ISSN (Print) : 0974-6846
Indian Journal of Science and Technology, *8(25), DOI: 10.17485/ijst/2015/v8i25/80763, October 2015* ISSN (Online) : 0974-5645

A Comparative Study on Erector-Spinaes Muscle Thickness According to Low Back Pain

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Abstract

It is reported that low back pain is related to erector spinae muscle. The purpose of this study was to investigate that between subjects who have low back pain and who don't have low back pain on four different sit positions that have stability difference by comparing for effect on the thickness change of erector spinae muscle. The study collects 15-people who were diagnosed that was not operated because of a medical or surgical disease without low back pain and who were diagnosed. It measures the thickness of erector spinae muscle by real-time ultrasonopaphy, according to prone position, sitting on a chair position, sitting on a gymball position and sitting on a gymball with left leg rising. There were significant difference for the thickness of erector spinae muscle in prone position, sitting on a chair, sitting on a gymball (p<.05). However, there were no significant difference in sitting on a gymball with left leg rising (p>.05). This study demonstrated that the lower stability position, the more effects on the thickness of erector spinae muscle.

Keywords: Erector-spinae Muslces, Low Back Pain(LBP), Sitting Postures, Ultrasonography

1. Introduction

Back pain is the second most musculoskeletal disease for visit to the hospital in adults living in contemporary society[4] and up to 80% of the total population experience back pain at least once during life time[2]. There are various factors that can induce back pain such as obesity, fatigue, stress, poor working environment, improper posture, gait and, muscle weakness[28]. Back pain caused by these factors reduces muscular strength, endurance, mobility and coordination, which may lead to inability to perform daily tasks[9,14,29,26].

According to previous studies, there is an association between the ability to control back stabilizing muscles (e.g. transvers abdominis muscle, erector spinae muscles) and back pain [6,8,11,12,17].

It has been reported that back stabilizing exercise assists functional activities by increasing spinal and pelvic stability[7,25]. Lately, core stabilizing exercises have been applied in neurologic and musculoskeletal diseases in enhancing functional movements[13,22].

Core exercises are performed in various types of forms such as in posture on all fours, in bridge postures, or exercises using slings or balls[5]. Among these forms of working out, exercise using gym ballsis used for reinforcing core strength, flexibility, balance, and coordination abilities. Furthermore, by putting effort into maintaining balance when leaning against the gym ball, it can also facilitate reflexes, perception abilities and sense of balance[3]. Therefore, postures and exercises using the gym ball would primarily affect the back muscles which may contribute to back stability. In order to identify the changes of muscles thickness, previous study used a real time sonography to measure the thickness of the transversus abdominis muscle[10]. While there have been several reports on back pain and back stabilization, studies on comparing subjects and erector muscles of the back are still lacking to identify the effect of back muscles thinkness on back pain in adults. Therefore, this study aims to investigate whether the level of stability in sitting position affects thickness alteration of back muscles in young adults with and without back pain.

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2. Materials and Methods

2.1 Subjects

15 paricipants with back pain and 15 healthy participants were recruited from Sunmoon university in Chungnam, South Korea. Exclusion criteria were as follows: 1. other medical disorders, 2. prior history of disease or operation related with back pain, 3. neurologic disorders, 4. congenital malformation of limbs. 30 subjects were selected after proving them with sufficient information about the study including the objective and methods in written form and accepting their consent on entering the study Table 1.

