INTRODUCTION
The deltoid and supraspinatus muscles are the primary muscles involved in shoulder abduction movement. The supraspinatus also acts in conjunction with the rotator cuff to stabilize the humeral head in the glenoid fossa. The relationship between the deltoid and supraspinatus muscles have been implicated in the development of shoulder pathologies such as shoulder impingement syndrome [1]. A somewhat linear relationship exists between force and EMG amplitude[2]. Fatigue affects the relationship between EMG amplitude and force[3]. However, the muscles have only been evaluated under specific force levels and not the entire sub-maximal force output range.

The purpose of this study is to examine the relationship between isometric shoulder abduction force and deltoid EMG amplitude and the effect of fatigue.

METHODS
Four individuals were assessed for the study. Participants stood upright throughout the experiment. Participants were seated so that the styloid process of the wrist was directly above the lower edge of the load cell with the elbow in full extension. Participants were orientated so that they abducted in the scapular plane. The humerus was placed in the neutral or ‘thumbs up’ position. The wrist was attached to the load cell using non-elastic lifting straps. A MVIC at 60° was collected via tension force on the load cell. For the trials, participants were instructed to steadily increase shoulder isometric abduction force until max force over a 5 second period. Arm movement was prevented by the wrist strap. Participants completed 3 trials at 60° shoulder abduction. A further 3 trials were taken immediately after fatigue achieved through lifting a weight equivalent to 40% of max force until failure.

A sliding window of 300 samples (30ms), 150 data points before and 150 data points after, was used to calculate the RMS for EMG. EMG data were normalized to MVIC and torque data was normalized to max torque. Measures were calculated up to 80% of max force effort.

RESULTS AND DISCUSSION
There is a general linear relationship for each individual between deltoid EMG amplitude and external abduction force. This is consistent with previous research examining muscular force and EMG. Although not substantial, after the fatigue protocol, the graph is shifted down and towards the right. This indicates that fatigue has effect the EMG force output relationship. This outcome has consequences on the experimental design of deltoid and supraspinatus studies.

CONCLUSIONS
A linear relationship exists between deltoid EMG amplitude and external abduction force. This relationship is altered if the deltoid is fatigued.

REFERENCES