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Relationship Between Lumbar Lordotic Angle and Hamstring Muscles Tightness

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Abstract:
Purpose: to examine the relationship between the lumbar lordotic curve and hamstring muscle tightness in adults.
Methods: In this study, lumbar curve angle was measured by bubble inclinometer, and Hamstrings muscles tightness was measured with a standard goniometer (using active knee extension test technique), in 40 males (17) and females (23) subjects with mean age of 39 years not complaining from structural abnormalities of the spine or knee region.
Results: this study found that there was a non-significant correlation between lumbar lordotic angle and hamstring muscle tightness (spearman correlation coefficient (rho)=0.2, P value=0.12).
Conclusion: lumbar lordotic angle not significantly correlates with hamstring muscle tightness. This may underestimate the importance of hamstring muscle stretching exercises in treating patients complaining with mechanical low back pain.
Key words: lumbar lordotic angle; inclinometer; hamstrings muscle tightness, correlation.

1.Introduction

The normal lumbar lordotic curvature ranges from 20-45 degrees, which not differs between ages and genders (1). The normal hamstring flexibility was >160o (in the active knee extension test) (2).

Measurement of lumbar lordotic Angle (LLA) best calculated by Cobb's angle from radiological images (3). However, given the high cost and radiation dangers of this method (4), alternative methods such as inclinometers are commonly used (5).

Postural deviations from the "neutral" range are considered to be the cause of back pain (6), according to several studies (7-10). Postural assessment radiographic methods accuracy is high (11).

The effect of hamstrings tightness on trunk postures is not well documented (12). Imbalance of muscles causes the biomechanical defect of hyperlordotic posture in the lumbosacral region (13), and incoordination of the lumbopelvic rhythm (14), hamstrings tightness generates posterior pelvic tilt and decreases lumbar

lordosis, which can result in LBP, as they attach of hamstrings to the ischial tuberosity (15-19).

Forward bending is a combining movement between lumbar flexion and pelvic rotation, it called lumbopelvic rhythm (20). It results from coordinated activity between the back extensor muscles and the hip extensor muscles (21). Hamstring shortening is a common cause of LBP disorder Lengthening the hamstrings may allow greater motion to occur at the hips (17).

The literature review revealed a contradiction between literature in the effect of hamstring tightness on LLA.

This study was done to detect the relation between hamstrings muscle tightness and lumbar lordotic angle.

2.Patients and Methods

2.1. Study participants and recruitment criteria:

Forty participants of both genders aged 20-60 years were included. These participants were selected from the outpatient clinic of physiotherapy, Kasr Al Aini Hospital, Cairo University, Egypt. Informed formal consent has been obtained from each patient after full explanation of the purpose and nature of all procedures used.

Inclusion Criteria:

Patients were included if their age ranged from 20-60 years, Cooperative and Coherent, Willing to participate, Both males and females.

Exclusion Criteria:

Patients were excluded if they had structural spinal problems, inflammatory or osteometabolic diseases, any congenital disorders, and history of vertebral fractures and surgical spinal fixation or lower limb surgery.

2.2. Study Design:

Cross-sectional, Correlational study design was used in this study.

2.3. Instruments:

1-Bubble inclinometer for LLA measurements.
2-Standard goniometer for hamstring tightness measurements use in active knee extension test.

2.4.Assessment:

1- Measuring LLA:

After recording demographic information, the spinous process of the first lumbar and the last thoracic vertebra (L1 and T12) was identified and was marked: The spinous process of the L1, T12, SI, and 2 can be verified by identification of the fifth lumbar vertebrae and palpating superiorly and inferiorly from that point. Participants were asked to be steady. Then, The upper foot of the inclinometer was placed at the level of L1 and T12 and the value was recorded, then the upper foot of the inclinometer was placed at the level of S1,2 and the value was recorded. LLA is the absolute difference between these two values (22).

2- Measuring hamstring tightness:

Hamstring muscle length also was characterized using the active-knee-extension (AKE) test described by Gajdosik and Lusin 1983 (23). The subject was positioned supine with the posterior thigh held firmly against a vertical board that was attached to the table so that the thigh was stabilized at a 90-degree angle with the trunk. This hip position was maintained while a standard goniometer was placed at the knee joint (Stationary arm parallel with femur, movable arm parallel with leg).