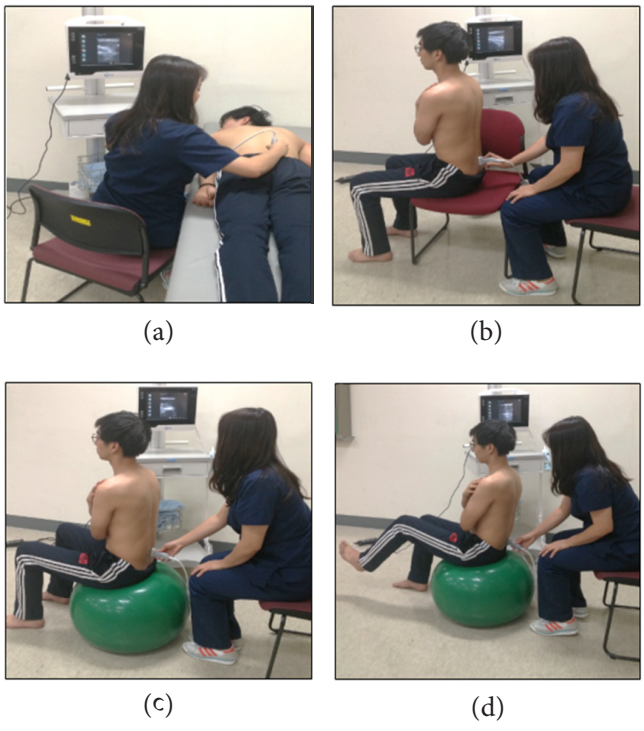
Table 1. General characteristics of the subjects.

(n=30)

	NLP (n=15)	LP (n=15)
Gender	Male(7), female(8)	Male(7), female(8)
Age (year)	19.33 ± 0.82	20.00 ± 1.65
Height (cm)	169.13 ± 8.31	167.60 ± 8.30
Weight (kg)	62.33 ± 7.87	62.07 ±10.37

All values are mean value ± standard deviation(SD), NLP: non-low back pain, LP: low back pain

2.2 Study method



(a) (b) (c) (d)

Figure 1. Position of the stability level.

Thickness of erector muscles were measured in 4 postures which are as follows. 1. Prone position, 2. Sitting on a chair, 3. sitting on a gym ball that 63cm in diameter, 4. sitting on a gym ball and lifting left foot 5cm above the ground. The order of the postures was (A), (B), (C), (D). 1. The head was tilted to one side so that the subject can maintain a comfortable position in prone posture. In 2. sitting position on a chair and 3. on a gym ball, the lines connecting the first toe and the heel on both sides were positioned to be parallel to each other. The flexion angle of the knee was 90˚ and both arms were crossed with hands on the opposite shoulder. The arms were position in the same way when 4. lifting the left foot 5cm above the floor sitting on a gym ball, with no equipments to lean against or support Figure 1.

2.3 Measuring Equipments and Location of Thickness Measurement

The thickness of erector spinae muscles was measured using B-mode ultrasonography with 7~10MHZ(eZono, eZono 3000, Germany, 2011), applying real time thickness measuring method. In order to measure the muscle thickness, we placed the transducer vertically over the lateral portion of transverse process of third lumbar bone. We then measured the length between thoracolumbar fascia and the superficial margin of the transverse process. This length is the thickness of the erector spinae muscle Figure 2.

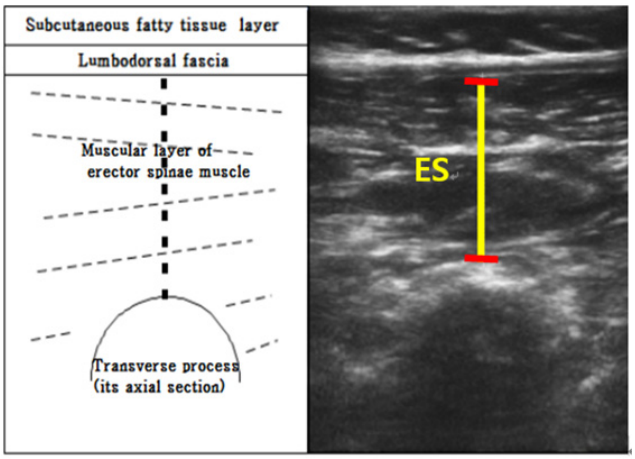


Figure 2. The thickness of muscle measured at the sagittal plane.

