Purpose: Verify and validate the clinical viability of a GammaBeam Tomotherapy system

Methods: A full commissioning of the GammaBeam Tomotherapy unit is performed. This novel radiotherapy system integrates the Co-60 Equinox machine (Best Theratronics, Canada), MIMiC MLC, AutoCrane and nomoSTATM software (Best Nomos, PA). PDDs, output factors and profiles was acquired and entered into the Corvus GammaBeam treatment planning system. Patient treatment plans for H&N, Pelvis, Brain and Brain SRS were generated. Corresponding pre-treatment QA plans were calculated and delivered on the Octavius QA phantom (PTW, NY). As acceptance criteria, we applied a gamma analysis with a DTA ranging from 3 mm to 5 mm and a dose difference from 1% to 4% (of local dose). Plan quality is also analyzed in terms of target coverage, organ at risk sparing, skin dose, hot spots, etc., in comparison to serial tomotherapy plans generated on the same CT sets using linac based photon beams.

Results: For the H&N plan, acceptance criteria were set to 4%, 5 mm DTA to meet the minimum requirement of more than 90% of points passing. For the Pelvis, 91.6% of points pass the 3%, 3 mm DTA. For Brain and Brain SRS, a gamma analysis based on 2%, 2 mm DTA resulted in 98% and 90.9% of points passing. In the most complex case of H&N, constraints were met with 10% hot spot (within the target) and a skin dose ~50% of the prescribed dose.

Conclusions: investigation has demonstrated that the GammaBeam Tomotherapy system is clinically viable. At maximum source activity (~15000 Ci), a 2 Gy fraction of the H&N plan took 20 minutes to deliver. Although this time is expected to slowly increase, due to source decay, to reach ~30 minutes three years later, it remains comparable to linac based tomotherapy treatment times.

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