



ISSN 2815-0481

ANNUAL RESEARCH SYMPOSIUM 2022

**Digital Transformation and Innovative Approaches
to Mitigate Challenges in the Higher Education Sector**

16th November 2022



University of Colombo

<https://cmb.ac.lk/ars>

Dosimetric Comparison of Intensity Modulated Radiation Therapy and Volumetric Modulated Arc Therapy for Treatments of Thyroid Cancer

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This study aims to compare volumetric modulated arc therapy (VMAT) treatment techniques against intensity modulated radiation therapy (IMRT). Planning target volume coverage, doses to the organs at risk, dose to the normal tissues, the number of monitor units (MUs) and the gamma passing rate at the endpoint of the treatment were considered for the comparison. CT data of twenty thyroid cancer patients already treated via Elekta synergy linear accelerator at the National Cancer Institute Sri Lanka in 2021 were used. For comparison, two VMAT plans with one arc and double arc and two IMRT plans with seven and nine fields were used for each patient. 6MV photon energy beams with Monte Carlo algorithm used for planning in Elekta Monaco TPS. The clinically estimated PTV coverage was achieved from all four plans at the same constraints, with superior average coverage of PTV from the IMRT nine fields plan. The better homogeneity, conformity indexes and the lowest maximum doses at PTV were recorded in the IMRT plan with nine beams. Spinal cord and parotid glands were spared better in the IMRT plan with nine fields than in other plans. Regarding the number of monitor units, both VMAT plans were minimal compared to the other two modalities. Considering the low dose to the normal tissues, 50% of the prescribed dose received to the patient was minimal at the IMRT plan with nine fields. The gamma passing rate of the patient-specific quality assurance VMAT double arc plans passed better than IMRT plans. VMAT with double arc had the highest normal tissue irradiation compared to other plans. Considering all the results of the dosimetric parameters, such as PTV coverage and sparing OAR considered here, the IMRT plan with nine beams was better than other plans. According to the MU calculation, the gamma passing rate index VMAT with a double arc plan was suitable for thyroid cancer.

Keywords: volumetric modulated arc therapy (VMAT), intensity modulated radiation therapy (IMRT), Dosimetric Comparison