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Research Article

Association of Balance and Pelvic Tilt among the Individuals with Functional Lordosis- An Observational Study

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Abstract

Balance or the Postural Sway is defined as the movement of body in still or erect position [1]. Balance is the term frequently used by the health professionals working in a wide variety of clinical specialities [2]. The Centre of Gravity (COG) is the most common parameter which affect the balance, the COG is the balance point in your body at which your upper and lower body weight is balanced, and combined mass of body appears to be concentrated. The disorders in spinal posture are significantly seen at the young age group, the functional Lordosis is predominantly a most common feature in females of young generation, the important parameters used to assess the role of pelvis in sagittal alignment is the pelvic incidence [3]. The normal curvature of the lumbar spine is visible in sagittal plane, some factors such as Age, gender, weight, muscular strength, physical activity, lifestyle of individual shows great impact on spinal curvature [4].

Aim of the Study: To determine the association Between Balance and Pelvic tilt among the individuals with functional lordosis.

Objectives of the Study: To find out pelvic tilt in individuals with Functional Lordosis

To find out Balance in individuals with Functional Lordosis.

Methodology: Ethical Committee approval was obtained from the Institutional Ethical Committee before the commencement of study. 30 Female individuals were recruited from the College of Physiotherapy with and without Functional Lordosis. The subjects fulfilling the Inclusion Criteria were selected for the study and all the participants were explained about the procedure and importance of the study, Written Informed consent was taken from each participant. Demographic information of the participants including name, age, gender, occupation, past medical history was noted if present along with any Exclusion criteria. The individuals were evaluated individually for measurement of Pelvic tilt and Balance assessment and Lumbar Lordosis. the pelvic tilt was measured by pelvic inclinometer, balance was checked by Sway meter and lumbar lordosis with flexible ruler individually.

Result and Conclusion: We found that in the Female individuals ranging from the age group of 18-25years with the Functional Lordosis has weakly positive correlation with lordosis with Pelvic tilt and Lordosis with right side balance, has showed weakly negative correlation with the anterior side of balance and no association with left and posterior side of balance.

Keywords: Balance; Pelvic Tilt; Functional Lordosis; Flexible Ruler

Abbreviations

COG: Center of Gravity

Introduction

Balance or the Postural Sway is defined as the movement of body in still or erect position [1]. Balance is the term frequently used by the health professionals working in a wide variety of clinical specialities [2]. The Centre of gravity (COG) is the most common parameter which affect the balance, the COG is the balance point in your body at which your upper and lower body weight is balanced, and combined mass of body appears to be concentrated. The disorders in spinal posture are significantly seen at the young age group, the functional Lordosis is predominantly a most common feature in females of young generation, the important parameters used to assess the role of pelvis in sagittal alignment is the pelvic incidence [3] the normal curvature of the lumbar spine is visible in sagittal plane, some factors such as Age, gender, weight, muscular strength, physical activity, lifestyle of individual shows great impact on spinal curvature [4]. The purpose of the study was to investigate the relationship between the lumbar lordosis, pelvic tilt and balance affection in normal healthy adults.

Materials and Methods

Materials needed

Pelvic Inclinometer, Swaymeter, Flexible Ruler.

Methodology

Ethical committee approval was obtained from the institutional ethical committee before the commencement of study. 30 female subjects were recruited from the College of Physiotherapy with and without functional lordosis. The subjects fulfilling the inclusion criteria were selected for the study and all the subjects were explained about the procedure and importance of the study, Written Informed Consent was taken from each participant. Demographic information of the subjects including name, age, gender, occupation, past medical history was noted if present along with any exclusion criteria. The subjects were evaluated individually for measurement of pelvic tilt and balance assessment and lumbar lordosis. the pelvic tilt was measured by pelvic inclinometer, balance was checked by Sway meter and lumbar lordosis with flexible ruler individually.

Measurement of pelvic tilt

The subjects were taken in comfortable standing position with normal base of support. The anterior pelvic tilt was measured.

