

The effectiveness of home based eccentric shoulder exercise program.
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Purpose: Shoulder external rotators are eccentrically challenged to decelerate an arm during throwing. Human and animal studies have identified sarcomereogenesis as an outcome of eccentric training indicated by more torque generation with the muscle in a lengthen position. We hypothesize that a home-based eccentric exercise program can increase the shoulder external rotators eccentric strength at terminal internal rotation.

Design and Setting: Cohort study carried out in the Musculoskeletal Laboratory

Patients or Other Participants: 10 healthy subjects (age=30 ±10 years)

Methods: Dynamic eccentric shoulder strength was measured isokinetically at 60°/sec with arm abducted to 60° in the scapular plane on a Cybex Norm. All participants were tested over a 100° arc from 50° of external rotation to 50° of internal rotation for 6 repetitions. Three baseline measures were taken over three weeks to evaluate reliability and allow familiarization with novel eccentric strength testing. An eccentric strengthening program was initiated after third testing day that consisted of two exercises. Participants were instructed to perform 2 sets of 15 repetitions of side-lying external rotation and side-lying horizontal abduction daily. Participants were provided detailed instructions to alter their body position to return the weight to starting position to minimize concentric contractions to target eccentric contractions. Torque, angle, and time data from the middle 4 repetitions of each trial on each day was extracted into an excel spreadsheet. The average angular impulse (Nm*s) was calculated from the 4 middle trials. The primary dependent measure was the angular impulse. This was divided into 4 arcs; 1)50-25° ER, 2)25-0° ER, 3)0-25° IR, 4)25-50° IR as we expected the primary change to occur in arc 4. A repeated measure ANOVA with 2 within factors time and arc was applied to determine if eccentric training program increase the torque generated in one of the 4 arcs.

Results: Between day reliability for eccentric shoulder external rotation at each arc of motion produced ICC≥.89 with arc 1-4 generating a minimal detectable change of 1.47, .94, .44, .78 Nm*s, respectively. There was a significant interaction between time and arc (P=.033). Least significant difference post hoc analysis revealed a difference between arc at baseline (8.3±4.2 Nm*s) and after (9.4±5.4 Nm*s) training program in the 4th arc (P=.07).

Conclusions: Eccentric angular impulse was increased by median .55 (range -.79 to 4.3 Nm*s) between 25-50° of shoulder internal rotation after training.

Clinical Relevance: All participants did not respond to training program to the same degree as indicated by the range of responses in arc 4. The increased energy absorption properties of the shoulder external rotators can be enhanced with eccentric exercises and may provide protection for the demands during arm deceleration if a similar protocol for a longer duration is applied to overhead throwing athletes.