Quality control in "Intensity Modulated Radiation Therapy-IMRT" using thermoluminescent dosimeters

Matsushima, L. C.(1); Veneziani, G. R.(2); Sakuraba, R. K.(3); Campos, L. L(2).

(1)Instituto de Física - Universidade Federal de Goiás, Campus II Samambaia, CEP: 74001-970, Goiânia-GO, Brazil.
(2)Gerência de Metrologia das Radiações (GMR) – Instituto de Pesquisas Energéticas e Nucleares (IPEN – CNEN/SP), Av. Prof. Lineu Prestes, 2242, Cidade Universitária, CEP: 05508-000, São Paulo-SP, Brazil.
(3)Setor de Radioterapia da Sociedade Beneficente Israelita Brasileira – Hospital Israelita Albert Einstein, 665, Morumbi, CEP: 05652-000, São Paulo-SP, Brazil.

e-mail of corresponding author:* *luciana.matsushima@gmail.com

Introduction

Quality assurance in radiation therapy included all actions for ensure the maximum dose for the target volume (tumour) and minimum dose for the healthy tissues. The use of thermoluminescent detectors for evaluation of the absorbed doses in treatments that involve the use of ionizing radiation is widespread and well established in clinical routine. The quality measures are employed to validate system performance, such as IMRT quality assurance (QA). An example for IMRT QA is the decision not to treat the patient if the comparison between a point-dose measurement and the planned value exceeds a predefined acceptance criterion (±5%). This work aimed the evaluation of absorbed doses with the use of thermoluminescent detectors (TLDs) of lithium fluoride doped with magnesium and titanium (LiF:Mg,Ti) and a polymethylmethacrylate (PMMA) phantom in Intensity Modulated Radiation Therapy – IMRT planning.

Methods

In this study the PMMA phantom simulated a patient in treatment. The central cavity (rectangular format) was considered like target volume (tumour) and the others four cavities were considered like organs at risk. The TLDs were positioned inside the cavities; each cavity has an EVA mold for the positioning of TLDs.

Results

Table 1: Absorbed doses calculated by TLDs and treatment planning system (TPS).

Cavity	Position	Absorbed doses by TPS (Gy)	Absorbed doses calculated by LiF:Mg,Ti			
			1st measure (Gy)	2nd measure (Gy)	3rd measure (Gy)	Mean ± SD (Gy)
Rectangular (Tumour)	7	1.94	2.01	2.02	2.06	2.03 ± 0.03
	8	1.95	2.01	2.10	2.00	2.04 ± 0.05
	9	1.95	2.02	1.79	1.94	1.91 ± 0.12
	10	2.01	2.24	2.12	2.12	2.16 ± 0.07
	11	1.99	2.10	2.20	2.13	2.15 ± 0.05
	12	1.99	2.18	2.12	2.07	2.12 ± 0.05
Triangle	1	0.28	0.27	0.28	0.27	0.27 ± 0.01
	2	0.31	0.33	0.29	0.31	0.31 ± 0.02
	3	0.71	0.82	0.73	0.77	0.77 ± 0.05
Small square	1	0.79	0.75	0.74	0.82	0.77 ± 0.04
	2	0.43	0.35	0.38	0.32	0.35 ± 0.03
	3	0.23	0.24	0.22	0.22	0.23 ± 0.02
Circle	1	1.17	1.03	1.09	1.19	1.11 ± 0.08
	2	0.5	0.48	0.43	0.44	0.45 ± 0.03
	3	0.22	0.22	0.19	0.23	0.21 ± 0.02
Big square	1	0.3	0.30	0.27	0.35	0.31 ± 0.04
	2	0.37	0.36	0.37	0.35	0.36 ± 0.01
	3	0.95	0.85	1.23	0.89	0.99 ± 0.21

Conclusions

The results demonstrated the good agreement for the absorbed doses calculated by TLDs of LiF:Mg,Ti and the doses provided by the treatment planning system. The successful of the radiotherapy treatment is based on the quality control of radiation doses distributed by linear accelerators.