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Comparison of Lumbo-Pelvic Stability between Patients with Chronic Low Back Pain and Healthy Subjects

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ABSTRACT

Because of the importance of lumbo-pelvic stability as one of the suggested factors to prevent low back pain and since to date no study accomplished to compare lumbo-pelvic stability between chronic low back pain (CLBP) and healthy subjects, the aim of this study was to determine and to compare lumbo-pelvic stability, lumbar lordosis, and lumbar mobility between CLBP and healthy subjects. Thirty CLBP patients and thirty healthy subjects through simple non-probability sampling participated in this cross-sectional analytical study. Lumbar lordosis, lumbar flexion and extension range of motion, lumbo-pelvic stability was measured through flexible ruler, modified-modified schober test, and Pressure Biofeedback Unit (PBU) respectively. ANCOVA test were used for statistical analysis ($p<0.05$). The results showed that mean of amounts obtained from pressure biofeedback unit did not significantly differ between two group ($p>0.05$). Also lumbar lordosis, and lumbar flexion and extension range of motion did not significantly differ between two groups ($p>0.05$). There is no difference between CLBP and healthy subjects in terms of the lumbo-pelvic stability, lumbar lordosis, lumbar flexion and extension range of motion. The present study supported that lumbar lordosis, lumbar mobility, and lumbo-pelvic stability not affected by CLBP.

Keywords: Chronic Low Back Pain, Lumbo-pelvic Stability, Lumbar Lordosis, Lumbar Mobility

INTRODUCTION

Low back pain (LBP) is one of the major public health problems, with high economic and social costs, loss of job and disability in many of communities [1, 2]. Studies that have been carried out in Iran, were reported a high prevalence of LBP in different groups of community [3-5]. Between 10 to 40 percent of patients with acute LBP are becoming chronic, and 85 percent of them are in non-specific type [6]. Despite of numerous efforts, to date determining the causes of LBP is difficult and it is remained as a consistent and quality of life-related problem [7, 8].

Lack of core stability is one of the potential predisposing cause of recurrent LBP [9]. The motor control and muscle participation are two major components of the spinal stability [10]. Delayed onset of muscle activity, in the presence of excessive movement or tension, will result in failure of spinal stability [10].

Because of the lumbar stability role as one of the important predisposing causes of chronic LBP (CLBP), several methods were proposed to evaluate spinal stability and motor control of the lumbo-pelvic region. One method that is more relevant clinically and is reliable method to evaluate spinal stability is lower limb movement tests. These tests were constructed based on the Sahrmann abdominal exercises and based on Comerford method [11, 12]

However this method less used in previous studies. Little studies were accomplished to evaluate lumbo-pelvic stability in LBP and healthy subjects. Also methods of measurement of lumbo-pelvic stability were different and no study accomplished to compare lumbo-pelvic stability between LBP and healthy subjects [13-15].

As well as lumbar lordosis is often measured during the evaluation of patients with LBP as a Causes of LBP [16, 17]. To assess spinal function, to select appropriate therapies, and to monitor the patient's recovery, it is important to measure potential risk factors in low back pain [18]. Although the relationship between lumbar lordosis and CLBP was investigated in previous study, but there was contradictory between researches about it [19]. Based on the several studies there is no relationship between lumbar lordosis and low back pain [17, 19-25]. Mousavi and Nourbakhsh showed that lumbar lordosis was not different between normal subjects and those with LBP [19]. But the findings of some of studies mentioned that there is relationship between lumbar lordosis and LBP [26-28]. Chanplakorn et al demonstrated that there are differences between lumbo-pelvic alignments between healthy males and females. In addition, the high prevalence of low lordosis in males may reduce the occurrence of LBP in obese males [26]. Also Norton et al demonstrated that women have more lordosis than men during stance and Subjects with LBP that categorized as having either a rotation-with-extension or extension diagnosis have more lumbar lordosis than those categorized as having a rotation-with flexion diagnosis [27].

Another subject that be considered as a common impairment in the clinical setting is range of motion restriction [18]. Spinal injuries may be resulted in range of motion limitation, and finally the loss of normal function of the spine [18]. Concerning the relationship between LBP with spinal mobility and lumbar muscle flexibility it is not seen agreement between studies. Some authors have reported the relationship between LBP with hip and low back mobility [29, 30], while others have not reported this association [31, 32]. Based on the mentioned above, this study aimed to determine and to compare the lumbo-pelvic stability, lumbar lordosis, lumbar flexion and extension range of motion in CLBP and healthy controls subjects.

