THE ATTENUATION EFFECT OF TREATMENT COUCH IN ADVANCE RADIOTherapy TECHNIQUES

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Introduction: The posterior and posterior oblique fields which are directly pass through the treatment couch are commonly used in radiotherapy treatment technique. The new treatment planning system is capable to insert treatment couch to improve the calculation accuracy. The purpose of this work is to study the dosimetric parameters influenced in the Exact couch and the Exact IGRT couch attenuation and to determine the effect of couch attenuation in 3D and IMRT treatment techniques.

Materials and methods: The measurements were performed in two Varian linear accelerators, Clinac 21EX and Clinac iX, which were equipped with Exact couch and Exact IGRT couch, respectively. The acrylic cylindrical phantom with 0.65 cc Famer type ion chamber was used in this study. The measurements were done in both energy of 6 MV and 10 MV photon beams with field sizes of $3 \times 3 \text{ cm}^2$, $5 \times 5 \text{ cm}^2$, $10 \times 10 \text{ cm}^2$, and $20 \times 20 \text{ cm}^2$ for various gantry angles around the treatment couch at cranial couch position, and the measurements were repeated at middle and caudal couch position. The effect of couch attenuation of 3D and IMRT treatment techniques were also studied. The measurements from ion chamber were compared with calculation from treatment planning. The 3D and IMRT techniques were studied for head and lung cases with 6MV and for pelvis case with 10MV photon beams.

Results: The maximum attenuation was detected at 6MV with the smallest field for all couch positioning setups. The Exact couch showed maximum attenuation of 18.4% for 6MV and 14.7% for 10MV at 170 degree (and at 190 degree), while the Exact IGRT couch presented the maximum attenuation of 5.0% for 6MV and 4.9% for 10MV at 150 degree (and at 210 degree). The maximum measured dose differences between with and without couch consideration in parallel opposing fields of lung treatment were 18.63% for Exact couch in rail-in position, 4.8% in 5 fields of pelvis treatment for of Exact couch in rail-out position, and 2.3% in 1 field of spine treatment for IGRT couch. The percent dose differences in 7 fields IMRT between calculation and measurement were varied between 0.37% to 7.0% for Exact couch and 0.38% to 3.5% for IGRT couch. The uncertainty of the dose between calculation and measurement was 2%.

Conclusion: The dose difference from beam attenuation by the treatment couch is significant for patients treated with posterior or oblique posterior field, particularly those patients treated with small single field. Impact the dose difference due to couch attenuation of Varian couch depends on different field size, angle beam and energy. Therefore, patients should avoid the beam pass directly through rail position in posterior and posterior oblique or the correction should be included in treatment planning systems.