A PC-based Program for Monitor-Unit Calculation for Megavoltage x-rays

In this study we wished to evaluate if one could use generic data when calculating dose per monitor unit (MU) for checking purposes. A PC-based MU-Calculation program was developed for x-rays. Data for each beam is entered as five text files for head-scatter factor *H(c)*, Off-axis Ratio *OAR(r)*, Wedge off-axis Ratio *WOA(x,y)*, Scatter factor in phantom *SF(s,d)*, and Electron disequilibrium factor *E(s,d)*. The first three dosimetry quantities are measured at 100 cm distance from the source in a miniphantom, but can be approximated by in-phantom measurement at depth of maximum dose. All beam data in phantom are normalized to the depth of 10 cm. *SF* is determined by two parameters a_0 and w_0 according to $SF(s,d)=(1+a_0 sd/(w_0 \cdot s+d))/(1+ a_0 \cdot 10/(w_0+1))$. The attenuation function is determined by $A(d)=exp(-\mu d(1-\eta d))/exp(-\mu 10(1-\eta 10))$. Dose is calculated as:

$$D = MU \cdot D_{ref} \cdot SF(s,d) \cdot A(d) \cdot INV \cdot H(cx,cy) \cdot OAR(x,y) \cdot WOA(x,y) \cdot K \ ,$$

where $K=TF \cdot WF \cdot DMF$ and $INV = 100^2/(SSD+d)^2$. As a benchmark tool we use measured μ to determine a_0 and w_0 according to Ref. 1. Monitor units calculated for the most common clinical cases for different accelerators are compared. We conclude that one must account for different accelerator models having different beam data, even if the nominal energy is the same. Factors that depend on beam quality (*WF*, *TF*, *A*, *SF*) may vary and produce difference of up to 6% for open beam and up to 10 % for wedge beam. This difference increases with depth for open beam but decreases with depth for wedge beam.

Ref 1: Med. Phys. 22, 1191, 1995