J. Phys. Ther. Sci.
24: 319–320, 2012

Effects of Different Bridge Exercises for the Elderly on Trunk and Gluteal Muscles

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Abstract. [Purpose] The purpose of this study was to show the effects of different bridge exercises for the elderly on trunk and gluteal muscles. [Subjects] Twenty elderly persons were recruited. [Methods] The EMG activities of the right side L5 paraspinal, external abdominal oblique (EO), and gluteus maximus (GM) muscles were measured during three bridge exercises: conditions 1, 2, and 3. [Results] The EMG activities of the for the L5 paraspinal, EO, and GM muscles showed significant differences among the 3 bridge exercise conditions. The EMG activity of the EO muscle significantly increased in the order of condition 1<2<3. The EMG activity of the GM muscle also significantly increased in the order of condition 1<2<3. [Conclusion] Bridge exercises with special boards are effective exercises because they help to strengthen and develop the EO and GM muscles that help to stabilize the spine of the elderly.
Key words: Bridge exercise, EMG, Senior people

(This article was submitted Oct. 13, 2011, and was accepted Nov. 16, 2011)

INTRODUCTION

Some back exercises have been used for rehabilitation of the low back injury, prevention of injury, and fitness training programs but excessive loading on the low back can exacerbate existing structural weaknesses of the elderly[1–3)]. Exercise-based active rehabilitation programs for the elderly can reduce LBP intensity, alleviate functional disability, and improve back extension strength, mobility, and endurance[4, 5)]. In active exercise treatment programs for the elderly, these functional limitations can be improved, and this is the rationale for such programs[6, 7)]. Bridging exercise is a quick and easy methods for strengthening the back and gluteus muscles[2)]. The purpose of this study was to assess the L5 level paraspinal (L5 spinal), external abdominal oblique (EO), and gluteus maximus (GM) muscle activities during various bridging exercises using a special board.

SUBJECTS AND METHODS

Twenty elderly persons, age 55–60 years with a mean height and weight of 155.1 ± 5.2 cm and 61.5 ± 8.0 kg, respectively, participated in this study. None of the subjects had upper limb or spine pathologies, or rheumatological or neurological conditions. Ethical approval for this study was obtained from the Inje University Faculty of Health Sciences Human Ethics Committee.

The EMG signals were pre-amplified by a pre-amplifier placed close to the electrodes, and signals were then sent to the data acquisition unit of an MP150 system (Biopack System, Santa Barbara, CA, USA), which amplified and sampled the EMG inputs at 1000 Hz. The EMG data were analyzed using a program created by AcqKnowledge software (version 3.9.1) and expressed as percentages of maximum voluntary contractions (MVC). Surface electromyographic measurements were made during 3 bridge exercise condition. We developed a safe but unstable board for use by the elderly. This special board is designed for anterior-posterior motion, like a seesaw. This special board can be more safely used by the elderly than a general purpose unstable board or ball. Condition 1 was with the unstable board under the lower limbs and a stable board under the trunk; condition 2 was with the unstable board under the trunk and the stable board under the lower limbs; and condition 3 was with the unstable boards under both the lower limbs and trunk. Surface electrodes were attached to the external abdominal oblique (EO), halfway between the ASIS and the inferior border of the ribcage, the L5 paraspinal muscles at L5, 2 cm laterally from the midline, and the gluteus maximus (GM), half the distance between the trochanter and sacral vertebrae. The EMG signal was collected for one minute and the first and last 10 seconds were discarded. Statistical analysis was performed using one-way repeated measures analysis of variance (ANOVA). The Bonferroni correction was performed to identify specific differences between multiple pairwise comparisons. Results were considered significant for value of $p < 0.05$, and SPSS version 18.0 (SPSS, Chicago, IL, USA) was used for the statistical analyses.

Table 1. Comparison of normalized EMG data in the three bridge exercises

Muscles	mean ± SD (%MVC)		
	Condition 1	Condition 2	Condition 3
L5 spinal	32.0 ± 18.3	36.3 ± 23.7	38.6 ± 16.4
EO	22.7 ± 12.6	32.3 ± 16.0*	40.1 ± 19.5*
GM	42.8 ± 16.5	48.9 ± 24.2*	55.8 ± 25.7*

*: $p<0.05$

RESULTS

The EMG activities of the L5 paraspinal, EO, and GM muscles showed significant differences among the 3 bridge exercises ($p<0.05$)(Table 1). The EO muscle activity significantly increased in the order of condition 1<2<3 ($p<0.05$). The GM muscle activity also significantly increased in the order of condition 1<2<3 ($p<0.05$)(Table 1).

DISCUSSION

By changing the lower limb and trunk position and support condition, or by unbalancing trunk muscle movements, it is possible to increase trunk muscle activities[8, 9]. In this study, muscle activities of EO and GM increased more during exercises performed with the unstable surface under trunk (condition 2, condition 3) than the unstable surface under the lower limbs (condition 1), and the greatest activities were seen during exercises performed with unstable surfaces under both the trunk and lower limbs (condition 3). A recent study showed the necessity of bridge exercise with unstable conditions[2, 3]. Our results, it show the effect of exercise according to the unstable board position and they indicate that an unstable surface under the trunk is effective for bridge exercise. The stress of the thoracolumbar fascia is increased, regulating tension of the overall lumbar extension, stimulating EO and GM activities[10]. Also, the unstable board under both the trunk and lower limbs was the hardest exercise method. The L5 spinal muscle showed no significant differences among the conditions. For elderly high activation of the lumbar paraspinal muscles may lead to unfavorable forces impinging on the spine[9]. Previous studies have documented that inappropriate motor patterns can result from a history of low-back dysfunction[7, 9]. These perturbed motor patterns have also been linked to unstable events and subsequent reinjury[2, 3]. Specific and selective exercises for EO and GM have been advocated by physical therapists as an effective means of treating chronic low back pain in the elderly as it enhances the dynamic stability of the lumbar spine[7]. Our special board was designed to allow anterior-posterior motion, like a seesaw. Dynamic changes in the position with frequent posture change are beneficial. The special board can be used more safely for senior people than a general purpose unstable board or a ball, and we have shown it is effective at rehabilitating the back because it helps to strengthen and develop the EO and GM muscles that help to stabilize the spine of the elderly.

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