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Equipment-based Pilates reduces work-related chronic low back pain and disability: A pilot study

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Summary *Objective:* This study investigated effectiveness of an equipment-based Pilates protocol for reducing pain and disability in individuals with work-related chronic low back pain (CLBP).

Methods: Twelve workers with non-specific CLBP participated in a quasi-experimental, one-group, pretest-posttest pilot study of supervised 6-week equipment-based Pilates exercise. Pain severity was assessed using a 100-mm visual analog scale (VAS). Physical function was assessed using the Oswestry disability index (ODI).

Results: The Pilates intervention significantly reduced pain (mean decrease in VAS 30.75 ± 20.27 , $p < 0.0001$) and disability (mean decrease in ODI 11.25 ± 13.20 , $p < 0.02$) with large and borderline large effect sizes, respectively.

Conclusions: Rehabilitative Pilates exercise reduced pain and disability in workers with CLBP. Further research is needed to investigate Pilates exercise for rehabilitation of work-related injuries in large populations.

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Introduction

Chronic low back pain (CLBP) is a significant contributor to loss of work, reduced quality of life, and increased healthcare costs in the industrialized world (Richardson, 2004). The societal costs of CLBP continue to increase (Bunzli et al., 2013), and worker compensation data indicate recurrent episodes of low back pain are responsible for 70% of the overall cost associated with disability leave (Young et al., 2013). Additionally, the U.S. Bureau of Labor Statistics shows that musculoskeletal disorders such as low back pain account for 33% of all reported cases of injury and illness (U.S. Bureau of Labor Statistics 2013).

More than 85% of CLBP cases are non-specific and mechanically based (Chou et al., 2007). Although the etiology of mechanical low back pain is not completely understood, workplace factors such as repetitive motion, lifting ratios, and poor ergonomic workstation design have been associated with CLBP (Williams, 2014). Specifically, muscle dysfunction and weakness in the deep abdominal muscles, namely the transversus abdominis, the gluteals, and the lumbar multifidi, along with maladaptive postural changes, contribute to CLBP (Costa et al., 2012; Wells et al., 2012).

Treatment of work-related CLBP is based on clinical practice guidelines that may include non-pharmacologic treatments such as physical therapy, chiropractic care, and Back School programs (Cifuentes et al., 2011; Jaromi et al., 2012). However, treatment success varies among individuals, and the availability of multiple individualized treatment options is essential for effective management of adult workers with CLBP (Suri et al., 2012).

Recently the Pilates method, developed by Joseph Pilates in the 1920s for rehabilitation of former soldiers injured during World War I, has been rigorously evaluated for its therapeutic benefit for CLBP. The Pilates method, which focuses on improving body awareness and movement through particular exercises (Andrade et al., 2015), is thought to manage CLBP by activating the deep spinal and abdominal muscles while promoting greater spinal stabilization. This specific stabilization training has been shown to improve pain, reduce disability, and increase symmetry of the lumbar multifidi at the vertebral level in healthcare workers with CLBP (Maraschin et al., 2014).

Lumbo-pelvic posture affects activation of the deep core muscles (Barbarosa et al., 2015). Specifically, a posterior pelvic tilt and activities that involve lumbar flexion increase load on the annular and posterior ligaments of the spine and reduce recruitment of the deep abdominal and spinal musculature (Mawston and Boocock, 2012). Movement and training these muscles in a neutral pelvic position in which the symphysis pubis and anterior superior iliac spines are level on a horizontal plane reduces the load on the spine and optimizes the use of the transversus abdominis and lumbar multifidi. Pilates exercises involve engagement and strengthening of the deep abdominal and spinal muscles with a neutral pelvis.

Randomized controlled trials have shown that Pilates is more effective for reducing CLBP and functional disability than traditional therapies such as back care education, rest, ice, heat analgesics, and non-steroidal anti-inflammatories (Rydeard et al., 2006; Donzelli et al., 2006).

Furthermore, individuals with CLBP who undergo one-on-one clinical Pilates training with a physiotherapist have a clinically meaningful reduction in disability (Taylor et al., 2011; Miyamoto et al., 2013). The use of specialized Pilates equipment under the direction of a Pilates-certified therapist has been shown to further reduce disability and enhance the participants' value of the exercises (da Luz et al., 2014). Along with reductions in disability, participants with CLBP have reduced frequency, duration, and intensity of their pain following Pilates training (Natour et al., 2015; Wajswainer et al., 2012; Quinn et al., 2011; Curnow et al., 2009; Lim et al., 2008; Gladwell et al., 2006).

Although the usefulness of equipment-based Pilates exercises has been clearly demonstrated in the general population with CLBP, it has not been evaluated as a treatment in an occupational injury setting. Certain professions may be particularly prone to low back pain, and determining the effectiveness of Pilates in an occupational injury setting could aid in the development of targeted therapeutic protocols based on common etiologies of injury. The aim of this pilot study was to determine the effectiveness of a supervised 6-week Pilates training program for reducing pain and disability in individuals with CLBP from occupational injuries using a protocol designed for the Pilates Cadillac exercise machine.

Methods

Preliminary procedures

The interdisciplinary intervention design team was comprised of stakeholders from primary care (including nurse practitioners, physicians, and case managers) and occupational medicine (physicians and physical therapists). The principal investigator acquired the Pilates Cadillac (MERRITHEW™, Toronto, Canada) on loan exclusively for the purposes of the project.

Study design and participants

This study used a one-group pretest-posttest quasi-experimental design. Participants were recruited from an Occupational Medicine clinic within an integrated health-care system in a suburban region of Northern California. Individuals were eligible if they had low back pain for more than 3 months, had not undergone any surgery within the last 12 months, were 20–65 years of age, and had no previous experience with Pilates exercise. Other prior or current CLBP treatment interventions were not disqualifying factors. Of the 20 individuals screened, 16 met the eligibility criteria. Of the 16 eligible participants, four were unable to attend all 12 sessions due to scheduling conflicts and subsequently withdrew. Twelve participants completed the 6-week pilot study (Fig. 1). The Institutional Review Boards of Kaiser Permanente and Samuel Merritt University approved the study, and each participant gave informed consent.

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