Purpose:
(1) To validate a Monte Carlo model for Varian's OBI CBCT in head scan mode and calculate the dose inside a Rando head phantom; (2) To compare the dose in head phantom for 125 kVp and 100 kVp scans.

Methods:
The BEAMnrcMP Monte Carlo package was employed and modified to simulate Varian's OBI CBCT system operated at 125kVp and 100kVp in full-fan full-bowtie mode for the same mAs and 200 deg scans only. Percentage depth dose (PDD) of a single KV beam was measured with a cc01 micro ion chamber in water tank. Dose profiles of the single KV beam at multiple depths including 0.5 cm were also measured with the same micro chamber. After the validation of the Monte-Carlo model with the measured beam data, dose calculations were performed on a Rando head phantom.

Results:
The Monte Carlo simulated PDD curves agree very well with the measurements. Also, the simulated dose profiles matches well to the measured ones in both in-plane and cross-plane directions. Monte Carlo dose calculation made on a Rando head phantom indicated that the post right side of head get higher dose, due to the posterior KV scan from gantry 290 deg to 90 deg. The dose ratio between bone and soft tissue were ~4.4 and ~4.9 for 125kVp and 100kVp, respectively. The dose ratio between 125kVp and 100kVp is about 1.7, close to the theoretical value of 1.252=1.56.

Conclusions:
Our Monte Carlo model has been validated by measurements to simulate Varian's OBI CBCT system. It was shown that CBCT dose in bone is four times of that in soft tissue, such that the accumulated bone dose during a treatment course could be up to >100cGy in posterior area. Investigation on patient dose deposition due to kV CBCT is in progress.