

# MULTI-JOINT REFLEXES AT THE ELBOW AND SHOULDER IN RESPONSE TO BICEP TENDON TAPPING IN HEMIPARETIC PERSONS POST STROKE

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## **Introduction:**

The Deep Tendon Reflex (DTR) in a neurologically impaired patient is commonly assessed by a clinician to evaluate the nervous system. An enhanced or depressed DTR indicates a likely lesion in the nervous system. Concerns involving clinical assessment of a DTR include tapping location, variable tapping force, and subjective interpretation of the results. In addition, a distinctive coupling between elbow and shoulder joints during volitional movement has been observed in the stroke population. This coupling could be due to descending drive from the cortex or demodulation of reflex inhibition between muscle groups.

## **Methods:**

In this study, the reflex torque and muscle activation responses at the shoulder and elbow to Bicep tendon tapping were measured in 12 people with unilateral hemiparesis secondary to stroke and 2 neurologically intact control subjects. A novel electromechanical tapping device was utilized to deliver a tendon tap that was consistent in location and tap force. Muscle activity of 11 different muscle groups was measured through the use of electromyography, and a load cell at the elbow was used to determine shoulder and elbow torque responses. The purpose of this study was to identify reflex coupling between the elbow and shoulder joint.

## **Results:**

The stroke subjects displayed activation of multiple muscles in response to Bicep tendon tapping. This is confirmed by torque and EMG readings. The timing of the muscles in stroke subjects compared to normals seem to differ in the activation of the Triceps. EMG analysis showed that in normals the triceps were activated much later in response to bicep tendon tap, perhaps due to reciprocal inhibition. In the stroke subjects the Triceps activated almost concurrently with the Biceps, suggesting a demodulation of the reciprocal inhibition. This demodulation could lead to the hyperexcitable reflex associated with spasticity.

Stroke subjects demonstrated greater but not significant (ANOVA  $p = 0.08$ ) elbow flexion reflex torque but less shoulder adductor torque than normals. A trend toward hyperexcitability in spastic stroke patients is apparent. The pattern of shoulder adduction coupled with elbow flexion has also been found using a full range stretch input to the bicep; however, this coupling pattern is contrary to the typical “synergy patterns” that have been elucidated in the literature. This suggests that multi-joint coordination in a stroke subject may involve multiple volitional and reflexive pathways.

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