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THE ADAPTIVE CHANGES IN ANTICIPATORY POSTURAL ADJUSTMENTS AND MOVEMENT COORDINATION WITH TRAM FLAP BREAST RECONSTRUCTION: A CASE STUDY.

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SUMMARY

The purpose of this study was to investigate the effects of the pedicled TRAM flap breast reconstruction on anticipatory postural adjustments and coordination of load transfer in a breast cancer survivor.

Spine – hip movement coordination and anticipatory postural adjustments as determined via EMG and center of pressure (COP) were examined in a single subject design with pre and post TRAM flap surgery measures. Three sets of measures were taken, Day 1 was 4 days post inferior epigastric vessel ligation and one day pre TRAM surgery; Day 2, was 6 weeks post TRAM surgery; Day 3, was 13 weeks post TRAM surgery.

The study showed that while TRAM flap surgery significantly impacts on muscle activation patterns causing delayed onsets which resulted in larger COP variations in both the x and y directions and poor coordination of the hip and spine, the system is able to adapt within 13 weeks and recover to near normal appearance.

INTRODUCTION

Transverse Rectus Abdominis Myocutaneous (TRAM) flap breast reconstruction is a common but controversially type of breast reconstruction performed post cancer related mastectomy. Several studies have linked the pedicled TRAM flap reconstruction to long term weakness of the abdominals and back extensors as well as increased risk of low back pain. During internally induced perturbations postural stability is maintained by anticipatory control of the lower limb and trunk muscles in order to effectively transfer load through the body and control the shift of the center of mass. Studies have shown that individuals suffering from low back and pelvic pain have defective anticipatory postural control as evidenced in the delayed onset of key muscles in the load transfer system. Although the rectus abdominis is considered to have little influence on postural stability or load transfer, the question is; does the permanent disruption of this muscle have an effect on the anticipatory postural adjustments required for controlled load transfer?

METHODS

Spine – hip movement coordination and anticipatory postural adjustments as determined via EMG and center of pressure (COP) were examined in a single subject design with pre and post TRAM flap surgery measures. Three sets of measures were taken, Day 1 was 4 days post inferior epigastric vessel ligation and one day pre TRAM surgery; Day 2, was 6 weeks post TRAM surgery; Day 3, was 13

weeks post TRAM surgery. Load transfer was examined during repeated modified Gillet tests performed to an auditory signal given at random time intervals. Muscle activation of the biceps femoris, adductor magnus, gluteus maximus and external oblique was recorded with an 8 channel Telemet EMG system. Movement of the spine pelvis and lower limb was captured via 10 camera Vicon Motion Analysis system.

Integrals of EMG activity, joint angles, angular velocity and center of pressure displacements were calculated for 50ms epochs over two timing windows. The two timing windows were defined as early APA (APA1) which began at the trigger + 70ms and ended 50ms after the initiation of weight shift in the Fx direction (t_0). And late APA (APA2) which began at $t_0 + 50ms$ and ended at initiation of limb movement as defined by segment motion in the z direction.

RESULTS AND DISCUSSION

Early APA's were detected on days 1 and 3 of testing (Figure 1). On day 2 of testing (6 weeks post-surgery) only late APA's were detected in the EMG data. The lack of early APA's on day 2 appeared to have a significant impact on the postural control as the COP displacements were five times larger on day two than day 3. Further the loss of early APA's significantly affected the smoothness of load transfer through the hip and spine, and resulted in an excessively noisy hip-spine coordination pattern (Figure 2).

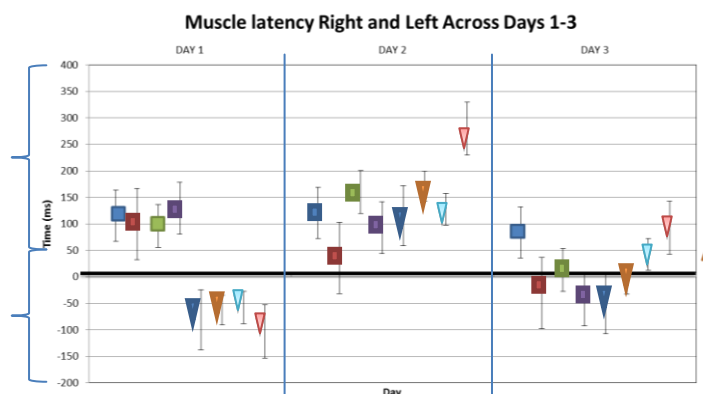


Figure 1: Muscle latencies for left (square: affected) and right (triangle: non affected) side muscles across three days of testing.

CONCLUSIONS

The findings of this study indicate that the permanent disruption of the rectus abdominis, an unimportant postural

muscle, has a significant impact on the motor control of the load transfer mechanism and postural stability for at least 6 weeks post-surgery. However the CNS is eventually able to adapt and reorganise in order to restore postural control and coordinated movement to its pre-surgery level.

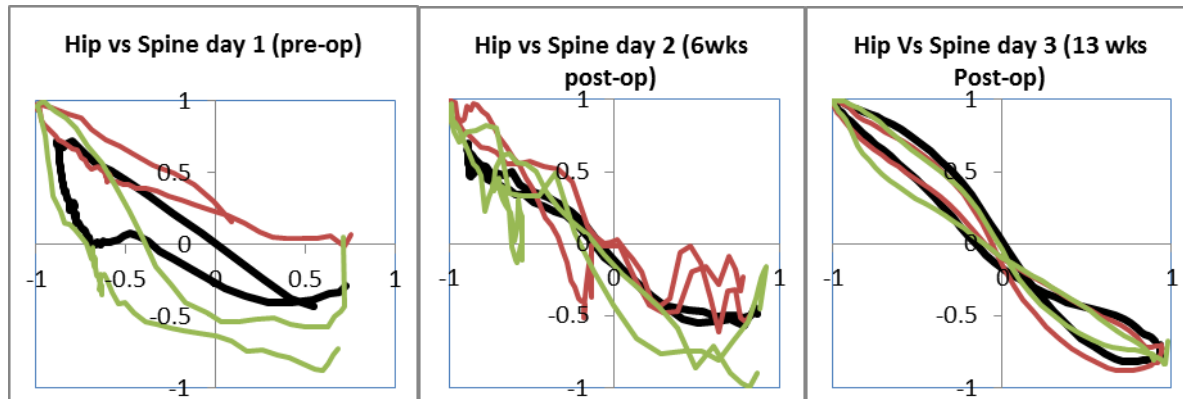


Figure 2: Normalised hip vs spine angle-angle plots for three trials of modified Gillet tests.