The subject then slowly and actively extended the leg while maintaining the thigh against the vertical board. The non-tested lower extremity maintained flat on the table. The range of restricted extension in the knee joint was measured by reading the angle on the goniometer (i.e., total knee extension was recorded as 0"). The AKE test was repeated two more times, and these three measurements were averaged. The resulting mean AKE angle was used to reflect hamstring length, both limbs were measured.

3.DATA ANALYSIS AND RESULTS:

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 24, with alpha=0.05.

Spearman correlation coefficient was used to find the correlation between LLA, and hamstring tightness, as they were not normally distributed (Shapiro-Wilk test <0.003).

Forty patients (17 males and 23 females) participated. Means (standard deviations) of age and BMI for all patients were 39 (11.5) years and 26(2) kilogram per meter squared (Kg/m2). see **table (1).**

Means (standard deviations) of lumbar lordotic angle and hamstring tightness were 39 (0.9) and 27.5 (2) respectively. see **table (2).**

Table (1): Demographic characteristics of the participants.

Demographics	Mean (SD)
Age	39(11.5)
BMI	25.7(2.2)
Male/female (count)	17/23

(SD): standard deviation

Table (2): Descriptive statistics for lumbar lordotic angle and hamstring tightness:

Clinical data	Mean (SD)
LLA	39 (0.9)
Hamstring tightness	27.5 (2)

Spearmen correlation coefficient revealed the non-significant correlation between lumbar lordotic angle and hamstring tightness (rho=0.2, P= 0.12). see **table (3).**

Table (3): Correlation between lumbar lordotic angle and Hamstring tightness

Relation between	Spearman's Correlation Coefficient (rho)	Sig. (2-tailed)
LLA and HT	0.2	0.12

LLA lumbar lordotic angle; HT Hamstring tightness

4.DISCUSSION:

The main purpose of the present study was to detect if there is a relation between LLA and hamstring tightness. Results of the current study found that there was a non-significant correlation between LLA and hamstring tightness. This can be explained by some participants with tight hamstring muscles may not rotate the pelvis posteriorly and affect the lumbar curve, but instead of that, they tend to flex their knees.

The present study disagrees with that of Kamal, Zedan, Hafez, and Hypa (2017) due to differences in sample size and method of assessment (24). In addition to that, the present study contradicts what was reported by Saur et al. (1996) in that comparison of measurements using the bubble inclinometer with those from radiographs and others indicated no significant difference (25).

Results of our study disagree with the work of Toppenberg and Bullock (1986) who found that hamstring muscles tightness were related to lumbar hyperlordosis. Although they found no relationship between pelvic tilt and lumbar curvature (26).

The present study disagrees with the notion that short hamstrings were associated with decreased flexion range of motion of the lumbar angle (12).

The findings of the current study agree with the results of the study which showed no significant difference for the pelvic inclination angle and lumbar angle in standing between men with short hamstrings and men without short hamstrings (27).

Findings of the present study did not support the notion that short hamstring muscles, because of their attachments to the posterior leg and the ischial tuberosity, may limit forward bending and cause back pain due to their influence on lumbar pelvic rhythm (28,29). So, stretching of the hamstring may not be necessary to be carried out at the same exercise of stretching back muscles, during treatment of lumbar problems.

The present results agree with the findings of Flint (1963) (30)., concerning unilateral tightness, who found that lumbar lordosis was unrelated to hip and trunk flexibility.

Li, Mcclure, and Pratt do not support a direct relationship between hamstring muscle length and standing lumbar and pelvic posture and agree with other research findings of no correlation between postural alignment and muscle length (31). Our results agree with the findings of Li, Mcclure, and Pratt of no relation between hamstring tightness and LLA (28).

Kendall and McCreary argued that individuals with "flat" backs (reduced lumbar curvature) while standing to tend to have short hamstring muscles. They presumed that short hamstring muscles rotate the pelvis posteriorly, resulting in a concurrent reduction of lumbar lordosis. This argument disagrees with the results of our present study (16).

This study had some limitations potential inaccuracies on palpation of anatomical landmark scan be the source of error during the measurement procedure.

5.CONCLUSION:

According to the present study, hamstring tightness was not associated with lumbar lordotic angle. This may have a future implication in treating patients with lumbar problems.

Declaration of interest:

There is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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