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Difference of Lumbar Lordosis in Patients with Low Back Pain and Controls

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< Abstract >

Objectives: The purpose of this study was to compare the difference of Lumbar Lordosis Angle (LLA) between patients with Low Back Pain (LBP) and control groups. Methods: Questionnaires were completed by 40 adults LBP patients seeking physical therapy services and by 40 controls at the department of Physical Therapy, SaeJong Neurosurgical Clinic in Taegu city, South Korea from October 1999 to March 2000. LLA was measured on lateral x-ray films with standing position. The angle between a line parallel to the top of the first Lumbar (L1) and the top of the fifth Lumbar (L5) was defined LLA. Results: LLA of 29.88° for LBP patients was statistically significant decrease from that of 35.31° for controls in the difference of lumbar lordosis ($p<0.01$). There were statistically significant differences between genders in patients groups. Females (32.22°) had significantly greater angles than males (27.32°) ($p<0.05$), while 36.63° for female was also greater than 34.12° for male in the controls. No significant difference was found between age. In patient groups, 27.95° for below age 40 was a smaller than 32.32° for above, however, 35.82° for below age 40 was a little greater than 34.27° for above in controls. Patients in sitting posture had greater LLA (31.35°), than those standing (28.93°), however, values for controls were similar to each other. Conclusions: Results from this study indicate that distinct difference exist among patients and controls and gender, whereas little difference exists in age and working posture.

INTRODUCTION

Low back pain (LBP) remains one of the nation's most frequent clinical complaints and is industrial society's most extensive and extensive health problems (Torgerson and Dotter, 1976; Mayer et al, 1984). Approximately 50~90% of all adults will experience some low back pain at least once during their life time (Nachemson, 1976; Biering Sorensen, 1982; Frymoyer et al, 1983; Hikka et al, 1989; Svensson et al, 1990; Christie et al, 1995).

Many factors associated with LBP are reported including degenerative disc disease, sprains and strains, age, smoking status, pregnancy, occupational factors (prolonged sitting and

standing (Magora, 1972) lifting, bending, and twisting (Frymoyer et al, 1980; Svensson and Andersson, 1983; Videman, 1984), heavy manual work (Wicksstrom, 1978), industrial vibration exposure, and time spent in a car (Nachemson, 1976; Christie et al, 1995; Pamela, 1999). Several authors cite a change in lumbar lordosis, decrease or increase, as a contributing factor in LBP (Saunders, 1986; MecKenzie, 1999). Itoi (1991), Youdas et al (1996), and Adams et al (1999) stated that predicators of LBP were reduced range of lumbar lateral bending, a long back, reduced lumbar lordosis, previous no serious LBP, and abdominal muscles. Mellin (1990) reported that lordosis and kyphosis had significant relationship with mobility in sagittal planes. Thoracolumbar mobility had higher correlation with LBP than mobility of the lumbar spine. Lateral flexion and rotation in women had stronger relationship than forward flexion and extension with LBP. In the men back pain group, extension, lateral flexion and the sum of mobility in the lumbar spine were significantly smaller. In the women back pain group, extension and the sum of mobility in the thoracic spine, and extension, external rotation, and the sum of mobility in the hips were significantly diminished.

Some researchers have studied the lumbar spine radiographically, each finding different average LLAs and describing different techniques for radiographically measuring lordosis angles. Farfan et al (1972) demonstrated a mean LLA of 42° for specimens. Stagnara et al (1982) stated a standing lordosis angle of 56°, in whom the angle was measured from the top of the sacrum to the upper surface of whichever lumbar vertebra gave the largest angle. Fernand and Fox (1985) demonstrated a lumbosacral angle of 47° for women and 43° for men. Lord et al (1997) stated that lumbar lordosis averaged 49° standing and 34° sitting from L1 and S1, 47° standing and 33° sitting from L2 to S1, 31 standing and 22° sitting from L4 to S1, and 18° standing and 15° sitting from L5 to S1. ohlén et al (1989) said that average LLA was 35° in women gymnasts. In young skier with LBP, the LLA was 69° (70° in men and 64° in women) (1988). Byung-Gwon (1992) reported LLA of 27.7° for patients. Young-Moo et al (1996) stated LLA of 27.7° for acute patients, 20.7° for chronic patients. Byung-Gyu (1997) reported a lumbosacral angle of 34.3° for patients. However, the appropriate degree of lumbar lordosis has not been defined (1997), However, there was little data on LLA in Physical Therapy field. Therefore, this study was undertaken to compare the difference of lumbar lordosis between adult patients with LBP and control groups.

