FORCE STEADINESS, NEUROMUSCULAR ACTIVATION AND MAXIMAL MUSCLE STRENGTH IN SUBJECTS SUFFERING FROM SUBACROMIAL IMPINGEMENT SYNDROME

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INTRODUCTION

The therapeutic rehabilitation regime of subjects suffering from subacromial impingement syndrome (SIS) typically includes sensory-motor training of the shoulder. The rationale for this treatment is the assumption that the SIS causes an impairment of shoulder sensory-motor control. This view is in part supported by the findings of reduced maximal shoulder muscle strength [1], deltoid muscle fiber atrophy [2], and impaired kinesthetic sense of the shoulder [3] in patients with SIS. In the present study, therefore, it was hypothesized that shoulder sensory-motor control expressed as force steadiness would be impaired in subjects suffering from SIS.

METHODS

Nine male subjects with unilateral SIS, who remained physically active in spite of shoulder pain ((mean) 28.2±1.8yrs (SEM)) and 9 healthy matched controls (27.7±1.4yrs) were included. No significant between-group differences were noted at baseline for any of the variables used to match the two groups (height, weight, involvement in upper body sports or not, and participation in strength training or not). Shoulder sensory-motor control and maximal shoulder muscle strength (MVC) were assessed using an isokinetic dynamometer (KinCom). Isometric and dynamic submaximal shoulder abduction force steadiness was determined at target forces corresponding to 20, 27.5 and 35% of the maximal shoulder abductor torque and expressed as the standard deviation (SD) and coefficient of variation (CV) for the exerted abductor force. Isometric steadiness contractions (10 seconds duration) were performed at 90 degrees of shoulder abduction in the scapular plane and dynamic contractions (15 deg/sec) were performed from 30-120 degrees of abduction in the scapular plane. Shoulder MVC´s were performed at 45 and 90 degrees of shoulder abduction. Neuromuscular activity (EMG) was assessed by surface and intra-muscular recordings in eight shoulder muscles: supraspinatus, infraspinatus, upper trapezius, lower trapezius, latissimus dorsi, serratus anterior, anterior and middle deltoid muscles.

RESULTS AND DISCUSSION

While no differences were observed for isometric force steadiness, concentric submaximal force steadiness at the 35% target force level was reduced in SIS subjects (Figure 1). Thus, shoulder sensory-motor control expressed, as isometric submaximal force steadiness was not impaired in SIS subjects. Expressed as dynamic submaximal force steadiness, shoulder sensory-motor control was only impaired during concentric contractions at the highest target force level. It is possible that the pain-induced changes in shoulder afferent feed-back with SIS can be compensated for during isometric contractions.

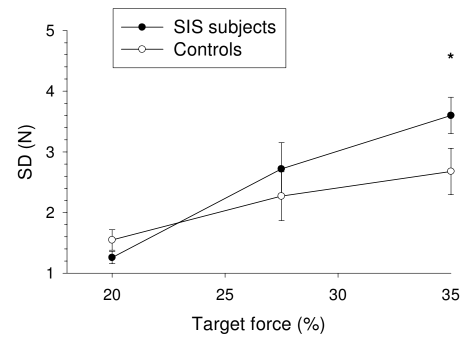

Figure 1: Dynamic (concentric) shoulder force steadiness. * denotes a statistical between-group difference.

This might not be the case during more complex movements. It seems that the control of contraction types requiring graduation of muscle force during articular movement with changes in muscle length/tension relationships, such as concentric contractions, are more prone to impairment in SIS subjects. All SIS and control subjects demonstrated activity in all of the investigated muscles for every target force level during both isometric and dynamic contractions. Muscle activity was similar between SIS and control subjects in almost all steadiness conditions examined. Only latissimus dorsi muscle activity during concentric submaximal force steadiness at the 20% target force level was elevated in the SIS subjects (SIS subjects: 16.2±3.8%EMGmax vs. controls: 9.0±1.9%EMGmax, p=0.046). No differences in maximal shoulder muscle strength were found between groups (ABD45-SIS subjects: 32.3±2.4Nm vs. controls: 32.5±2.4Nm, p=1.00, and ABD90-SIS subjects: 57.9±5.1Nm vs. controls: 54.8±2.6Nm, p=0.537). Thus, maximal shoulder abduction muscle strength was not found to be reduced in SIS subjects.

CONCLUSIONS

In conclusion, the present results suggest that shoulder sensory-motor control expressed as force steadiness is only mildly impaired, with neuromuscular activation remaining largely unaffected, and maximal shoulder abductor muscle strength unaffected in SIS subjects who are able to continue with upper body physical activity in spite of shoulder pain.

REFERENCES

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