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

Descriptive Reliability Study

The prone bridge test: Performance, validity, and reliability among older and younger adults☆

Richard W. Bohannon [a], Michal Steffl [b], Susan S. Glenney [c], Michelle Green [a], Leah Cashwell [a], Kveta Prajerova, PhD [b], Jennifer Bunn [a, *]

[a] Department of Physical Therapy, College of Pharmacy and Health Sciences, Campbell University, Buies Creek, NC, USA
[b] Faculty of Physical Education and Sport, Charles University, Prague, Czech Republic
[c] Doctor of Physical Therapy Program, Department of Kinesiology, School of Agriculture and Health Sciences, University of Connecticut, Storrs, CT, USA

ARTICLE INFO

Article history:
Received 9 March 2017
Received in revised form
14 July 2017
Accepted 19 July 2017

ABSTRACT

Introduction: The prone bridge maneuver, or plank, has been viewed as a potential alternative to curl-ups for assessing trunk muscle performance. The purpose of this study was to assess prone bridge test performance, validity, and reliability among younger and older adults.
Method: Sixty younger (20-35 years old) and 60 older (60-79 years old) participants completed this study. Groups were evenly divided by sex. Participants completed surveys regarding physical activity and abdominal exercise participation. Height, weight, body mass index (BMI), and waist circumference were measured. On two occasions, 5–9 days apart, participants held a prone bridge until volitional exhaustion or until repeated technique failure. Validity was examined using data from the first session: convergent validity by calculating correlations between survey responses, anthropometrics, and prone bridge time, known groups validity by using an ANOVA comparing bridge times of younger and older adults and of men and women. Test-retest reliability was examined by using a paired *t*-test to compare prone bridge times for Session1 and Session 2. Furthermore, an intraclass correlation coefficient (ICC) was used to characterize relative reliability and minimal detectable change ($MDC_{95\%}$) was used to describe absolute reliability.
Results: The mean prone bridge time was 145.3 ± 71.5 s, and was positively correlated with physical activity participation ($p \leq 0.001$) and negatively correlated with BMI and waist circumference ($p \leq 0.003$). Younger participants had significantly longer plank times than older participants ($p = 0.003$). The ICC between testing sessions was 0.915.
Conclusion: The prone bridge test is a valid and reliable measure for evaluating abdominal performance in both younger and older adults.

1. Introduction

Muscles of the trunk play an important role in the execution of everyday activities. It is important, therefore, to have clinimetrically sound tests for quantifying trunk muscle performance. Historically, curl-ups have been used to test performance of the trunk flexors muscles (Hislop et al., 2014; Pescatello, 2014). While informative, curl-ups involve a stressful flexion of the back which may be contraindicated for some individuals, particularly older women who are osteoporotic (Sinaki and Mikkelsen, 1984). A potential alternative to curl-ups is the prone bridge (plank). This maneuver requires the individual to maintain a prone position on the forearms and toes while maintaining a neutral back and hips. Performance of the prone bridge has been found to have validity based on the level of activation of the abdominal muscles during the procedure (Czaprowski et al., 2014, Ekstrom et al., 2007; Escamilla et al., 2016; Lehman et al., 2005; Schellenberg et al., 2007) and its correlation with performance on other tests of abdominal muscle performance (Durall et al., 2012). Its validity is also supported by its ability to distinguish between known groups-varsity and nonvarsity athletes (Strand et al., 2014). Durall et al. (2012) have shown repeated measurements obtained from 10 individuals performing the prone bridge test to be reliable over three test sessions (intraclass

☆ Supported in part by AZV Research Project 16-29182A Czech Ministry of Health.
* Corresponding author. US Hwy 421 South, Lillington, NC 27546, USA.
E-mail address: bunnj@campbell.edu (J. Bunn).

