

Integrating Static Angle Ports and Dynamic Collimator Rotation in Volumetric Modulated Arc Therapy for Hypofractionated Whole Breast Irradiation in Chinese Females: A Single-Centre Dosimetric Study

Adams Hei Long Yuen

School of Medical and Health Sciences, Tung Wah College, China

Department of Clinical Oncology, LKS Faculty of Medicine, The University of Hong Kong, Pok Fu Lam, Hong Kong

Mohan Huang

School of Medical and Health Sciences, Tung Wah College, China

Abstract

Background: Whole breast irradiation (WBI) remains a standard adjuvant treatment following breast-conserving surgery for early-stage breast cancer. While conventional RapidArc™ (volumetric modulated arc therapy) offers dosimetric efficiency, its use of a fixed collimator angle can lead to suboptimal beam shaping, often increasing low-dose exposure to adjacent organs at risk (OARs), including the heart, ipsilateral lung, and contralateral breast. These limitations are particularly pronounced in Chinese female patients, who often present with anatomical challenges such as smaller, crescent-shaped breasts and closer heart-to-target distances. The novel RapidArc Dynamic™ system addresses this by integrating dynamic collimator rotation with static angle ports, enabling superior, real-time beam shaping throughout the arc. This dosimetric study aims to evaluate the implementation of RapidArc Dynamic™ for hypofractionated WBI by comparing its performance against conventional RapidArc™ in a cohort of Chinese female patients.

Methods: Ten patients with early-stage left breast cancer were retrospectively replanned using RapidArc™ and RapidArc Dynamic™ on Eclipse™ (v18.1). Plans employed 6MV photons on a TrueBeam™ with Millennium 120-leaf MLC, normalized to cover 95% of Breast PTV for evaluation with 38 Gy (15 fractions). Dosimetric parameters for PTV and OARs were analyzed using Wilcoxon signed-rank test.

Results: The results demonstrated that RapidArc Dynamic™ reduced contralateral breast exposure by 10.3% in maximum dose (30.526 Gy vs 27.371 Gy) and 25% in mean dose (4.149 Gy vs 3.114 Gy). Significant doses reductions in left lung were observed with a 13.6% lower mean lung dose (4.551 Gy vs 3.931 Gy). Cardiac sparing improved with 17.8% lower mean heart dose (3.590 Gy vs 2.952 Gy).

Conclusions: RapidArc Dynamic™ demonstrates significant improvement in OAR sparing, despite anatomical challenges in Chinese female patients.