METHODS

The authors studied 80 lateral radiographs (40 LBP adult patients seeking physical therapy services and 40 control groups) of the lumbar spine taken at Saejong Neurosurgical Clinic in Tague city from October 1999 to March 2000. All subjects were recruited from the same facilities so that those with LBP and those without would be as alike as possible on uncontrolled variables such as demographical distribution. Exclusion criteria included: spondylolysis, spondylo-osthesis, spinal surgery, and above 65 years old. A case-control study design was used.

All x-ray films were taken using standard radiographic technique with subject standing with his or her hands resting on a bar in front of the subject at the shoulder level. LLA was measured on lateral x-ray films using angle in LBP patients and control groups. The angle between a line parallel to the top of the first Lumbar (L1) vertebra and the fifth Lumbar (L5) was defined as the lumbar lordosis angle.

Data are expressed as the mean±standard

deviation unless otherwise stated. Categorical data is presented percentage, and Cross-tabulated data were analyzed using a Chi-square test. Association with LLA between patients and controls was analyzed by t-test. The Statistical Analysis System (SAS) was used for all the statistical analysis.

RESULTS

Table 1. Comparison of gender, age, and working posture between patients and controls

Variables	Category	Patients No (%)	Controls No (%)	X^2	p-Value
Gender	Male	17 (42.5)	21 (52.5)	0.802	p>0.05
	Female	23 (57.5)	19 (47.5)		
Age	< 40	20 (50.0)	27 (67.5)	2.527	p>0.05
	40 ≤	20 (50.0)	13 (32.5)		
Working posture	Sitting	20 (50.0)	16 (40.0)	0.808	p>0.05
	Standing	20 (50.0)	24 (60.0)		

Table 1 shows the comparison of gender, age and working posture between patients group and control groups. There were no significant differences between patients and controls by Chi-square test. The mean age for patients was 37.3 with 34.7 for controls. The mean number of months from LBP onset were 35.9, with a range of 3 to 175.

The difference of LLA between LBP patients and controls is presented in Table 2. 29.88° for patients was significantly smaller than 35.31° for controls ($p<0.01$).

Table 2. The difference of LLA between LBP patients and controls (Unit: Mean±SD)

Variable	LBP patients (n=40)	Controls (n=40)
LLA(°)*	29.88±9.29**	35.31±7.84

* LLA: Lumbar Lordosis Angle, ** $p<0.01$ by test.

Table 3. The differences of LLA for patients and controls between gender (Unit: Mean±SD)

Variable	LBP patients (n=40)		Controls (n=40)	
	Men (n=17)	Women (n=23)	Men (n=21)	Women (n=19)
LLA(°)	27.32±7.10*	32.22±10.40	34.13±9.00	36.63±6.31

* Comparison of male patients to female patients, $p<0.05$ by test

Table 3 shows the difference in LLA between LBP patients and controls and gender. In patient groups, 27.32° for men it was a smaller than 32.22° for women ($p<0.05$). 34.13° for men it was also smaller than 36.63° for women in the controls. however, there was no significant difference.

Table 4. The differences of LLA for patients and controls in age (Unit: Mean±SD)

Variable	Age			
	LBP patients		Controls	
LLA(°)	〈40 (n=20)	40≤ (n=20)	〈40 (n=27)	40≤ (n=13)
	27.95±8.72	32.32±8.94	35.82±8.62	34.27±6.08

The difference in LLA between LBP patients and controls by age is given in Table 4. In patients group, 27.95° for below age 40 was a smaller than 32.32° for above, however, 35.82° for below age 40 was a little greater than 34.27° for above in controls. There was no significant difference.

Table 5. The differences of LLA for patients and controls in working posture (Unit: Mean±SD)

Variable	LBP patients		Controls	
LLA(°)	Sitting (n=20)	Standing (n=20)	Sitting (n=16)	Standing (n=24)
	31.35±9.29	28.93±8.31	35.01±6.43	35.52±8.78

In Table 5, there was no significant differences of LLA between LBP patients and controls with respect to working posture. In patient groups, 31.35° for sitting posture was a greater than 28.93° for standing, however, values for controls were similar to each other. There was no significant difference.

DISCUSSION

This study was undertaken to compare the difference of LLA between patients with LBP and control groups. In this study, a 29.88° angle for patients was significantly smaller than 35.31° for controls between LBP patients and controls ($p<0.01$). Itoi (1991) said that LBP was highly associated with a decreased lumbar lordosis and an increased sacropelvic angle. Our data confirm data that Byung-Gwon (1992) demonstrated in which the 21.71° angle for patients was significantly smaller than that of 27.7° for controls ($p<0.01$). He measured the angle from the top of L1 to the top of L5.