2.4 Data Analysis

Collected data was analyzed using a statistics software SPSS 18.0 for windows. General characteristics of the subjects were analyzed with frequency analysis. Normality was tested and confirmed via Shapiro-Wilk. Independent

t-test was used to compare the measured values between the subjects with and without back pain in 4 different postures respectively, with p<.05 set as a significance level.

3. Results

There was significant difference in the thickness of erector spinae muscle between subjects with and without back pain in prone position, sitting position on a chair and on a gymball (p<.05). No significant difference in muscle thickness was observed in a sitting position on a gym ball with left leg raised above the ground (p>.05) (Table 2).

Table 2. Difference of ES each position.

	Posture	NLP(n=15)	LP(n=15)	p
ES		Mean ± SD	Mean ± SD	
	Prone lying	19.17 ± 3.23[a]	21.34 ± 2.35	.04
	Sitting on chair	15.26 ± 5.77	19.61 ± 3.49	.02
	Sitting on gym ball	17.52 ± 4.46	20.87 ± 4.38	.04
	Lifting the left foot	20.47 ± 2.99	22.47 ± 4.17	.16

[*]p<.05 All values are mean ± standard deviation. NLP(non-low back pain), LP(low back pain)

4. Discussion

From this study, we found out that erector spinae muscle was thicker in subjects with back pain in 4 different positions with different stability levels.

Several studies have reported measurments of back stabilizing muscles according to stability levels. Anne-Marie et al.(2006) investigated the thickness change of transversus abdominis muscle and internal oblique abdominal muscle of 30 healthy subjects in 4 different postures. They reported that thickness increased in sitting position on a gym ball with left leg raised[1]. Our results in both groups were in accordance with this report.

Rasouli et al[24]. reported that thickness change of transversus abdominis and internal oblique abdominal muscle was considerably greater when sitting on a gym ball than on a chair in both back pain patients and healthy subjects[23]. This study shows that change in muscle thickness is greater in a position that is lower in stability. It also shows that rate of thickness change was smaller in back pain patients than in healthy subjects. The reason that erector spinae muscle becomes thicker in low-stability postures is that load on the back is greater in such positions and greater contraction is required to maintain stability[19]. Our study showed similar results with thicker muscles in subjects with back pain than in painless subjects (p<.05). The thickness difference between the two groups were smaller in positions with lower stability. Back pain inhibits all activities of muscles near the pain region. This inhibition persists after the pain is resolved, leading to weakening or atrophy of muscles near the lumbar spine. Muscular atrophy is thought to be the result of the lack of spontaneous recovery[16].

Marshall et al. reported that core stabilizing exercises, which intensifies erector spinae muscle, one of the muscles that stabilizes the back, can reduce back pain by maintaining the alignment of the body[15,18,20]. This report was significant in that it investigated erector spinae muscle in both subjects with back pain and those without back pain.

Takahiro et al[28]. investigated the thickness change of errector spinae muscle according to back flexion and extension angle. The results showed that as the back extension angle from the neutral position increased, thickness of errecor spinae muscle also increased significantly[27]. Our study is based on the fact that errector spinae muscle became more thicker in subjects with back pain than in painless subjects when extending the back in sitting position. The two groups showed significant difference in prone position, sitting position on a chair and on a gym ball.

This is in concordance with the objectives of this study, proving that there is a close relation between back pain and errector spinae muscle. However, the two groups did not show significant difference when raising left leg sitting on a gym ball. This may be due to the fact that, as preceding research reports, alteration in errector spinae muscle is smaller in positions with lower stability. Due to human's protective response to maintain posture, the angle of flexion and extension could not be limited. It is thought that compensatory actions affect the thickness of muscles[21].

5. Conclution

In this study, we compared the change of erector spinae muscle thickness between subjects with and without back pain in 4 different positions. In prone position, sitting position on a chair and on a gym ball, thicker erector spinae muscle was observed in subjects with back pain than without back pain. We believe that the results of this study can aid setting up exercise programs for subjects with back and pelvic pain according to stability levels.

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