Purpose:To measure the 2D dose distribution inside a Rando head phantom in OBI CBCT's head scan mode using XR-QA film and Monte Carlo calculation because CTDI can hardly be employed to characterize the highly uneven dose distribution.

Methods:Two pieces of films were cut from a single XR-QA film: the first has the same shape as one Rando head slab and the second is a 5 cm x 15 cm piece for air-kerma calibration. Before CBCT scan, the two pieces were taped on a single piece of paper and traced on the paper, and scanned using a flatbed scanner to get the background color image. Then the first film was set inside the Rando head and a CBCT scan was acquired in the high quality head mode using a half-bowtie filter. Right after that, the calibration film was cut into 12 pieces, each was 2.5 cm x 2.5 cm and delivered different exposure of x-rays. Then the 12 pieces were taped together, placed back to the paper along with the phantom film, and scanned using the same scanner to get the irradiated color image. After the red components of this image and the background image were extracted, the difference between them was converted to a 2D dose image by using the air-kerma calibration and the air-kerma to dose conversion factor calculated by Monte Carlo.

Results:CBCT scan delivered a maximum of 2.6cGy at the posterior area, 0.2cGy at the anterior area. The left and right areas received about 1.5cGy and 2.5cGy, respectively. The measurement accuracy was about ~10%.

Conclusions:It is crucial to eliminate the non-uniformities of both the XR-QA film and the document scanner and also not to align the film plane to beam's central-axis plane for accurate low CBCT dose (<1 cGy) measurement.