Neuromuscular Control Patterns And Strength Of Overhead Athletes And Control Subjects

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The purpose of this study was to simultaneous assess strength and neuromuscular control of the shoulder. The independent variables were group (overhead athlete and control) and test [passive perturbation test (PPT) or reactive eccentric test (RET)]. The dependent variables were impulse and muscle latency. The study was performed at the Biodynamics Laboratory. A Pearson product moment coefficient was used to determine the correlation between muscle force production and latency within groups. Independent t-tests were used to determine differences between groups. The control group consisted of 15 male college students who did not compete regularly in competitive athletics. The overhead athlete group included 13 competing varsity baseball, football and tennis players. All subjects had no history of neck or upper extremity pathology in the past year. A Biodex System 3 was used to measures of torque (ft-lbs) and velocity (m/s) which was recorded synchronously with EMG data via Datapac software through a PC computer. The subject was seated and the dominant arm was positioned in 90/90° position in the scapular plane. During the PPT the subjects were instructed to resist as hard and as fast as possible the unanticipated movement of the dynamometer arm into internal rotation. For the RET, the subjects applied an external rotation force against the dynamometer arm to initiate movement and then maximally resisted the arm as it moved into internal rotation. Eight trials for each condition were ensemble averaged for data analysis. Latency was defined as the time between the onset of movement of the dynamometer arm and the onset of muscle activity. Impulse was calculated for the PPT and RET by multiplying peak torque to body weight ratio by the time to peak torque. Mean latencies for the control group were significantly longer compared to the overhead athlete group ($p<0.01$) for the supraspinatus (149ms ± 24.7ms) vs (115ms ±26.3ms), and for the posterior deltoid (144ms± 26.7ms) vs (111ms ± 29.5ms). No significant difference between infraspinatus latencies (132ms± 37.5ms) vs (109ms ± 28.4ms) was observed. PPT and RET impulse values were significantly less for the control group as compared to the overhead athlete group ($p<0.01$). There were moderate correlations between latency and PPT impulse ($r = -0.37$ to -0.49). A low correlation was observed between muscle latencies and PPT impulse production, suggesting a necessity to record EMG activity in combination with strength in order to assess neuromuscular control during testing. The overhead athlete group displayed shorter latencies as well as higher impulse values for both tests. It appears both neuromuscular and strength differences can be identified between groups and most likely are explained by the difference in activity and training regimens of the overhead athlete group.