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Original article

Effects of the pelvic rotatory control method on abdominal muscle activity and the pelvic rotation during active straight leg raising

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ABSTRACT

The aim of this study was to examine the effects of the pelvic rotatory control method on abdominal muscle activity and the amount of pelvic rotation while maintaining active straight leg raising (ASLR) at the level of the target bar.

In this study, 27 healthy female volunteers were instructed to perform ASLR, ASLR with a pelvic compression belt, and ASLR with the pelvic rotatory control method. Surface electromyography (EMG) data were collected from the bilateral rectus abdominis (RA), external oblique abdominis (EO), and internal oblique abdominis (IO) muscles, and angles of pelvic rotation were measured using a 3-dimensional motion-analysis system.

EMG activity of all abdominal muscles was greater and pelvic rotation was less in the pelvic rotatory control method compared with both the conventional ASLR method and the ASLR with pelvic compression belt method ($p < 0.05$).

The findings suggest that ASLR with the pelvic rotatory control method is effective in activating the abdominal muscles and minimizing unwanted lumbopelvic rotation during ASLR exercise.

1. Introduction

The active straight-leg raise (ASLR) exercise is often performed for abdominal muscle strengthening in healthy people for the promotion of health and the prevention of musculoskeletal disease, as well as for rehabilitation in individuals with back and hip pathologies (Gatti et al., 2006). Excessive lumbar spine movement and unwanted pelvic movement frequently occur during ASLR exercise in patients with lumbopelvic pain (Lee, 2004). Repeated lower limb movement associated with increased lumbopelvic motion may produce or exacerbate low back pain or musculoskeletal disorders in women with lumbopelvic instability (Roussel et al., 2009; Hoffman et al., 2011a,b). To minimize lumbopelvic motion during limb movement, patients have been instructed to stabilize the pelvis using various methods.

The pelvis can be stabilized either externally or internally. Internal stabilization refers to the maintenance of a body segment using an isometric contraction of an adjacent muscle group that does not enter into the movement pattern. Internal stabilization steadies the body segment by the proximal attachment of the muscle being strengthened (Kisner and Colby, 2007). External stabilization refers to the manual maintenance of a body segment by the therapist's hands, therapeutic belt, or straps (Oh et al., 2007).

External stabilization can be passively achieved using horizontal passive compression of the pelvis by a pelvic compression belt that can be adjusted in response to effort and/or pain (Takasaki et al., 2009; Beales et al., 2010a,b). Passive compression methods are mainly used for women with pelvic instability and/or pain. Although some studies have reported that pelvic compression methods are suitable for forcing closure of the pelvis, these methods are unsuitable and insufficient for improving internal lumbopelvic stabilization (Takasaki et al., 2009; Hu et al., 2010; Beales et al., 2010b).

Internal lumbopelvic stabilization can be achieved by co-contraction of local and global muscles (Richardson et al., 2004). Although global muscles cannot stabilize individual spinal segments because they have little or no direct attachment to the vertebrae (Page et al., 2009), they have better mechanical advantage for exerting control over lumbopelvic axial rotation in the

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