Comparison of Trunk Muscles Activity during Bridging Exercise with Hip Adduction and Hip Abduction

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Abstract. [Purpose] This study compared trunk muscle activities hip adduction and hip abduction during bridging exercises. [Subjects] Nine healthy individuals (5 males, 4 females) participated. [Methods] The subjects performed bridging under three conditions: with the hip in a neutral position, with hip adduction, with hip abduction. Surface electromyography was used to measure the electrical activities of the rectus abdominis, the external oblique, the multifidus, and the gluteus maximus muscles. Normalized EMG activities were compared using repeated one-way ANOVA. [Results] The EMG activities of all the muscles during bridging with hip adduction and abduction were significantly increased compared to the neutral hip position. Also, MF muscle activity was significantly higher during bridging with hip adduction than during bridging with hip abduction. GM muscle activity was significantly higher during bridging with hip abduction than during bridging with hip adduction. [Conclusion] The bridging exercise with hip adduction enhanced MF, and the bridging exercise with hip abduction enhanced GM.

Key words: Bridging exercise, Hip adduction, Hip abduction

INTRODUCTION

In clinical practice, the bridging exercise is commonly used in trunk stabilization programs. The bridging exercise is prescribed for low back pain patients to reduce pain and to help posture control by retraining appropriate coordination of both gross and local muscles1). However, Arokoski et al2) reported patients with chronic low back pain showed no significant changes in muscle activities of the rectus abdominis and the external oblique during standard bridging exercise. Thomas3) reported that the hip adductor muscle is connected to the internal abdominal muscle through the iliacus, psoas major, and quadratus lumborum. Kim and Yoo4) reported that the muscle activities of the external oblique, internal oblique, and L5 paraspinous muscles increased during hip adduction using a visual feedback device in the sitting position. Kendall et al5) reported that the hip abductor muscle strength of patients with nonspecific low back pain was 31% weaker than that of normal subjects. They also suggested that strengthening of the hip abductor muscle would increase stability and decrease nonspecific low back pain5). Therefore, in this study, we compared activities of the trunk muscles during bridging exercises with hip adduction and hip abduction.

SUBJECTS AND METHODS

Our study subjects were performed on 5 males and 4 females aged 26.7 ± 2.5 years (mean ± SD) who had a mean height and weight of 168.3 ± 6.4 cm and 60.1 ± 8.9 kg, respectively. Subjects with conditions that might have affected trunk mobility, such as injury or neurologic deficits of the hip and lower extremities during the previous year, were excluded from the study. All subjects provided their written informed consent to participation prior to the commencement of the study. All EMG signals were amplified, band pass filtered (20 to 500 Hz), and then sampled at 1,000 Hz using Acqknowledge 3.9.1 software. The amplitude was normalized by the maximal voluntary isometric contraction. We measured 4 muscles: the rectus abdominis (RA) at the muscle belly between the pubic bone at the center of the navel; the external oblique (EO) at 15 cm from the navel point; the multifidus (MF) at 2 cm from the spinous process L4–L5; and the gluteus maximus (GM) at the mid-point between S2 and the greater trochanter. We used a pressure bio-feedback unit (Stabilizer, USA) to control the force of hip adduction and abduction. The subjects performed the bridging exercise in the supine position with the hip joint fixed at 45° and the knee joint fixed at 90°; both shoulders were abducted at about 30° and the feet and knees were kept apart at shoulder width. During the bridging exercise, the subjects performed hip adduction
and hip adduction isometric exercises using a wooden plate fixed between both knees and maintained at 150 mmHg for 5 seconds. The analysis of data was performed using SPSS 18.0 for Windows. Repeated one-way ANOVA was used to test differences among the different bridging conditions, with a significance level of α=0.05.

RESULTS

The EMG activities of the RA, EO, MF, and GM muscles during bridging with hip adduction and abduction were significantly higher than during the bridging exercise with the neutral hip position (p<0.05). The MF muscle activity was significantly during higher bridging with hip adduction than during bridging with hip abduction (p<0.05). The GM muscle activity was significantly higher during bridging with hip abduction than during bridging with hip adduction (p<0.05). The RA and EO showed no significant differences between bridging with hip adduction and bridging with hip abduction (p>0.05) (Table 1).

DISCUSSION

This study showed that RA, EO, MF, and GM muscle activities were higher during bridging exercise with hip adduction than during bridging exercise with the neutral hip position. Hip adductors are linked to trunk muscles in order to support the trunk or fix the trunk muscle[5]. Also, hip adductors are sited from the pelvis to the thigh and affect the control of trunk muscles attached to the pelvis. They are known to play a role in promoting contraction of the internal abdominal muscle[6]. Of particular note, our results show that MF muscle activity was significantly higher during bridging with hip adduction than during bridging with hip abduction. Co-activation of the hip adductor, pelvic floor muscle and internal abdominal muscle reinforces MF powerfully and contributes to spinal stability[7]. The MF and abdominal muscles are involved in lumbar stabilization and act to maintain balance[8]. We think that the bridging exercise with hip adduction recruited the abdominal muscles and the back muscles for trunk stability. Our results also show that RA, EO, MF, and GM muscle activities were higher during bridging exercise with hip adduction than during bridging exercise with the neutral hip position. Nadler et al[10], reported that female athletes with high abductor muscle strength had less incidence of back pain. In our study, GM muscle activity was significantly higher during bridging exercise with hip adduction than during bridging exercise with hip abduction. Oliver et al[11], reported the gluteus muscles activates during hip abduction. Therefore, we recommend both bridging with hip adduction and bridging with hip abduction for RA, EO, MF, and GM muscle strengthening. Also, bridging with hip adduction or bridging with hip abduction could be selectively used by individuals wanting to selectively strengthen the MF or GM muscles.

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