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Review of the TG-51 Protocol and Practical Clinical Implementation Issues for Clinical Reference Dosimetry of high-energy Electron Beams

In 1999 the Task Group 51 of the AAPM Radiation Therapy Committee published a protocol for clinical reference dosimetry of high energy photon and electron beams used in radiation oncology. This new protocol uses ion chambers with absorbed dose to water calibration coefficients traceable to national primary standards instead of the air kerma standard used previously in the TG-21 protocol. The TG-51 protocol is quite prescriptive outlining the exact steps needed to perform the calibration of electron beams, from geometrical setup of the water phantom, ion chamber choice and placement, irradiation conditions, beam quality determination, corrections to the ionization readings and dose calculation. The protocol chose not provide the theory behind the procedures and factors but rather reference multiple other peer reviewed publications that describe them in greater detail. The first part of this presentation is devoted to a review of the TG-51 procedure for calibrating electron beams focusing on the required equipment, irradiation conditions and determination of the absorbed dose to water under reference conditions.

As radiotherapy clinics across the USA and Canada implemented the TG-51 protocol, common errors as well as techniques were identified that now make implementing the protocol much simpler and result in a more accurate dose determination. The process for using TG-51 includes reading and understanding the requirements of the protocol, acquiring the necessary calibration equipment and performing the measurements in the most accurate manner. The Radiological Physics Center, which had implemented the TG-51 protocol by January 2000, offered assistance and advice to the medical physics community on how best to perform a TG-51 calibration. It was believed that the protocol would be easy to implement, but because of its large differences from the previous TG-21 protocol, many physicists found parts of the new protocol to be confusing especially with the calibration of electron beams. The second part of this presentation will focus on the practical implementation issues of the TG-51 protocol as they pertain to the calibration of electron beams and where errors are commonly made by medical physicists.

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Educational Objectives:

1. Implement the prescriptive steps and understand the equations for implementing the TG-51 reference dosimetry protocol for the calibration of electron beams.
2. Account for the practical considerations when implementing the TG-51 protocol for electron beam calibrations.
3. Illustrate common errors that are encountered when using the TG-51 protocol to calibrate electron beam.