Author Response: Nintendo Wii Remote Controllers for Head Posture Measurement—Accuracy, Validity, and Reliability of the Infrared Optical Head Tracker Letters

We thank Siamak Sabour and Fariba Ghassemi for their interest in the IOHT. In our article,1 we reported that the newly developed IOHT showed strong concordance with the CROM, which is considered a gold standard for head posture measurement, and has relatively a good test–retest reliability, thereby proving its validity and reliability as a head posture-measuring device.

First of all, in their letter Sabour and Ghassemi questioned why we did not use the seven well-known statistical tests (sensitivity, specificity, positive predictive value, negative predictive value, likelihood ratio positive and negative, and odds ratio) for evaluating the validity of the infrared optical head tracker (IOHT) compared to cervical range of motion (CROM). In our article,1 the angle of the head was measured in 10° intervals from −40° to +40° for three kinds of head movements (head turn, cervical flexion/extension, and lateral tilt). The variables measured for these movements were discrete numbers and not binary status (e.g., disease or not); therefore, it would not be appropriate to apply the statistical tests mentioned above when considering the purpose of study and type of data in our article.2

Secondly, as Sabour and Ghassemi pointed out, we agree that Pearson correlation test by itself may not accurately represent the validity of IOHT. Taking this into account, we also showed how the measurements of IOHT are quite close to those of CROM by using several plots in the 1-D and 3-D positions of the head movements. In these plots, we included error bars at each interval of measurements, indicating the mean angular difference and standard deviation of output at each position (Figs. 6, 8).1 As with Sabour and Ghassemi’s suggestion, the intraclass correlation coefficient (ICC) exact type for two-way mixed model3 between IOHT and CROM was calculated and the ICC was greater than 0.95 in all 1-D and 3-D head movements of the human head. This shows a high degree of agreement amongst the measurements between IOHT and CROM.

Finally, as Sabour and Ghassemi mentioned, validity and reliability are two different concepts, which we evaluated in our study with different tests. A high IOHT reliability means further clarification of the validity of IOHT, we found the ICC between IOHT and CROM to be above 0.95 in all 1-D and 3-D head movements of the human head. In addition, we calculated the test–retest reliability by using the Bland-Altman plot and 95% limits of agreement for the evaluation of the reliability of IOHT measurements. We appreciate the comments of Sabour and Ghassemi, giving us an opportunity to clarify the validity and reliability of our newly developed IOHT.

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