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An Electromyographic Study of Muscle Coordination during Dynamic Glenohumeral Joint Elevation

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Abstract : Introduction: There remains a lack of information on sophisticated coordination patterns across shoulder girdle muscles. Considering the stability of the shoulder being heavily dependent on coordinated muscle activity during its wide-ranging movements, it is important that key intermuscular relationships are well-defined for a better understanding of underlying pathology. This study investigated shoulder intermuscular coordination during different planes of shoulder elevation. Materials and Methods: EMG was recorded from 14 shoulder muscles in 20 healthy participants during shoulder flexion, scapula plane elevation, abduction, and extension. Cross-correlation by means of Pearson Correlation Coefficient (PCC) was used to examine the coordination between different muscles and muscle groups. Results: Coordination between rotator cuff and deltoid muscle groups was significantly higher (p =0.020-0.035) during the initial (PCC) = 0.79) and final (PCC = 0.74) phases of elevation compared to the mid-range (PCC = 0.34). Furthermore, a high level of coordination (PCC = 0.89) was noted between the deltoid group and the adductor group (latissimus dorsi and teres major) during the initial stage of shoulder elevation. Conclusion: The destabilising force of the deltoid during the initial stage of shoulder elevation is balanced by coordinated activity of rotator cuff, latissimus dorsi, and teres major. This is also the case for the end-range of movement, where increased demand for stability again leads to higher coordination between the deltoid and rotator cuff muscle groups. Appreciation of the sophistication of normal shoulder function evidence-based rehabilitation strategies for conditions such as subacromial impingement syndrome or shoulder instability can be developed.

Keywords : shoulder, coordination, EMG, muscle activity, upper limb
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