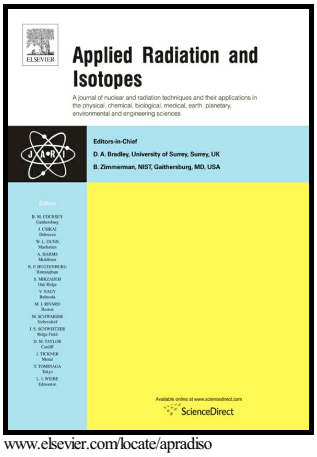

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Commissioning of Beam Shaper Applicator for Conformal Intraoperative Electron Radiotherapy

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Abstract

Beam shaper is a newly designed device for beam shaping in IOERT. The aim of this study is evaluating the performance of this device for conformal IOERT and preparing it for clinical applications. Dosimetric characteristics for different combinations of energy/field size were determined by ionometric dosimetry, film dosimetry and Monte Carlo simulation.

Desirable dosimetric characteristics of beam shaper make it a useful tool for conformal IOERT. Usability of Monte Carlo simulation in any clinical setup of beam shaper was demonstrated.

Keywords: IOERT, Beam Shaper Applicator, Electron Dosimetry, Monte Carlo Simulation

1. Introduction

Intraoperative radiation therapy (IORT) is one of the specific procedures of radiation therapy that delivers a very high dose (9-25 Gy) to the tumor bed during the surgical procedure (Di Venanzio et al., 2015). The increasing use of IORT is mainly due to the administration of a high single fraction of radiation dose in appropriate clinical situations without any significant normal tissue morbidity (Gunderson et al., 2011; Willett, 2001; Willett et al., 2007). IORT can be implemented through three different techniques including intraoperative electron radiation therapy (IOERT), intraoperative X-ray radiation therapy (Low-KV IORT) and intraoperative high-dose-rate brachytherapy (HDR-IORT) (Wydmanski et al., 2005). The more uniform dose distribution of electron beam, limited depth of penetration and short treatment time have contributed to the popularity of IOERT relative to the two other techniques (Baghani et al., 2015a). Due to the limited range of electron, healthy tissues underlying the tumor bed would receive an acceptable low dose. This fact can effectively minimize the side effects of radiotherapy and improve the treatment cosmetics.

IOERT implementation can be performed either employing conventional linear accelerators or new mobile accelerators specifically designed for this purpose. Due to some difficulties such as increased