

# IMPROVEMENT IN TARGET COVERAGE AND IN SPARING OF ORGAN AT RISK FOR OROPHARINGEAL CANCER WITH HELICAL TOMOTHERAPY: A PLANNING STUDY.

A. Pierelli<sup>a</sup>, C. Fiorino<sup>a</sup>, I. Dell'Oca<sup>b</sup>, S. Broggi<sup>a</sup>, A. Chiara<sup>b</sup>, E. De Martin<sup>a</sup>, N. Di Muzio<sup>b</sup>, B. Longobardi<sup>a</sup>, F. Fazio<sup>b,c</sup>, R. Calandrino<sup>a</sup>

<sup>a</sup>Medical Physics, S. Raffaele Institute, Milano, Italy, <sup>b</sup>Department of Radiotherapy, S. Raffaele Institute, Milano, Italy, <sup>c</sup>IFM CNR, Milano, Italy

## BACKGROUND AND PURPOSE

The goal of this study was to estimate the ability of Helical Tomotherapy (HT) to optimize the dose distribution in patients with oropharyngeal cancer (OPC) using a simultaneous integrated boost (SIB) approach with respect to more conventional IMRT.

## MATERIALS AND METHODS

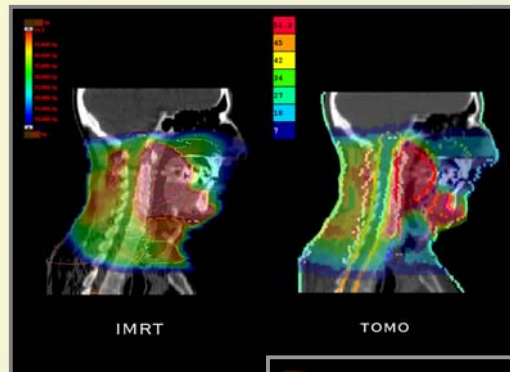
Four T1-3 N0-2 OPC patients were considered. Two IMRT plans, both in SIB modality, were performed for each case: one with the TomoTherapy Hi-Art2 System<sup>®</sup> and the remaining with 5 fields and dynamic MLC (Varian 600CD Linac, Millennium<sup>™</sup>MLC-80) inversely optimised by the Helios/Eclipse system. The plan prescriptions were 54 Gy, 61.5 Gy and 64.5 Gy delivered in 30 fractions to 95% of PTV1 and at the median dose of PTV2 and PTV3 respectively, where PTV1, 2 and 3 correspond to low-risk nodes, high-risk nodes and tumour respectively.

## RESULTS

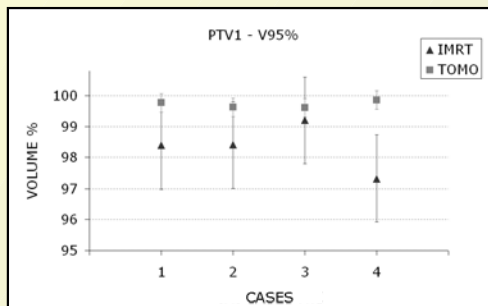
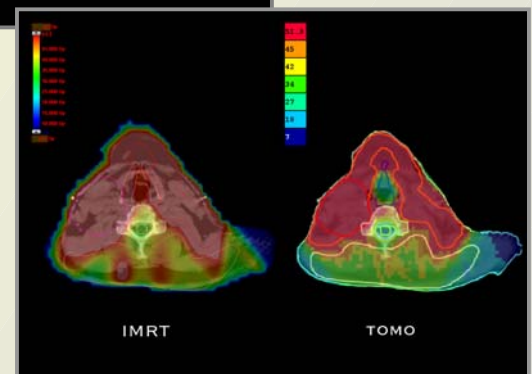
Results show a better coverage with HT for all PTVs: the fraction of PTV1, 2 and 3 receiving more than 95% of the prescribed doses (V95%) increased from 98.3% to 99.7%, from 97.7% to 99.7%, from 95.6% to 98.2% respectively; moreover, a better homogeneity of the dose distribution within each PTV was found; for example, D\_Max for PTV3 reduced from 70.4 Gy to 67.6 Gy.

Concerning OARs, HT showed a much more efficient sparing: D\_Median of the parotids decreased from 31.3 Gy to 25.8 Gy and the spinal cord D\_Max decreased from 40.4 Gy to 35.5 Gy. For other structures, like thyroid and esophagus, D\_Mean was reduced on average of about 15 Gy.

$(TV90\%)_{HT}/(TV90\%)_{IMRT}$  equal to 0.7 and  $(TV95\%)_{HT}/(TV95\%)_{IMRT}$  equal to 0.8 were found, showing that HT significantly decreased the tissues irradiated at high dose outside PTV.



FIVE FIELDS  
IMRT PLAN  
VS  
TOMOTHERAPY



✓ BETTER PTVs COVERAGE WITH BETTER DOSE HOMOGENEITY

✓ OARs DOSE REDUCTION

- PAROTIDS: D.MEDIAN FROM 31.3±1.2GY TO 25.8±1.8GY
- SPINAL CORD: FROM 40.4±1.2GY TO 35.5±1.2GY

THERAPEUTIC GAIN

✓ IMPROVED SPARING FOR STRUCTURES OF CYLINDRICAL GEOMETRY

- LARYNX: V20 AND V30 DECREASE FROM 27 TO 20 GY AND FROM 27 TO 11 GY RESPECTIVELY
- ESOPHAGUS: D.MEDIAN REDUCE FROM 37.3 TO 21.2 GY

✓ GREATER ABILITY TO PRESERVE STRUCTURES OF LITTLE VOLUME

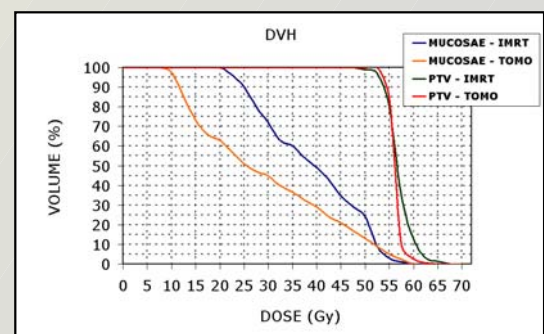
• THYROID: D.MEDIAN REDUCE FROM 53.2 TO 39.5 GY

✓ INTEGRAL DOSE AND IRRADIATED VOLUME BEYOND 20 GY (IV20GY) COMPARABLES

✓ GREATER IRRADIATED VOLUME BETWEEN 10 AND 20 GY (IV10-20GY)

$$\text{Integrale Dose} \sim \frac{E_{TOT}}{\rho} \rightarrow 129 \pm 18 \text{ GY} \cdot 1 \text{ (IMRT)} \approx 134 \pm 16 \text{ GY} \cdot 1 \text{ (HT)}$$

$$IV = \frac{V_{BODY-PTV}}{V_{PTV}} \rightarrow \begin{aligned} & \bullet \text{ IV20GY RATIO HT/IMRT IS } 1.0 \pm 0.1 \\ & \bullet \text{ IV10-20GY RAISE TO } 2.7 \pm 0.6 \end{aligned}$$



EXAMPLE SHOWING SPARING OF MUCOSAE AND THE IMPROVED TARGET COVERAGE