

Evaluation of lumbosacral angle in low back pain and healthy subjects*

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Objective The aim of this investigation is to find the change of lumbosacral angle in chronic low back pains and to assess the normal value of angle in various age groups in healthy subjects.

Methods Fifty patients with low back pain were evaluated for a possible relationship between the increase of lumbar lordosis (Ferguson's angle) and a group of chronic low back pain disorders such as fibromyalgias, lumbar disc degeneration, lumbar disc bulging, lumbar arthrosis and pain due to segmental instability. Another group consisted of forty eight healthy subjects who has never claimed previous back pain history were underwent spinal X-ray as control group. The angle between a line parallel to the cranial end-plate of S1 vertebrae and a horizontal line was defined for the Ferguson's angle. In both groups patients were 30 years old or over. We also measured spinal instability

in both groups by a vertical line from the middle of the corpus of L3 vertebrae.

Results The results showed that in low back pain group there was a statistically significant increase in the Ferguson's angle and 62 % of this group has got spinal instability. In the control group the Ferguson's angle was in normal range and only 10% of them had spinal instability.

Conclusion There is a clear correlation between increased Ferguson's angle and chronic low back pain the exercise therapy is more important in this group of patients.

Key words Lumbosacral angle, low back pain, exercise therapy.

Introduction

The most common of musculoskeletal pains that confront the physiatrist is the low back pain syndrome. It has been estimated that 80 % of population will experience low back pain at some time. A 90 % of low back pains disappear in three months but recurrence is frequent (1,2,3,4). There are numerous etiologies and theoretical mechanisms that require careful history, precise clinical examination, and specific laboratory confirmation. From studies all over the world, the prevalence of low back pain is becoming known (5,6,7,8,9,10).

The mechanical low back pain etiologies can be classified as static (postural) or kinetic (faulty biomechanics). Of the static type etiology, the most prevalent is excessive lordosis. The mechanism is weight bearing assumed by the facet joints, posterior compression of the disc causing posterior compression upon the posterior longitudinal ligament, and closure of the intervertebral foramina (5). The diagnosis is based on the history and during the examination re-creation of the hyperextension of the lumbar lordosis which reproduces the patient's pain symptoms. X-ray examination frequently reveals

increase in the lumbosacral angle with approximation of posterior facets, but this cannot be quantitated with normal values. Narrowing of the intervertebral disc space between L₄-L₅ and L₅-S₁ is increasingly more prevalent with age and can be elicited in 50 to 60 % of adults past age of 50 years. Increased lumbar lordosis fully extends anterior longitudinal ligament, compresses nucleus, which then bulges posteriorly and presses upon sensitized posterior longitudinal ligament. Neural arch approximates, compressing facets and narrowing intervertebral foramina.

Interspinous ligaments become contracted so that the tips of spinous processes and facets kiss. Conversely abdominal muscles overstretch and relax. This process may be accelerated by pregnancies and obesity. The pelvis tilts anteriorly than normal, and the hip flexors shorten. The lumbosacral angle increases. There is often secondary degenerative changes on X-ray examination (11). Gluteus maximus and hamstring acting in a closed kinetic chain, maintain the pelvis in a posteriorly rotated position, generating tension on the thoracolumbar fascia. Contraction of the abdominal muscles develops tension in the thoracolumbar fascia, providing an extension moment at the lumbar spine without generating excessive shear (10).

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Table 1. Demographic characteristics of low back pain patients and controls

	Male/ Female	Age	Weight	Height
Low back pain patients (n=50)	31/19	42.2±10.9	70.6±9.2	163.16±7.23
Controls (n=39)	23/16	40.8±7.4	73.8±12.2	165.79±7.05

Material and Method

This study was performed in the clinic of Physical Medicine and Rehabilitation of Yuzuncu Yil University, Faculty of Medicine in Eastern Turkey between June 1995 and February 1996. The patients applied to the outpatients clinics of hospital with low back pain and had a satisfying inclusion criteria, were recruited for this study. The inclusion criteria were typical findings of degenerative disc disease of lumbar vertebrae in X-rays (Osteophyte formation, joint space narrowing and subchondral bony sclerosis), mechanic pain due to increased lumbar lordosis, lumbar disc bulging with persistent pain more than one year unrelieved by standard medical care and recurrent episodes requiring analgesic drug treatment.