- **Anterior pelvic tilt (right):** (Figure 1A and 1B): Position of the Subject: The subject was in standing position with the normal base of support. Position of Therapist: on the right side of the subject.
- The pelvic inclinometer was used to measure the pelvic tilt, the anterior superior iliac spine was palpated on the right side with the posterior superior iliac spine on the side. One tip of inclinometer was placed over the ASIS and another over the PSIS on the same side.
- **Measurement of Balance:** (Figure 2A and 2B): The Sway meter is the instrument used to check the Postural sway which is constructed with the 40 cm rod attached to a belt. A pen was attached at the end of the rod to measure the postural sway. The sway meter is fixed to the level of anterior superior iliac spine. The Sway meter is placed posteriorly to the subject, so the influence of vision is excluded. The foots were placed 3inch apart from each other. The graph sheet was placed behind the subject. The subjects were instructed to remove the footwear and stand on the footprints. Instruct the subject to stand normally with hand at the side of body n stand still as possible. Proper instructions were given to the subjects before starting the procedure. the starting point was marked on the graph sheet .30 sec were given for every trial and 5 to 10 sec rest was given between every trial. total 3 trial was taken with eyes open.
- **Measurement of lumbar lordosis:** (Figure 3A and 3B): The subjects were asked to stand in a relaxed position with the lower back and upper buttocks exposed. The subjects were told to stand in bare foot with body weight evenly distributed on the markings done by adhesive tape on the floor with the distance of 15 cm between feet. The subjects were made to stand with their arms at the sides and fix his/her eyes on the opposite wall. The flexible ruler was then placed over the contour of the lumbar spinous process of the back and the readings on the flexible ruler that intersected with the markings done on spinous processes were noted the measurements were recorded by the tester after carefully removing the flexible ruler without changing the curve. Then, the outline of the curve was traced from the readings noted for T12 to S2

Figure 1A: Measurement of Pelvic Tilt (Anterior Aspect).

Figure 1B: Measurement of Pelvic Tilt (Posterior Aspect).

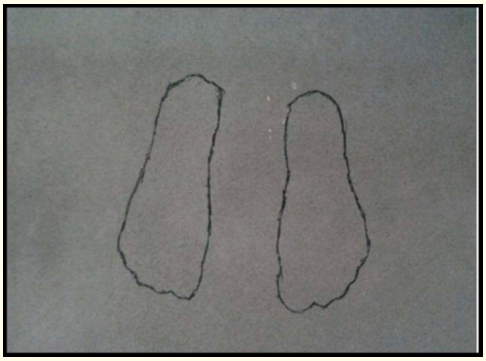


Figure 2A: Footprints with 3 inches apart.

Figure 2B: Measuring Balance of the subject with Sway meter.

Figure 3A: Placement of flexible ruler to assess the Lumbar Lordosis.

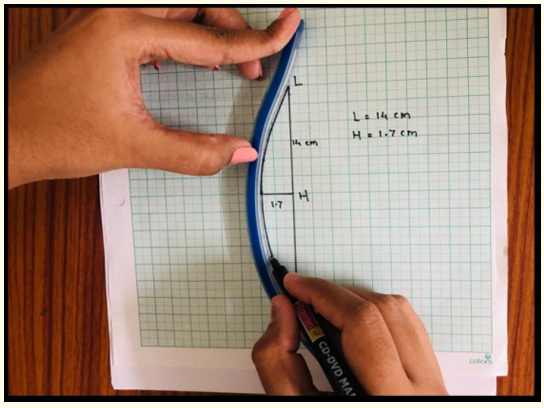


Figure 3B: Calculation of the Measurements.

spinous processes using a pencil along the flexible ruler onto the graph sheet. Outline of the curve. The vertical line (L) was drawn to connect the location of spinous processes T12 and S2 landmarks and were labelled as A and B respectively. The deepest point of the curve was identified by recording the steep of the curve and a perpendicular line (H) from the point to the line L was drawn. The length of the lines L and H were measured in cm.

Results and Discussion

From data collected we have analyzed the correlation among the balance and pelvic tilt with lumbar lordosis. Statistical analysis was done by GraphPad instant software. The data was entered into an excel spread sheet, tabulated, and subjected to statistical analysis. Various statistical measures such as mean, SD and Pearson's correlation test were utilized to analyze the data.

