Reliability Of Bilateral Scapular Motion Using A Three-Dimensional Electromagnetic Device.

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Three-dimensional scapular kinematics is important in order to understand normal scapular function. Numerous studies have investigated the motion of one scapula. The purpose of this study was to assess the inter-day and intra-day reliability of measuring bilateral scapular motion three-dimensionally in order to develop normative baseline values for future studies. A repeated measures design was instituted to determine reliability. All testing was performed at the Lexington Clinic Sports Medicine Center. Subjects were tested on two separate days, a minimum of one week apart. Ten subjects (age 26.9±5.4 yrs., ht. 169.7±18.5 cm., mass 71.1±16.1 kg.) were studied: Subjects were excluded if they had any prior history of shoulder or scapular pathologies. Subjects were instrumented with three lightweight receivers from the MotionMonitor System (Innovative Sport Technologies, Chicago, IL) which were attached with double sided tape bilaterally at the posterior acromial angles and at T2. Following digitization of the thorax and bilateral scapulae, a five-second resting file was obtained. The subjects were then instructed to elevate their arms six times in the sagittal plane, and after a two-minute rest; six times in the scapular plane to their maximum elevation. A metronome was used to control rate of movement on a four-second count, and the order of flexion or scaption was counterbalanced within and between subjects. Eight data points were selected every 50 milliseconds throughout the arc of motion. The data from the second and fourth repetitions in each plane were compared for within day reliability and the second repetitions in each plane were compared for between day reliability. The intra-day reliability was determined by $ICC_{2,1}$ and the standard error of measure (SEM) was calculated. Flexion values were .62 $\pm$5.7° for upward rotation, .94 $\pm$ 2.5° for external rotation, and .94 $\pm$ 3.7° for posterior tilt. Reliability values for scaption were found to be .63 $\pm$ 6.3° for upward rotation, .66 $\pm$ 6.3° for external rotation, and .96 $\pm$ 2.8° for posterior tilt. The inter-day reliability for flexion was .27 $\pm$ 11° for upward rotation, .36 $\pm$ 8.2 for external rotation, and .77 $\pm$ 8.9° for posterior tilt. The reliability values for scaption were .47 $\pm$ 9° for upward rotation, .16 $\pm$ 9.4° for external rotation, and .96 $\pm$ 2.2° for posterior tilt. These results indicate the intraday reliability is moderate to excellent and could detect differences between scapular kinematics on the same day. However, comparison of bilateral scapular kinematics across days to detect differences with the above technique requires modification to improve the reliability. Modification of electromagnetic sensor location may be necessary to improve reliability.