A method for accurate conversion of PDD to TMR values

Tissue maximum ratios (TMR) are required as input for many treatment planning systems. However, some water phantom systems are not equipped with a TMR measurement option. Therefore, measured percentage depth doses (PDD) need to be converted to TMR.

Several existing methods express the TMR in terms of PDD, phantom scatter factor (S_p) , and inverse square law. However, the collimator scatter factor needs to be measured to obtain S_p . For field sizes smaller than the build-up material required for lateral electronic equilibrium, e.g., necessary for stereotactic treatments, such measurements are not reliable and can cause errors in determined TMR values.

To avoid this problem we have developed an alternative method to obtain TMR from PDD. The absolute doses are expressed in terms of PDD, total scatter factor and inverse square law. For each depth, the dose is fitted to a double exponential as a function of field size. The TMR is calculated by taking the ratio of this function at the depth of interest and the reference depth for the correct field sizes.

The method was applied to obtain TMR values for our stereotactic treatment planning system. For small square and circular fields, calculations were compared with diode measurements. The agreement was always within 1 %, which proves that this relatively simple conversion method is very accurate and can be used routinely.