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EXPLORATORY STUDY

Effects of Alexander Technique training experience on gait behavior in older adults

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Summary Heightened fall risk, potentially caused by aging-related changes in gait, is a serious health issue faced by older adults. The Alexander Technique is thought to improve balance and motor function; however, the technique's effect on gait has not been studied. The purpose of this study was to examine the effect of Alexander Technique training in older adults on the temporospatial characteristics of gait and medio-lateral center of mass displacement during fast and comfortably paced over-ground walking. Six licensed Alexander Technique teachers and seven controls between the ages of 60 and 75 years of age participated in the study. Alexander Technique teachers exhibited a reduction in medio-lateral center of mass displacement during fast paced walking compared to comfortably paced walking that was not present in controls. Due to this difference Alexander Technique teachers displayed a smaller medio-lateral Center of Mass displacement compared to controls during fast paced walking. Alexander Technique teachers also demonstrated significantly smaller stride width and lower gait timing variability compared to controls. These findings, which suggest superior control of dynamic stability during gait and potentially reduced fall risk in Alexander Technique teachers, warrant further study.

Introduction

The mortality risk associated with falling increases markedly with age and represents a significant health risk to older adults (US Census Bureau, 2012). Side falls pose a particular problem as they are one of the primary risk factors for hip fractures, accounting for approximately 90% of all incidents in older adults (Grennspan et al., 1998). Hip

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fractures are an increasingly prevalent medical concern as the global population of older adults continues to grow (Marks, 2010) because they have serious consequences, with one study finding 20% estimated risk of mortality during the year following a hip fracture (Leibson et al., 2002). Most falls, including those resulting in hip fractures, occur while walking (Niino et al., 2000) which is the most common form of exercise ("Sports and Exercise BLS," 2008) and the key to independent mobility (Shumway-Cook and Woollacott, 2012). It is imperative not only to identify the causes and risk factors of such falls, but also to explore preventative therapies to reduce fall risk.

Maintaining dynamic stability is a key component of locomotion. Of particular importance is dynamic stability in the medio-lateral (M-L) direction which, when impaired, is a risk factor for falling in older adults (Chou et al., 2003). Aging has been shown to correspond with increased M-L displacement and movement velocity of the COM during locomotion (Schrager et al., 2008). This change in COM behavior may be related to a decrease in the ability to maintain dynamic stability of the body, particularly the trunk, in the M-L direction during walking, which has also been associated with aging (Kang and Dingwell, 2009). Aging-related differences in other temporospatial and kinematic characteristics of gait have also been found, including: decreased step length, increased step width, an increased double support phase, increased gait timing variability, decreased ankle plantar flexion and plantar flexion power, decreased hip extension, and increased anterior pelvic tilt (Winter et al., 1990; Kerrigan et al., 1998; Kerrigan et al., 2001; Schrager et al., 2008; Owings and Grabiner, 2004; Menz et al., 2003).

In addition to magnitude differences in kinematic variables of gait, increases in the variability of stride width and gait timing have also been observed in older adults and identified as risk factors for falls (Verghese et al., 2009). The aforementioned aging-related changes in gait characteristics may be attributable to musculoskeletal factors, such as hip flexor contractures (Kerrigan et al., 2001) or weakness in the hip abductors (Winter, 1995), or functional declines in sensory systems that accompany aging (e.g., visual, vestibular, or kinesthetic; Robbins et al., 1995; Zwergal et al., 2012). Some of these changes (e.g., shorter step length, increased step width) may reflect the adoption of a more conservative gait strategy by older adults, either in response to functional declines or decreased confidence. While intended to prevent falls, this strategy may actually lead to further loss of function due to reduced challenge to the motor control and musculoskeletal systems (Winter, 1995).

The Alexander Technique (AT) is an educational method that has been used to improve posture and movement via conscious control of habits that interfere with good coordination (Alexander, 1923, 1932). Alexander argued that learning to identify and then inhibit habitual reactions to the stimuli that trigger specific behaviors was the first step toward changing maladaptive postures and movements and releasing chronic patterns of tension. The next step involves what he referred to as "directing" — a procedure in which guiding orders (motor commands) that specify the newly-desired coordination among body parts (i.e., the "means-whereby" a given objective can be accomplished) are projected to the body, without any attempt to physically carry out the orders (Alexander, 1923).

The most important directions concern the "Primary Control," a term Alexander coined to describe the dynamic relationship between the head, neck, and back, that he thought biased tonic muscular activity throughout the rest of the body, like a master reflex (McDonald, 1989). The purpose of these primary directions is to prevent the spine and back from shortening and narrowing during a movement. Consequently, these directions encourage the person to allow the neck be free, to allow the head to go forward (move anteriorly) and up (away from the spine), and to allow the spine and back to lengthen and widen. Alexander believed that by initially inhibiting the habitual response to a stimulus and then by projecting specific directions that encourage a pattern of lengthening and widening through the spine and joints, one can increase movement efficiency, diminish unnecessary muscle activation, and reduce chronic stress to the musculoskeletal system (Alexander, 1923, 1932; Garlick, 1932).

Because Alexander also believed that the demands of adapting to a rapidly changing civilization had dulled kinesthetic awareness and thus rendered kinesthetic feedback less reliable (Alexander, 1923), the AT is taught by an experienced teacher who uses manual guidance to help the student connect the aforementioned verbal directions to a new kinesthetic experience. In a typical lesson, a teacher might work on an every—day activity like transitioning from standing to sitting or from sitting to standing. The teacher might initially invite the student to sit, i.e., provide a stimulus that would typically trigger sitting, but simultaneously ask the student to inhibit her habitual response to the stimulus. While the student inhibited the desire to sit, the teacher would provide the verbal directions to let the neck be free, to allow the head to move forward and up, to allow the back to lengthen and widen, and then subtly manipulate the head-neck-back relationship so that the student experienced the appropriate kinesthetic feedback connected to the directions while being guided into sitting. With sufficient practice receiving the directions, but refraining from attempting to enact the directions in a habitual way, and connecting the directions to the new kinesthetic experience provided by the teacher's manipulation, the student would be expected to develop a more reliable kinesthetic appreciation and to ultimately be capable of consciously directing movements more effectively on her own.

Preliminary scientific research into the AT revealed distinct postural changes during quiet stance as a result of AT training, namely decreased forward protrusion of the head and flexion of the cervical spine, reduced curvature of the thoracic spine, and a slight forward shift of the COM relative to the base of support (Garlick, 1932). The changes in the head-neck-back relationship are likely related to a subsequent finding of decreased activation of the sternocleidomastoid muscle during guided movements common to AT sessions (Jones et al., 1961). More recent studies have shown AT to be beneficial for treatment of musculoskeletal (low back pain; Cacciatore et al., 2005; Little et al., 2008) and neurological pathologies (Parkinson's disease; Stallibrass et al., 2002). The AT has also been shown to improve functional reach in older adults (Dennis, 1999),