Nightly eight patients were allocated for this study. We made physical examination, and lateral lumbosacral X-rays. For confirmation of diagnosis laboratory tests such as Hb, Hct, WBC and erythrocyte sedimentation rate, brucella agglutination tests, and genitourinary tests were made for each patient before selecting for the study. We ruled out organic disease such as multiple myeloma, paget's disease, metastatic invasion, ankylosing spondylitis, rheumatoid arthritis, compression fractures, vascular lesions and low back pain referred from other sites. We measured Ferguson's angle in all this patients. The angle between a line parallel to the cranial end plate of S₁ vertebrae and a horizontal line was defined as the Ferguson's angle. We also measured the spinal instability in both groups by a vertical line from the middle of corpus of L₅ vertebrae. The patients satisfying eligibility criteria were asked for informed consent and randomly allocated for study group. The control group consisted of 48 healthy subjects were randomly allocated to match the patients group. In the control group subjects had no claiming of previous back pain history who underwent lateral spinal x-ray. We also measured Ferguson's angle and checked for spinal instability in this group.

In statistical analysis student's t-test was used to compare the continuous variables. The level of

statistical significance was accepted at $p < 0.05$. All analysis were performed using Systat software.

Results

In the low back pain group the demographic characteristics were as the following. Age: 42.2±10.9, weight: 70.6±9.2, male/female 31 (62%) / 19 (38%), height: 163.1±7.2, were as seen in Table 1.

In the control group consisted of healthy subjects was as the following: Age: 40.8±7.4, weight: 73.97±12.41, male/ female ratio 16 (41.02%) / 23 (58.98%), height: 165.7±7.05 seen in Table 1. Lumbosacral angle in low back pain group was 43.90±10.07, lumbar instability was present in 31 (62%) patients. In the control group lumbosacral angle was 35.79±7.16 and lumbar instability was present only in 4 (10.26%) patients. (Table 2).

Table 2. Lumbosacral angle and lumbar instability

	LSV angle	Lumbar instability
Low back pain patients (n=50)	43.90±10.07	31 (62%)
Controls (n=39)	35.79±7.16	4 (10.26%)
	$p < 0.0001$	$p < 0.001$

In table 3, we can see that the most complaining group of back pain are housewife's (60%).

Table 3. Professions of patients

	Low back pain patients (n=50)	Controls (n=39)
Housewife	30	24
Merchant	4	4
Farmer	4	1
Official	4	4
Worker	7	4
Retired	1	2

Discussion

It has been reported that the back pain is attributed to high loading and bent or twisted postures (13,14,15). These findings show that back pain were highest in housewife's. 50 % of patients reported the cause of pain as heavy loads and forward bending. The diagnosis of patient's group was as the following: Increased lumbar lordosis; 17 patients (34 %), degenerative disk disease and disc space narrowing; 13 patients (26%), lumbar spondylarthrosis in 8 patients (16%), Ketenci (4) and et al. have reported that incidence of back pain was the highest among housewife's (33.3 %). They also reported that in their study group the diagnosis of patients were as the following: degenerative disk disease and disc space narrowing in 40.3 % of patients, lumbar spondylarthrosis in 11.4 % of patients. In our study, the percentage of housewife's was higher than other reports. This may be due to the life style of people in Eastern part of Turkey

Meschan (6) reported LSV angle 34 degree in healthy persons. He took lateral lumbosacral x-rays in recumbent position. When the subject is in erect position this angle reaches to 41.1 degree. In our study we found Ferguson's angle as 35.7 degrees in healthy subjects who underwent lateral lumbosacral x-rays..

In our study the results showed that the LSV angle is increased in chronic low back pain group (Table 2). This increase is statistically significant. In healthy group it is 35.7 degree that correlates with the other reports (6,11). In low back pain group lumber instability was seen higher than healthy group. This increase is statistically significant ($p < 0.001$). Those findings show that increase in lumbosacral angle is much more higher in chronic low back pains. Hansson et al (2). studied to evaluate a possible relationship between the amount of lumbar lordosis in asymptomatic as well as subjects with acute and chronic low back pain. These findings indicated that the distribution and range of lordosis does not vary acute or in with chronic low back pain, more than in man without back pain in the same age. Those findings are not correlated with our study and other reports (6,11,12). Harada (3) studied the lumbar spine of spastic diplegia patients with healthy controls. The average angle of lumbar lordosis in spastics in the

standing position was grater than in normal subjects and increased with age. The patients had an increase in Ferguson's angle and increased lumbar lordosis.

In conclusion, in chronic low back pain patients LSV angle is generally increased. Increased lumbar lordosis also causes kinetic low back pain. Weak abdominal muscles impose a great stress upon the disc and allow increased lordosis. Treatment is that of decreasing lordosis and developing good abdominal wall strength by exercise and by corrective corsets, improving posture, modifying working, and standing positions.

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