P 72 Linac Twins with Flatness Filter Free Option in a Radiotherapy Department

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Introduction: Having two (or more) equal treatment machines (linac twins) enables a radiotherapy department to facilitate the workflow. The major part of the German standards (DIN) regarding quality assurance of medical linear accelerators has been reworked or has been published for the first time in the recent years due to technical developments. The aim of this study is to setup a commissioning procedure and a quality assurance program for linac twins with flattening filter free option and to investigate if time required for commissioning and quality assurance can be reduced as compared to 2 linacs of different types. This includes the radiotherapy planning system (RTPS).

Material and methods: Tenders were invited to provide two linacs of the same type to replace the old Siemens Primus machines. We asked for linacs with two photon energies (6 and 15 MV), additional flatness filter free (FFF) option, capability of intensity modulated radiotherapy (IMRT) and volumetric modulated arc therapy (VMAT), and 5-6 different electron energies between 4 MeV and 22 MeV. Our requirement was that patients should be treatable at both machines with the same treatment plan. The first of the twin machines, an Elekta Synergy with Agility head, XVI Cone Beam CT, and Iview Portal Imaging has been installed and commissioned according to earlier experiences [1] and has been running in the clinical routine for several months, but initially not FFF. The second linac will be installed in April, therefore no comparative measurements are shown here but may be added for the final presentation.

Although commissioning tests, the determination of basic performance characteristics, and consistency tests for linacs according the German standards [2] have to be accomplished for each machine, they can at least be set up identically without modifications for twin machines. This is also applicable for performance characteristics and consistency testing concerning special techniques as stereotactic radiotherapy [3; 4], and IMRT [5; 6], as well as electronic portal imaging devices (EPID) [2]. For commissioning of the linac in the RTPS Oncentra 4.3 (Nucletron an Elekta Company) a set of geometrical data, absolute, and relative dose measurements is required in addition to the acceptance test of the linac. The data are processed by the company to create a model of the treatment unit, which takes several weeks according to our experience. Once the model is delivered by the company, it has to be validated by the customer. One aim of the study is to investigate, if this procedure can be reduced to the validation process for the second linac.

The draft of the German standard for consistency tests of RTPS DIN 6873 – 5 [7] requires calculations for each treatment machine. Probably part 1 of DIN 6873 for commissioning of RTPS which is in development will demand this too. Having only one treatment machine model reduces time and effort for quality assurance. The German directive “Strahlenschutz in der Medizin” [8], paragraph 2.3.4, requires a concept to ensure patient treatment even during machine down times (e.g. maintenance or breakdown). Linac twins allow shifting all patients from one machine to the other without calculating new treatment plans. The record and verify system (Mosaiq) can be configured in a manner that fields for one machine can be delivered at the other without warnings or password confirmation.

Discussion and conclusion: We expect that the time and effort for commissioning and quality assurance will be reduced for linac twins. Earlier experiences with the Siemens Primus machines (of different generations) have shown that it was possible to get equivalent dose distributions at least for standard photon energies. As much more this should be possible for linacs of the same production series.

References

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