
ORIGINAL RESEARCH

ELECTROMYOGRAPHIC ANALYSIS OF SHOULDER GIRDLE MUSCLES DURING COMMON INTERNAL ROTATION EXERCISES

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ABSTRACT

Background: High level throwing performance requires the development of effective muscle activation within shoulder girdle muscles particularly during forceful internal rotation (IR) motions.

Study Design: Controlled Laboratory Descriptive Study

Purpose: To investigate activation pattern of 16 shoulder girdle muscles/muscle sub-regions during three common shoulder IR exercises.

Methods: EMG was recorded in 30 healthy subjects from 16 shoulder girdle muscles/muscle sub-regions (surface electrode: anterior, middle and posterior deltoid, upper, middle and lower trapezius, serratus anterior, teres major, upper and lower latissimus dorsi, upper and lower pectoralis major; fine wire electrodes: supraspinatus, infraspinatus, subscapularis and rhomboid major) using a telemetric EMG system. Three IR exercises (standing IR at 0° and 90° of Abduction, and IR at Zero-Position) were studied. EMG amplitudes were normalized to EMG_{max} (EMG at maximal IR force in a standard position) and compared using one-way repeated-measures analysis of variance (ANOVA).

Results: There were significant differences in muscles' activation across IR exercises ($p < 0.05$ – $p < 0.001$). Rotator cuff and deltoid muscles were highly activated during IR at 90° of Abduction. Latissimus dorsi exhibited markedly higher activation during IR at Zero-Position. While upper trapezius had the highest activation during IR at Zero-Position, middle and lower trapezius were activated at highest during IR at 90° of Abduction. The highest activation of serratus anterior and rhomboid major occurred in IR at Zero-Position and IR at 90° of Abduction, respectively.

Conclusions: Studied exercises have the potential to effectively activate glenohumeral and scapular muscles involved in throwing motions. Results provide further evidence for developing rehabilitation, injury prevention, and training strategies.

Keywords: Electromyography; Internal Rotation Exercises; Rehabilitation; Shoulder Muscle Activation

Level of Evidence: 4, Controlled laboratory study

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