Assessment of range of shoulder motion using Kinect

J-L. LIN, H-C. CHUAN, P-C. KUAN. ***Assessment of range of shoulder motion using Kinect.*** *Gerontechnology 2014;13(2):249;* doi:10.4017/gt.2014.13.02.217.00 **Purpose** Range of motion (ROM) is important for assessing body mobility[1]. It is often measured using a universal goniometer in a clinical setting[2]. Although it is a convenient instrument, a patient cannot measure ROM using the universal goniometer without the assistance of a trained examiner. ROM can be used to assess a patient's physical rehabilitation progress. With tele-rehabilitation, it is important to measure a patient's ROM not only in the clinic but also at home. However, a trained examiner is often not available in a home setting. An approach to measure ROM without the assistance of others is the key both to make measuring ROM at home feasible and to support tele-monitoring of a patient's physical rehabilitation progress. This paper proposes a method for measuring ROM of shoulder motion using the Microsoft Xbox Kinect sensor, such that no assistance of others is required. **Method** This method uses the skeleton tracking function of the Microsoft Kinect software development kit (SDK) to calculate ROM. Although the idea of using the Kinect sensor to measure joint angle is not entirely new[3], the reliability and validity of this method have not been studied. This paper compares data from the shoulder ROM (see *Figure 1*) acquired both from a pair of Kinect sensors and from a universal goniometer, to show the reliability and validity of the proposed method. The test environment included two Kinect sensors, without tilting, placed at two positions of different height (see *Figure 2*). The purpose of using two Kinect sensors at different positions is to study whether the relative position between the Kinect sensor and the subject affects the accuracy of the test results. **Results & Discussion** Students at Yuan Ze University were recruited as subjects for this study. Eight men and two women volunteered. For inter-observer (i.e., Kinect and goniometer) reliability testing of various shoulder motions, the Pearson's correlation coefficients ranged from 0.86 to 0.99. For intra-observer (i.e., two Kinects) repeatability testing of various shoulder motions, interclass correlations (ICCs) achieved 90% with a confidence interval (CI) range from 0.896 to 0.999. The results support the validity and reliability of using the Kinect sensor to measure range of shoulder motion. However, whether Kinect can provide accurate measurements for other motions (e.g., leg, head, and body) still requires further investigation.

References

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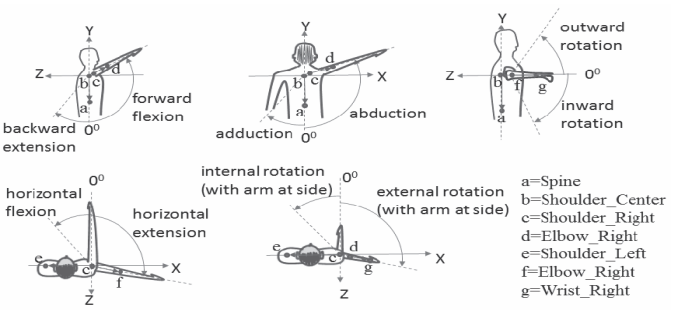

Figure 1. Shoulder ranges of motions and the related skeletal joints (points a to g) from Kinect

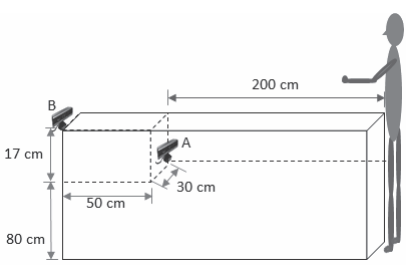

Figure 2. The placement of two Kinects