

Increased Long Thoracic Nerve Tension with Excessive Scapular Motion: Proof of Concept for Neuropraxia as a Cause of Dyskinesia in Overhead Athletes

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Purpose: Evidence suggests that the prevalence of scapular dyskinesia increases among overhead athletes during training [Madsen, 2011], yet the reason for this remains unclear. One mechanism of dyskinesia is neuropraxia of the long thoracic nerve (LTN) due to excessive tension along the 2nd rib and axillary fascial sling with repetitive or excessive scapular motion [Hester, 2000; Ebraheim, 1998]. The purpose of this study is to determine the possibility of LTN injury with varying scapular motion by comparing the 3-dimensional movement of the LTN under normal and altered scapular kinematic conditions that simulate mal-positioning. We hypothesize scapular motion that deviates from a normal pattern during humeral elevation will excessively tension the LTN and thus be a potential cause of LTN neuropraxia.

Methods: The course of the LTN was marked with tungsten wires and was tracked with a combined dual fluoroscopic and computed-tomography imaging system in a cadaveric model with intact torso and arms. Three simulated scapular kinematic conditions (normal, winging, excessive shrug) were evaluated during 10 separate repetitions of dynamic shoulder elevation. A change in resting length greater than 10% was defined as the threshold for development of neuropraxia [Bora, 1976].

Results: With normal humeral elevation, the LTN lengthened in the posterior-superior direction (8.6 ± 1.0 mm) from a point proximally where the nerve passes through the scalene musculature to the location of an axillary fascial sling along the 2nd rib. Compared to the normal condition, excessive scapular shrug resulted in an 18.5 ± 2.1 mm superior-posterior lengthening of the LTN. This equates to an 18% increase in resting length exceeds the minimal threshold found to induce neuropraxia. Scapular winging did not alter the length of the nerve compared to the normal condition.

Conclusions: Excessive scapular shrug increases the length of the LTN from the axillary sling to the scalene musculature beyond the physiological tolerance. This provides proof of concept that LTN neuropraxia can occur as a result of excessive scapular shrug motion during humeral elevation. Excessive scapular shrug is associated with fatigue [Ebaugh, 2006] and adaptations to sport participation in overhead athletes [Seitz, 2012]. Clinicians should consider neurogenic contribution to the development of shoulder dyskinesia over a season in overhead athletes.