Purpose:For dose calculation of kV Cone Beam CT (CBCT), Monte-Carlo simulation method is the best for accuracy. However, Monte-Carlo method is very time-consuming. Therefore it is not practical to be used in daily clinical work. The CTDI has been a useful tool to estimate dose for human bodies, however, this index is not intended to calculate the dose distribution in our bodies. Clearly, we need a reasonably fast and accurate calculation method. We propose a new calculation method by use of super position algorithm in Pinnacle. We calculated low-energy kernels in the range of 10-100 keV and implemented them in Pinnacle3 and estimated the dose from CBCT.
Methods:We used a user code of EGSnrc to make low energy kernels. To implement a cross section of low energy photons in the kernels, a cross section table on NIST XCOM was used. Then we implemented these kernels for 10-100 keV in Pinnacle3 and the modeling of the kV cone beam was performed. In order to validate the accuracy of them, we calculated a PDD and beam profiles in a water phantom and compared them to the measured values. To simulate the dose distribution in a human body, we used a RANDO phantom and measured the dose with glass dosimeters.
Results:The comparison of the results shows good agreement of the calculated beam profiles and measured values. Estimated maximum dose in the body from the RANDO phantom measurement was about 2 cGy that is about 1 % of the clinical dose. The discrepancy between glass dose and calculated dose by Pinnacle is within 20-30 %.
Conclusions:A fast and reasonably accurate dose calculation method by use of Pinnacle3 was proposed and validated. This is the first step toward a total treatment planning involving CBCT dose in clinical use.