Journal of Bodywork & Movement Therapies xxx (2017) 1–5

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

A patellar bandage improves mobility but not static balance in elderly female fallers

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Keywords:
Aging
Accidental falls
Postural balance
Proprioception
Compression bandages

A B S T R A C T

Background: The deterioration in the somatosensory and motor systems observed with increasing age can cause balance problems. Studies have shown that the use of infrapatellar bandages can enhance proprioception and improve postural balance.
Aims: To evaluate the effect of an infrapatellar bandage on static balance and mobility in elderly female fallers and non-fallers.
Methods: Forty older women (20 fallers and 20 non-fallers) were evaluated. Mobility (*Timed Up and Go test*) and balance (force platform) were measured in the presence and absence of additional sensory information (elastic infrapatellar bandage).
Results: Mobility differed in fallers ($p = 0.0001$), but not in non-fallers ($p = 0.27$), when the patellar bandage was applied. Additional sensory information did not improve static balance in either group ($p > 0.05$), but a trend towards improvement was observed in fallers.
Conclusion: Additional sensory input from an infrapatellar bandage improves mobility but not bipedal stance in elderly fallers.

1. Introduction

Falls are common among older people and result in their need for health care, thus representing a serious public health problem in this population (World Health Organization, 2016). Falls are a leading problem in general practice because of their high incidence, association with many risk factors, and considerable postfall morbidity and mortality (Tinetti et al., 1988; Campbell et al., 1990; O'Loughlin et al., 1993; Nevitt et al., 1989). One-third of people aged 65 years and over fall one or more times a year. In community-dwelling older people, the cumulative incidence of falls ranges from 25 to 40% (Stalenhoef et al., 1997).

The deterioration in the function of somatosensory and motor systems observed with increasing age can cause balance problems (Stalenhoef et al., 2000; Lord et al., 1991). Our sense of body position and movement irrespective of vision (i.e., proprioception) relies on muscle spindle feedback and is vital for performing motor acts. The proprioceptive system provides the central nervous system with information concerning joint angles and changes in these angles detected by muscle spindles, Golgi tendon organs and joint afferents (Riemann and Lephart, 2002). Over the last decade, studies have investigated the effect of somatosensory information on stance control using the technique of smooth touch on a rigid surface (Holden et al., 1994; Jeka and Lackner, 1994, 1995). In those studies, adult subjects exhibited a significant reduction in body oscillation when they stood up and touched the tip of the index finger on a rigid and stationary surface. Since the strength applied to the surface was not sufficient to provide significant mechanical support (Holden et al., 1994), the improvement in stance control was suggested to be the result of the additional sensory stimulus provided by the finger touching a stationary surface (Jeka and

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http://dx.doi.org/10.1016/j.jbmt.2017.05.012
1360-8592/

Lackner, 1994, 1995). These studies indicate that sensory information and motor activity are correlated in terms of maintaining the body at a given position and that additional sensory information can be used continuously, causing a reduction in body oscillation.

Studies have shown that the use of infrapatellar bandages can enhance proprioception in young athletes with anterior cruciate ligament injury (Barrett et al., 1991; Birmingham et al., 1998; Bonfim and Barela, 2007). Felicio et al. (2014) evaluated the effect of a patellar bandage on the postural control of subjects with and without patellofemoral pain syndrome and concluded that additional sensory input from a patellar bandage increases proprioceptive feedback, which may be related to improved postural control in subjects with this syndrome. According to Bonfim et al. (2009), the application of additional sources of sensory information can be decisive for patients who have some impairment in the acquisition of sensory stimuli (such as the elderly). In this case, the addition of sensory stimuli may offer a unique opportunity to improve motor performance.

Few studies have investigated the relationship between balance and additional sensory stimulation in elderly fallers and non-fallers and whether these subjects can benefit from this stimulus for improving postural balance and mobility. A review evaluating the effects of shoes and other ankle or foot appliances on postural balance in the elderly found only six studies that explored the topic and no conclusion could be drawn due to methodological differences (Hijmans et al., 2007). Hijmans et al. (2009) found that ankle compression was associated with improvement of joint position sense, but not of bipedal stance, in older people. The objective of this study was to evaluate the effect of a patellar bandage on static postural balance and mobility in elderly female fallers and non-fallers.

2. Materials and methods

2.1. Participants

In a cross-sectional study, postural control and mobility were assessed in a convenience sample of 40 older female volunteers under two different conditions, with and without a patellar bandage.

