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Emotional influences on sit-to-walk in healthy young adults

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ABSTRACT

The purpose of this study was to investigate influences of emotional feelings on sit-to-walk (STW). Eighteen healthy young adults performed STW while feeling sadness, anger, joy and neutral emotion. Emotions were elicited using an autobiographical memories task. We used an optoelectronic motion capture system to collect motion data and assessed kinematics of STW. Emotion-related differences in STW kinematics were consistent with differences in movement speed. Compared to neutral emotion, sadness was associated with increased STW duration and phase durations, decreased peak forward and vertical center-of-mass (COM) velocity, increased drop in forward COM velocity, and increased forward and vertical normalized jerk score (NJS). Anger and joy were associated with decreased STW duration and phase durations, increased peak forward and vertical COM velocity, decreased drop in forward COM velocity, and decreased forward and vertical NJS compared to neutral emotion. Findings suggest that emotional feelings affect movement speed, hesitation, and movement smoothness during STW.

1. Introduction

Rising from a chair and walking, referred to as sit-to-walk (STW), is a common and functional movement of daily living. Successful completion of STW requires a merging of two component

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movements, sit-to-stand and gait initiation, with the transition between the component movements occurring near the time of seat-off (Magnan, McFadyen, & St-Vincent, 1996). A high level of balance control is considered a key motor strategy for performing STW as the component movements are merged (Magnan et al., 1996). Successful completion of the task requires generation of sufficient vertical momentum to stand up and sufficient horizontal momentum to initiate gait while maintaining balance during the transition. The maintenance of horizontal momentum between the standing up and gait initiation phases has been used as a measure of the effective transition between the tasks, typically assessed as the relative decrease in forward velocity of the center-of-mass (COM) between standing up and walking.

Previous studies have shown that the ability to effectively coordinate the component movements in STW is negatively affected by age, neurological disorder, and risk of falling. STW duration and duration of component phases were greater for healthy older adults compared to healthy young adults (Buckley, Pitsikoulis, Barthelemy, & Hass, 2009), and for older adults with Parkinson's disease (Buckley, Pitsikoulis, & Hass, 2008), stroke (Dion, Malouin, McFadyen, & Richards, 2003; Frykberg, Åberg, Halvorsen, Borg, & Hirschfeld, 2009), risk of falling (Kerr, Rafferty, Kerr, & Durward, 2007) and history of falling (Chen, Chang, & Chou, 2013; Chen & Chou, 2013). In the gait initiation phase, initial step length and velocity were less for healthy older adults compared to healthy young adults (Buckley et al., 2009), and for older adults with Parkinson's disease (Buckley et al., 2008), and a history of falling (Chen & Chou, 2013; Chen et al., 2013). The ability to maintain horizontal velocity during STW, measured as drop in forward velocity, was decreased in healthy older adults compared to older adults with risk of falling (Kerr, Pomeroy, Rowe, Dall, & Rafferty, 2013). It is likely that a combination of diminished strength and age-related or disorder-related change in motor control explains the observed changes in STW performance.

Another factor that has been shown to affect whole body movements like STW is emotion. During gait initiation, when healthy young adults were exposed to high and low arousing pleasant stimuli, the velocity of the first step and the displacement of the center of pressure increased compared to low arousing unpleasant stimuli (Naugle, Hass, Joyner, Coombes, & Janelle, 2011). Also, in healthy young adults, exposure to unpleasant stimuli increased time to peak COM velocity compared to exposure to pleasant stimuli while the peak COM velocity remained similar for both stimuli (Gélat, Coudrat, & Le Pellec, 2011). Sad walking in healthy young adults has been characterized by decreased walking speed, reduced range of limb motion, and increased postural flexion of the neck and thorax, and joyful walking has been associated with increased walking speed, large joint ranges of motion, and greater trunk extension and shoulder girdle depression postural angles (Gross, Crane, & Fredrickson, 2012; Michalak et al., 2009). How emotion might affect performance of standing up, the initial component of the STW task, or the transition between STW component movements is not yet known.

According to an integrative approach proposed by Russell (1980), an emotion can be described by its location in a two-dimensional space, with emotional valence and emotional arousal comprising the two independent dimensions. In the circumplex model, location on the valence axis represents the degree of pleasantness or unpleasantness for an emotion, and location on the arousal axis represents the degree of excitement or calm for an emotion (Posner, Russel, & Peterson, 2005). According to this model, sadness is a combination of low arousal and unpleasant valence, anger is a combination of high arousal and unpleasant valence, and joy is a combination of high arousal and pleasant valence. Neutral emotion represents the midpoint on emotional valence and arousal axes.

In this study, we investigated the effect of emotion on STW performance in healthy young adults. We expected that emotion would affect STW by altering movement speed, and that the resulting speed-related changes in STW performance would be similar to those reported by others. Specifically, we hypothesized that high arousal emotions would increase movement speed, and low arousal emotions would decrease movement speed, as others have observed during gait. Because velocity is important in the transition between the standing up and gait initiation phases of STW, we also hypothesized that emotion-related changes in movement speed would affect coordination between these component phases of the task.

To test our hypotheses, we asked participants to perform STW while experiencing four target emotions – sadness, anger, joy and neutral emotion. By comparing STW performed while experiencing high arousal emotions with opposite valences (i.e., anger and joy), we could examine the effects