	Mean ± Standard Deviation (SD)
Lordosis	41.92 ± 8.69
Pelvic tilt	5.36 ± 2.35
Balance right	0.82 ± 0.56
Balance left	0.62 ± 0.43
Balance anterior	0.81 ± 0.46
Balance posterior	0.65 ± 0.35

Table 1

Table 1

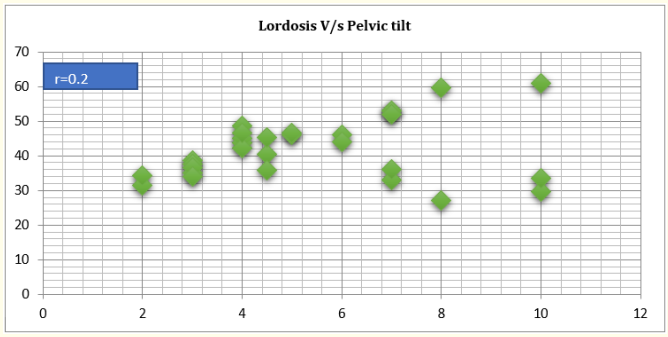
It represents the descriptive statistics of Baseline characteristics which includes (mean ± standard deviation) values of lordosis (41.92 ± 8.69), pelvic tilt (5.36 ± 2.35), Balance right (0.82 ± 0.56), Balance left (0.62 ± 0.43), Balance Anterior (0.81 ± 0.46), Balance posterior (0.65 ± 0.35).

Table 2

It represents the Pearson correlation values of lordosis, pelvic tilt and balance when compared with other, Result reported a weakly positive correlation between lordosis with pelvic tilt (r = 0.2) and lordosis with balance right (r = 0.2), weakly negative correlation was found between lordosis with balance anterior (r = -0.2) and there was no association found between the lordosis with balance left (r = 0.0) and lordosis with balance posterior (r = -0.0).

	Correlation (r)	Result
Lordosis v/s Pelvic Tilt	0.2	Weakly positive
Lordosis v/s Balance Right	0.2	Weakly positive
Lordosis v/s Balance Left	0.0	No association
Lordosis v/s Balance Anterior	-0.2	Weakly negative
Lordosis v/s Balance Posterior	-0.0	No association

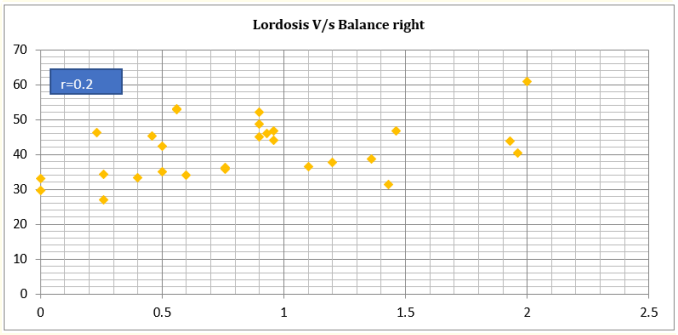
Table 2



Graph 1: Correlation between Lordosis and Pelvic tilt.

Graph 1

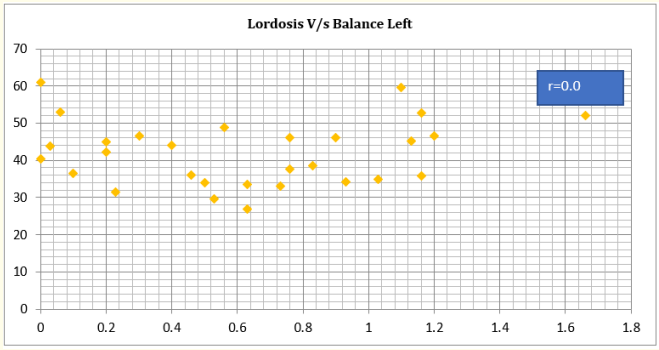
It represents the correlation between the lumbar lordosis and pelvic tilt was done, when the comparison of two measurements was done which include lumbar lordosis and pelvic tilt a weakly positive correlation was found with (r = 0.2), which indicates that both the measurements tends to go up in response to one another; but the relationship is not very strong.



Graph 2: Correlation between Lordosis and Balance right.

