

## ***ACTIVE CONTROL OF THE NEUTRAL LUMBOPELVIC POSTURE; A COMPARISON BETWEEN BACK PAIN AND NON BACK PAIN SUBJECTS***

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### ***INTRODUCTION***

Active control of the neutral lumbopelvic posture during therapeutic exercise is a common element in the successful rehabilitation of back pain (Saal and Saal 1989; Klein-Vogelbach 1990; Robison 1992). Despite the widespread use of this approach and its demonstrable success (Saal and Saal 1989), neither these authors nor clinicians have sought to quantify the techniques. Moreover, the precise nature of the deficit addressed during such rehabilitative exercises for low back pain (LBP) is yet to be elucidated.

There is considerable evidence to suggest a close link between the neutral lumbopelvic posture, segmental stability and the function of the deep local spinal muscles such as multifidus (Bergmark 1989; Vleeming, Pool-Goudzwaard et al. 1996; Cholewicki, Panjabi et al. 1997). According to Cholewicki, Panjabi et al. (1997) the stability of the spine in neutral lumbopelvic position is particularly dependent on deep muscle activity. Aspden (1992), Bergmark (1989); and Vleeming, Pool-Goudzwaard et al. (1996) further emphasise the interaction between the function of multifidus, the control and shape of the lumbosacral posture and lumbopelvic stability. In addition, dysfunction in the deep spinal muscles is strongly associated with the presence of LBP (Biedermann, Shanks et al. 1991; Hides, Stokes et al. 1994).

Clinical observation suggests that LBP patients have an initial deficit in lumbopelvic control which improves with treatment. As a result, this study proffered the hypothesis that LBP and non LBP subject have a differing ability to actively control the lumbopelvic posture. The study further postulates that these differences in lumbopelvic postural control may reflect changes in the capacity of subjects to actively stabilise the spine. Hence the ability to precisely control the lumbopelvic posture during forward inclination of the trunk was proposed as a clinical test of active lumbopelvic stability (re: Fig.1).

### ***AIMS OF STUDY***

To quantify and compare the ability of non LBP and LBP subjects to actively control the lumbopelvic posture during forward inclination of the trunk. (re: Fig.1). The intertrial repeatability of the measurements was also investigated.

### ***METHODS***

The Fastrak 3Space system (Pohlmeus) detected and measured three dimensional changes in the orientation of four sensors attached to the skin at the levels of the spinous processes: T5, T12, L4 and S2.

In two separate trials 20 non LBP and 22 matched chronic LBP subjects were examined. Subjects were placed by an experienced physiotherapist in a defined neutral upright sitting position. Following adequate instruction and practice, the subjects were then asked to slowly and progressively incline the trunk forward from the hips whilst attempting to maintain the neutral lumbopelvic posture. Fastrak measurements of angular displacement relative to the upright neutral position were recorded at three levels of forward trunk inclination ( 5,10 and 15 degrees).

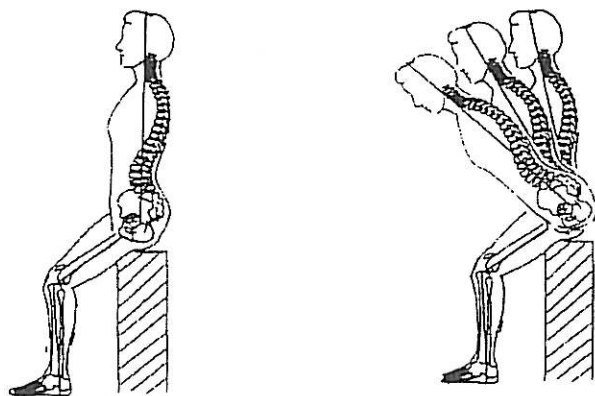


Figure 1

*The test of forward trunk inclination whilst actively maintaining the neutral lumbopelvic position.*

## **RESULTS AND DISCUSSION**

The hypothesis that non LBP and LBP subjects have a different ability to maintain the lumbopelvic posture precisely during forward inclination of the trunk was confirmed. ( $p < 0.01$ ). Duncan's Post Hoc comparison reveals that this difference was most obvious between the levels T12 and S2. Between these levels the displacement of lumbopelvic posture in LBP subjects was almost twice that of non LBP subjects. This difference was present at all levels of forward trunk inclination whereby the loss of postural control occurred consistently earlier and more markedly in LBP subjects. Additional results include a good intertrial consistency for the test of forward trunk inclination (RMSE  $< 3.77$ ).

These results confirm the clinical observation that LBP subjects are less able to precisely maintain the neutral lumbopelvic posture than their non LBP counterparts. The study thus provides evidence that the focus on exercises involving precise control of the neutral lumbopelvic posture in the rehabilitation of LBP is warranted.

## **REFERENCES**

1. Aspden, R. M. (1992). "Review of the functional anatomy of the spinal ligaments and the lumbar erector spinae muscles." *Clinical Anatomy* 5: 372-387.
2. Bergmark, A. (1989). "Stability of the lumbar spine." *Acta Orthopædica Scandinavica* 60(supplement 230): 1-54.

3. Biedermann, H., G. Shanks, et al. (1991). "Power spectrum analysis of electromyographic activity: Discriminators in differential assessment of patients with chronic low back pain." *Spine* 16: 1779-1784.
4. Cholewicki, J., M. M. Panjabi, et al. (1997). "Stabilizing function of the trunk flexor-extensor muscles around the neutral spine posture." *1997* 22: 2207-2212.
5. Hides, J., M. Stokes, et al. (1994). "Evidence of lumbar spine multifidus muscle wasting ipsilateral to symptoms in patients with low back pain." *Spine* 19(2): 165-172.
6. Klein-Vogelbach, S. (1990). *Funktionelle Bewegungslehre*. New York, Springer-Verlag.
7. Robison, R. (1992). "The new back school prescription: Stabilisation training." *Occupational Medicine: State of the art reviews* 7: 17-31.
8. Saal, J. A. and J. S. Saal (1989). "Nonoperative treatment of herniated lumbar disc with radiculopathy: An outcome study." *Spine* 14: 431-437.
9. Vleeming, A., A. Pool-Goudzwaard, et al. (1996). "The function of the long dorsal sacroiliac ligament. Its implications for understanding low back pain." *Spine* 21(5): 556-562.