Abstract Title:

First Elekta Versa HD Signature Model Linear Accelerator (LINAC) Commissioned in Bangladesh

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Purpose or Objective:
First Elekta Versa HD Signature Digital Linear Accelerator (LINAC) Commissioned in the Apollo Hospitals Dhaka at Radiation Oncology department, Bangladesh and put into clinical operation in 2017.The purpose of this study is to report the dosimetric aspects of commissioning performed on an Elekta Versa HD linear accelerator (LINAC) with high-dose-rate flattening filter-free (FFF) photon modes and electron modes

Material and Methods:
Beam data acquisition for commissioning was based on the recommendations of AAPM TG-106 for appropriate detector selection, measurement techniques, etc. Measurements were made using a Blue Phantom² water tank with a scanning range of 48 × 48 × 41 cm3. During the measurements different types of detectors: field diode (SFD), photon field diode (PFD), small cylindrical ion chamber (CC01), and a 'medium-sized" ion chamber (CC13) were used and all the scanned PDD and profile scans were processed using My QA software (IBA Dosimetry, Germany) navigation software. Acceptance and commissioning was performed on the Elekta Versa HD LINAC with five photon energies (6 MV, 10 MV, 15 MV, 6 MV FFF, 10 MV FFF), five electron energies (6 MeV, 8MeV, 8MeV, 12 MeV and 15 MeV) and 160-leaf (5 mm wide) multileaf collimators (MLCs). The measurements also include head scatter factor (Sc), relative photon output factors (Scp), universal wedge transmission factor, MLC transmission factors, and electron cone factors. Mechanical and dosimetric data were measured and evaluated.

Results:
Gantry, collimator, and couch iso-centricity measurements were within 1 mm, 0.6 mm, and 0.7 mm diameter, respectively. The PDDs of 6 MV FFF and 10 MV FFF beams show deeper dmax and steeper falloff with depth than the corresponding flattened beams. While flatness values of 6 MV FFF and 10 MV FFF normalized profiles were unexpectedly higher than the corresponding flattened beams, the symmetry values were almost identical. The cross-plane penumbra values were higher than the in-plane penumbra values for all the energies. The MLC transmission values were 0.5%, 0.6%, and 0.6% for 6 MV, 10 MV, and 15 MV photons beams, respectively.

Conclusion:
Dosimetric measurements demonstrated the agreement of checked parameters with the manufacturer's specification and IEC standards as well as international recommendations and literatures. The outcome of radiation treatment is directly related to the accuracy in the dose modeled in the treatment planning system, which is based on the commissioned data. Commissioning data provided us a valuable insight into the dosimetric characteristics of the beam.

Key Words: Flattening Filter-Free (FFF), Output Factor & Multi Leaf Collimator (MLC).

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