 ± 9 544 | 20 572 ± 10 130 |
| Treatment time (min) | 27 ± 7 | 38 ± 15 |

*Table 1: Comparison of dosimetric indexes and efficiency for MLC and IRIS plans (M ± )*