Byung-Gyu et al (1997) reported that a 34.3° angle in patients was smaller than 44.5° for controls ($p<0.001$). They measured the angle from the top of L2 to S1. Jackson and McManus (1994), Korovessis et al (1998) also reported that patients with pain had a decreased angle than those without. Some researchers stated that differences of previous findings in LLA were due to different techniques in radiographically measuring lordosis angles (Anderson et al, 1972; Torgerson and Dotter, 1976; Pelker and Gage, 1982; Stagnara et al, 1982; Fernand and Fox, 1985; Saraste et al, 1985). We agree with their opinion. Contrary to ohlén et al (1989) reported that patients had a significantly larger lordosis (Sullivan et al, 1994) than without (Amonoo-Kuofi, 1992). Christie et al (1995) also stated that chronic pain patients exhibited an increased LLA compared with controls ($p<0.05$).

Statistically significant differences were founded between gender in patients groups, in patient groups, 27.32° for men was a smaller than 32.22° for women ($p<0.05$). In the controls, a 34.13° for men was also smaller than 36.63° for women, however, there was no significant difference. Our data confirmed findings which Fernand and Fox

(1985) demonstrated that a study group of women had a larger lordotic angle than men. The LS angle in women was 47.19°, compared to 43.25° for men. The LLA was greater in women (32.42°) than in men (28.04°) ($p<0.0001$). In addition, Byung-Gyu et al (1997) demonstrated that a 35.3° LS angle in women was significantly greater than 32.2° for men ($p<0.01$) between patients. In control group, 47.5 for women was also greater than 44.0° for men ($p<0.05$). Amonoo-Kuofi (1992) and Korovessis et al (1998) also reported that women had greater angles than men ($p<0.05$). However, Mahlamäki et al (1988) stated that 64° in women was smaller than 70° in men by patients. Torgerson and Dotter (1976), Stagnara et al (1982), Fernand and Fox (1985), and Korovessis et al (1999) reported that they found no significant variation in LLA between genders. Stagnara et al stated that on physical examination, there was an increased lordosis in females, but assumed that this was due to a greater curve of their buttocks. Fernand and Fox measured the LLA in autopsy specimens and found no statistical difference between the genders. They assumed that their findings might be artifactual; due to the spine segments having been removed for autopsy. Bradford (1974) showed a LLA of 48° in men and 46° in women. So, there is need of further study on the difference for gender in future.

There was no significant difference in LLA among age. In patients groups, 27.95° for below 40 was smaller than 32.32° for above, however, values in the controls were similar to each other. That is, LLA increase with age. Our data confirmed findings that Tüzü et al (1999) reported, that LLA increased as age increased. Hansson et al (1989) and Korovessis et al (1999) reported that LLA had no differences in age. To the contrary, Jean and Alison (1988) stated that the lumbar spine flattens with age in most individuals. Sullivan et al (1994) and Split and Kotwica (1999) said that sagittal range of motion, flexion and extension angle decline with age.

There was no significant difference between patients and controls according to working posture. In patient groups, 31.35° for sitting posture was greater than 28.93° for standing, however, values in the controls were similar to each other. Keegan (1953), Akerbloom (1984), and Harison et al (2000) stated that flattening of the lumbar spine could be prevented by use of chairs with low back support. The use of a lumbar support is associated with a decrease in the intradiscal pressure and a reduction in the myoelectric activity of the posterior paraspinal muscles. Therefore, we think that the LLA for sitting patients is greater than for those in a standing position. That is, The intensity of pain for sitting patients is less than of those in a standing position.

CONCLUSION

Significant difference was noted on LLA between patients with LBP and controls when measuring from the top of L1 to the top of L5. 29.88° angle for patients whcih had a decreased angle, compared to 35.31° for those without ($p<0.01$). Our data demonstrated that female patients had a larger lordotic angle than male patients due to a difference in gender; 32.22° for female patients was significantly greater than 27.32° for male patients ($p<0.05$). In controls, a 36.63° angle for women was also a greater than 34.12° for men, however, there was no significant difference. No significant difference was found between age. In patients groups, a 27.95° angle for those below age 40 was a smaller than 32.32° for above, however, 35.82° for below age 40 was a little than 34.27° for above in controls. Patients in the sitting posture had greater lordosis (31.35°) than those standing (28.93°), however, values in

the controls were similar to each other.

The findings in our study indicated that LLA for patients group is significantly smaller than that for the controls, values for women were greater than men, and values for sitting patients were greater than standing patients.

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