The participants were allocated to two different groups (see Table 1), a faller and a non-faller group. All volunteers enrolled in the study were selected in the same way from primary health units, health centers, community centers, and geriatric clinics. The following subjects were excluded: subjects with neurological or musculoskeletal disorders or pain that interfered with their daily activities, subjects with lower extremity joint replacement, subjects with orthostatic postural hypotension, subjects with abnormal scores on the Mini-Mental State Examination according to educational level (Brucki et al., 2003) and subjscts that indicated the use of psychoactive or vasoactive medications at the time of testing. A fall was defined as the unintentional displacement of the body to a level lower than the starting position, with the inability of correction in a timely manner.

Table 1
Characteristics of fallers and non-fallers participating in the study.

	Fallers (n = 20) Mean (SD)	Non-fallers (n = 20) Mean (SD)	p value
Age (years)	69.5 ± 5.2	69.8 ± 4.3	0.92
MMSE	25.9 ± 3.3	27.05 ± 2.7	0.30
Number of medications	3.2 ± 1.7	3.6 ± 2.5	0.57
Number of falls	2.7 ± 2.8	–	<0.0001
Body mass index (kg/m^2)	31.4 ± 7.6	28.2 ± 5.6	0.10

MMSE: Mini-Mental State Examination.

The anthropometric characteristics of the subjects are shown in Table 1 (see Table 1). All participants answered questionnaires regarding their personal data, history of falling (place, number, and sequelae), and number of medications.

Written informed consent was obtained from all patients before enrollment. The study was approved by the Research Ethics Committee of the Faculty of Philosophy and Sciences, Universidade Estadual Paulista (UNESP), Marília, São Paulo, Brazil, and was conducted in accordance with Resolution No. 196/96 of the National Health Council (Protocol 0428/2012).

2.2. Procedure

All assessments were performed by the same person, a trained physiotherapist. Static balance and mobility were evaluated in the taped and untaped conditions. The taped condition consisted of the placement of a subpatellar bandage strap (Salvapé®) made of 2.0-cm wide elastic band with an anterior Microfoam pad and a Velcro tape for closure (see Fig. 1), placed on each participant according to manufacturer instructions. The order of the untaped or taped condition was allocated randomly. For randomization, a number was assigned to the taped (1) and untaped condition (2) and each participant was allocated by drawing lots to the group that would begin to be evaluated with or without a patellar bandage. The subjects were allowed to rest for 60 s between trials (3 attempts) and for 15 min between test situations (taped/untaped). The design of the study is illustrated in Fig. 2 (see Fig. 2).

2.3. Mobility

Mobility was evaluated by the *Timed Up and Go* test (TUG). The TUG has been recommended as a simple fall risk screening tool, primarily to identify people warranting more detailed assessment of mobility (Schoene et al., 2013; American Geriatrics Society and British Geriatrics Society, 2011). The test measures the time (in seconds) necessary for a person to rise from a chair with armrests, walk 3 m at a comfortable walking speed, turn, return to the chair, and sit down (Podsiadlo and Richardson, 1991). Poor TUG performance has been associated with low muscle strength, poor balance, slow gait speed, fear of falling, and physical inactivity (Podsiadlo and Richardson, 1991; Takahashi et al., 2006). The test was performed twice in the untaped and taped condition, first for familiarization and then for time recording.

2.4. Static balance

Postural stability was assessed by the same rater in the same

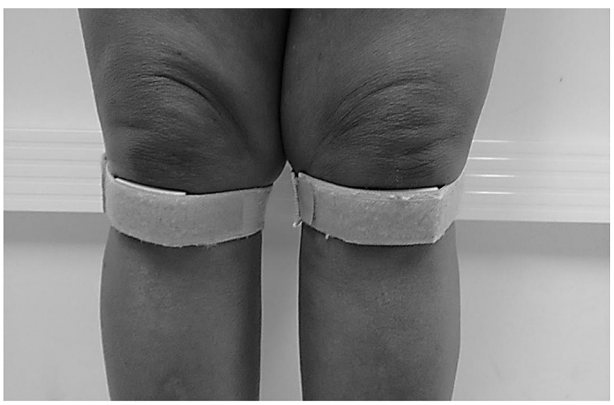

Fig. 1. Infrapatellar bandage.

Please cite this article in press as: Scheicher, M.E., et al., A patellar bandage improves mobility but not static balance in elderly female fallers, Journal of Bodywork & Movement Therapies (2017), http://dx.doi.org/10.1016/j.jbmt.2017.05.012