MATERIALS AND METHODS

Study Design

This study was a comparative- cross-sectional analytical study. Thirty CLBP patients and thirty healthy subjects through simple non-probability sampling participated in this study. This study was done at Physiotherapy Clinic, Zahedan University of Medical Sciences, between April and June 2014. All participants signed written informed consents.

Participants

Thirty patients with age between 18-50 years, pain in the area between the costal margin and buttocks, with or without reference to the lower extremity that lasted more than 3 months were included in this study. Patients were excluded if they reported a history of recent fracture, trauma or previous surgery at lumbar region, spondylolysis or spondylolysthesis, spinal stenosis, neurological disorders, systemic diseases, pregnancy, cardiovascular diseases, concomitant treatment with physical therapy modalities [33, 34]. Also thirty healthy subjects included in the study. Healthy subjects matched with patients based on age and body mass index.

Data Collection

Demographic data include: Age, height, weight, also site of pain, and onset of pain were measured firstly. Then lumbar lordosis, lumbar flexion and extension range of motion, lumbo-pelvic stability were measured through flexible ruler, modified-modified schober test, and Pressure Biofeedback Unit (PBU) respectively, based on following procedures:

Lumbar Lordosis Measurement

Angle of lumbar lordosis was measured in standing position through flexible ruler. The flexible ruler molded to the contours of the subject's lumbo-sacral spine. Two markers were fixed with double-sided adhesive tape to the skin of the spinous processes of T11 and S1. These marker positions facilitated lumbar lordosis measurements. Sites along the flexible ruler that intersected with adhesive dots marking were marked with twist-ties attached to the flexible ruler. The shape of the curve's outline was traced on a piece of poster board and marks corresponding to the spinous processes were made along the curve's contour. Quantification of the curve (degrees) was done with a technique that involved drawing a line from one end of curve to other end of it (L line) and then drawing a right angle line from middle of L line to apex of the curve (H line). Then the amount of curve calculated through following formula:

$\theta = 4\left[ARCtag\left(\frac{2H}{L}\right)\right]$ [35].

Lumbar Flexion and Extension Range of Motion Measurement

The modified-modified schober test was used to measure lumbar flexion and extension range of motion. This test was done at standing position. Subjects stand with 15 cm width between feet. The midpoint between the posterior superior iliac spines (PSIS) was marked with a pen. Then one point 15 cm proximal to first point identifies by tape and was marked by pen. As the client flexes the spine as far as possible, the distance between the superior and inferior marks was measured and recorded in centimeter. Similarly, the distance between the superior and inferior marks was measured and recorded in centimeter as the subjects extends the spine as far as possible [36].

Lumbo-Pelvic Stability Assessment

Stability of lumbo–pelvic region was assessed by the Stabilizer PBU, Chattanooga, Australia [37]. This device measures pressure changes from 0 to 200 mmHg with accuracy of 2 mmHg [37]. Monitoring of lumbo-pelvic motion was performed by recording the pressure changes during Knee Lift Abdominal Test (KLAT) and Bent Knee Fall Out Test (BNFOT) [37]. The baseline pressure was set to 40 mmHg [38]. The pressure values were recorded at the end of the maneuvers. Inter-observer reliability correlations for KLAT and BNFOT were 0.85 and 0.87, respectively [38].

Statistical Analysis

Results were presented as mean values and standard deviation (SD). Criterion of significancy was set as p<0.05. Kolmogrov-Smirnov test was used to describe normal distribution. ANCOVA test was used to compare variables between chronic LBP and healthy subjects groups.

RESULTS

The demographic features of subjects in CLBP and healthy groups were listed in Table 1. Analysis of demographic features has shown that the subjects in CLBP group did not differ from healthy subjects group.

Table 1: Between-Group baseline comparison of subjects' characteristics

	CLBP Group	Healthy Group	P value [c]
Age (y)	36.60±8.20[b]	35.13±9.80	0.32
Height (cm)	172.13±7.98	172.93±8.60	0.60
Weight (kg)	78.42±10.60	76.69±9.30	0.43
BMI[a]	26.66±4.74	25.49±4.20	0.60

[a] *BMI= body mass index.*
[b] *Values are Means and Standard Deviation.*
[c] *Statistical different at P < o.o5*

The result of kolmogrov-smirnov test showed that all of variables include lumbo-pelvic stability, lumbar lordosis, and lumbar flexion and extension range of motion had normal distribution (p> o.05).