http://dx.doi.org/10.1016/j.jbmt.2017.07.005
1360-8592/

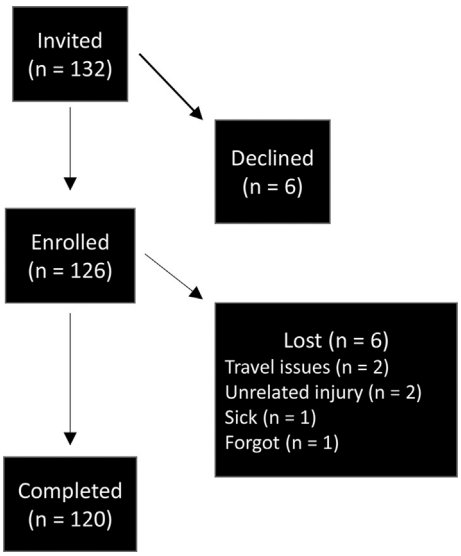

Fig. 1. Flowchart for participants in the study.

correlation coefficient [ICC] = 0.95). Norms for college aged students have been published (Strand et al., 2014).

Unfortunately, the aforementioned findings were all obtained from younger adults. Nothing, as far as we are aware, has been published regarding use of prone bridges to measure the trunk flexor muscle performance of older adults. The purpose of this study therefore was to describe prone bridge test performance, validity, and reliability among both younger and older adults. Specifically, we hoped to determine if validity of the test would be supported by better performance in individuals who: were more fit, exercised more, had lower adiposity, and were younger. We also considered that validity of the test would be bolstered by perceived exertion scores that were elevated at the time participants ended the test. Regarding reliability, our interest was in the relative and absolute reliability across two sessions, one-week apart.

2. Methods

This was a descriptive study approved by the institutional review boards of Campbell University, the University of Connecticut, and Charles University. It was conducted at two locations in the United States (North Carolina and Connecticut) and one location in Europe (Czech Republic). Testers at all sites, though already familiar with the prone bridge maneuver, were provided with a video that reviewed the key procedures of the study. Testing took place from August 2016 through January 2017.

2.1. Participants

Potential participants were recruited by word of mouth and personal invitation. They were eligible if between 20 and 35 or 60 and 79 years of age. They were excluded if they had symptoms or a diagnosis of a cardiovascular, pulmonary, or metabolic disorder, were currently experiencing low back or shoulder pain, or had been pregnant or had abdominal or thoracic surgery in the past year. There was no stipulation placed on fitness level, physical activity participation, or familiarity with the prone bridge.

A power analysis was conducted prior to participant recruitment. It was based on the assumption that a correlation of 0.50 would be found between prone bridge time and key explanatory variables. With alpha = 0.05 and power = 0.80, the analysis indicated that 29 participants were required. We therefore tested 30 participants in each sex/age stratum: The flow chart (Fig. 1) indicates how we arrived at our final sample of 120 participants: 10 younger men, 10 younger women, 10 older men, and 10 older women from each of the three locations.

2.2. Procedures

During the first testing session, participants provided written informed consent, and were screened for exclusionary criteria. They then completed the Veterans Specific Activity Questionnaire (VSAQ) to assess their fitness (McAuley et al., 2006). The VSAQ rates fitness based on the metabolic equivalent of the most demanding physical activity (eg, 11- cross-country ski, play basketball [full court]) that can be sustained by the respondent. They also completed and the Rapid Assessment of Physical Activity (RAPA) to assess their exercise participation (Topolski et al., 2006). The RAPA rates activity based on the intensity (ie, light, moderate, vigorous) and frequency (eg, five or more days a week) of participation in physical activirties and the inclusion of strengthening and flexibility activities. Participants were also asked if they did "abdominal muscle strengthening exercise on a regular basis" (yes, no) and if so, did the "exercises include prone bridges" (yes, no). Thereafter, height and weight were measured as they stood on a Health-o-Meter 597KL (Sunbeam Products, Boca Raton, FL). Body mass index (BMI), calculated using these measures, and waist circumference were then used as indicators of adiposity (Fogelholm et al., 2006).

Before beginning the timed prone bridge, participants were shown a picture of proper technique (Fig. 2) and were provided

Fig. 2. Photograph of individual performing prone bridge as described in study.

Please cite this article in press as: Bohannon, R.W., et al., The prone bridge test: Performance, validity, and reliability among older and younger adults, Journal of Bodywork & Movement Therapies (2017), http://dx.doi.org/10.1016/j.jbmt.2017.07.005