Graph 2

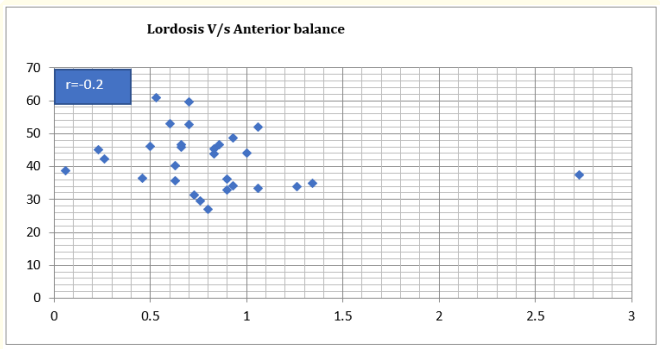
It represents the correlation between the lumbar lordosis and balance right was done, when the comparison of two measurements was done which include lumbar lordosis and balance a weakly positive correlation was found with (r = 0.2), which indicates that both the measurements tends to go up in response to one another; but the relationship is not very strong.



Graph 3: Correlation between Lordosis and Balance left.

Graph 3

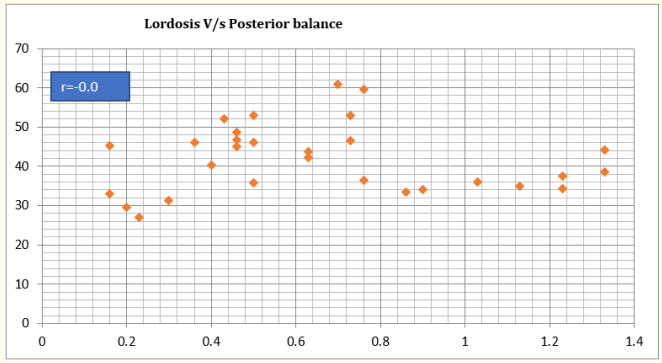
It represents the correlation between the lumbar lordosis and balance left was done, when the comparison of two measurements was done which include lumbar lordosis and balance in which no association was found with (r = 0.0), which indicates that there is no relationship between those measurements.



Graph 4: Correlation between Lordosis and Anterior balance.

Graph 4

It represents the correlation between the lumbar lordosis and anterior balance was done, when the comparison of two measurements was done which include lumbar lordosis and anterior balance a weakly positive correlation was found with (r = -0.2), which indicates that both the measurements tends to go up in response to one another; but the relationship is not very strong.



Graph 5: Correlation between Lordosis and Posterior balance.

Graph 5

The correlation between the lumbar lordosis and posterior balance was done, when the comparison of two measurements was done which include lumbar lordosis and balance in which no association was found with (r = -0.0), which indicates that there is no relationship between those measurements.

Discussion

Our study aimed at finding the Correlation of Lumbar Lordosis with Balance and Pelvic Tilt in healthy individuals (females), Balance is defined as the movement of body in still or erect position, the Centre of gravity is the most common parameter which affect the balance and it's the balance point in your body at which your upper and lower body weight is balanced and combined mass of body appears to be concentrated. the study aimed that the bipedal stance could be measured using the manual sway meter. The study done by Tejal C Nalawade and Shyam D Ganvir., *et al.* in year 2015 which was based on normative data of postural sway by using the sway meter among the young healthy adults, where they concluded that the 100% of sway was seen in anterior and posterior direction

with eyes open as compared to right lateral 98% and left lateral 95% with eyes open [1]. But in our study, we found that the anterior sway and posterior sway showed weakly negative and no correlation in the subjects with eyes open which was correlated with Lumbar Lordosis where lumbar lordosis was increased in 80% of subjects. Measurement of postural sway with a sway meter was studied by Sivakumar Ramachandran., *et al.* in year 2011 where they concluded that the sway may decreased with eyes closed instead of increasing, anterior and posterior sway was less with eyes closed instead of eyes open [5]. The reliability of a non-invasive method for measuring the lumbar lordosis was done by Dennis L Hart in which they found that the flexible ruler is a reliable clinical measure to measure the lumbar curve [6].

Conclusion

Our study concluded that there is a weak positive correlation of Lordosis with Pelvic Tilt and Balance right and weak negative correlation among Lordosis and Balance anterior in individuals with Functional Lordosis.

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