Table 2: Means and standard deviations of variables, p-value of between group comparisons

	CLBP Group	Healthy Group	P value
Lumbar Lordosis (degree)	47.70±14.25[b]	46.16±16.10	0.78[c]
Lumbar Flexion ROM (cm)	23.36±0.66	23.39±0. 98	0.93
Lumbar Extension ROM (cm)	13.30±0.75	13.50±0.73	0.47
Rt KLAT (mmHg)[a]	61.06±12.51	66.14±12.63	0.28
Lt KLAT (mmHg)	62.93±10.03	65.35±12.12	0.56
Rt BNFOT (mmHg)	29.86±1.76	29.70±3.49	0.65
Lt BNFOT (mmHg)	30.20±1.37	29. 07±2.40	0.17

[a] *Rt KLAT= Right Knee Lift Abdominal Test, Lt KLAT= Left Knee Lift Abdominal Test, Rt BNFOT= Rt Bent Knee Fall Out Test, Lt BNFOT= Lt Bent Knee Fall Out Test.*
[b] *Values are Means and Standard Deviation.*
[c] *P value for difference between group.*

ANCOVA test was used for comparison of variables between groups. The mean values of lumbo-pelvic stability obtained from the Knee Lift Abdominal Test and Bent Knee Fall out test did not show significant differences between two groups (p> 0.05). Also the mean of lumbar lordosis and mean of lumbar flexion and extension range of motion did not significantly differ between two groups (p> 0.05) (Table 2).

DISCUSSION

Based on the findings of this study, there were no significant differences between healthy subjects and patients with CLBP aspect of the lumbar spinal mobility. It is not seen agreement between studies concerning the relationship between LBP with mobility of the spine column and muscle flexibility of low back area. Findings of the present study is in contrast to the Findings of Mellin [29] and Burton and Tillotson [30] studies. Based on finding of mentioned studies, decreased mobility of lumbar is associated with increase of LBP. Of course, the study population of the present study was differed from the mentioned studies. But the findings of the present study is consistent with the findings of Sullivan et al [31] and Kuukkanen and Mälkiä [32] for the weak association between low back pain and lumbar flexion range of motion. They suggested that the acquisition of active lumbar flexion should not be important as a therapeutic aims. So it is not logical to rely on the results of measurements of range of motion as an indicator of pain and function [18, 31, 32].

Another finding of this study is the lack of significant differences between CLBP and healthy subjects in terms of the lumbo-pelvic stability. Studies performed in this field were different from this study for methods of measurement and research design. Therefore, this study is the first study to compare the stability of the lumbo-pelvic between low back pain and healthy subjects. Unlike the present study, the study conducted by Luomajoki et al [13], was an interventional type study and without control group. Also participants in Luomajoki et al study had to have motor deficits and motor test scores were expressed as a rating. However, the present study had the healthy controls and tests were graded quantitatively. Furthermore, in the present study patients were not allocated in certain subgroups of low back pain. The study conducted by the Phrompaet et al [14] was of the intervention type, done only on healthy subjects, and the method used for measuring the stability of the lumbo- pelvic was differed from the present study. In the Phrompaet et al study the lumbo-pelvic stability test performed with emphasis on stabilizer muscle contraction, and the people have been asked to perform the test with minimum change in pressure recorded by the pressure biofeedback device. Whereas in the present study to exam the unconscious activities of the local muscles, subjects did not contract consciously the transverse abdominis and the multifidus muscles during the motor control test. So that movements of the pelvic girdle and the values obtained from the test is not affected by the conscious activity of muscles.

The findings of this study are consistent with the findings of previous studies respect of lumbar lordosis and LBP. The results of most previous studies indicate that there is no a relationship between lumbar lordosis and LBP [17, 19, 25]. So, one can conclude that the findings of the present study confirm the findings of previous studies. Considering the findings of this study and previous studies, that there is no difference between CLBP and healthy subject's aspects lumbar lordosis, it appears that other factors may be important to create CLBP than lordosis [17, 20, 22, 24, 25]. Also lordosis may be influenced by other factors than LBP [21, 23, 25]. However the findings of some studies on the relationship between LBP and lordosis is different from the findings of the studies cited above [26, 28]. According to one study, the lumbar lordosis was not significantly different between patients with no distinguish LBP and healthy subjects [27]. So patients diagnosed with lumbar rotation with extension or lumbar extension have lumbar lordosis greater than of the patients with lumbar flexion rotation [27]. Some authors have reported reduction of lordosis in LBP patients with discopathy [39], but some have reported increased lordosis in patients with spondylolysthesis [39, 40]. Patients participating in the present study were chronic low back pain, but not necessarily as a specific subgroup of LBP.

CONCLUSION

Based on the finding of this study, it has not seen a difference between healthy subjects and CLBP in terms of the lumbo-pelvic stability, lumbar lordosis, lumbar flexion and extension range of motion. The present study supported that lumbar lordosis, lumbar mobility, and lumbo-pelvic stability not affected by CLBP.

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