



PELVIC TILT AS A MEASURE OF HAMSTRING MUSCLE FLEXIBILITY SIT REACH TEST

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ABSTRACT

Background and Purpose: The sit reach test is commonly used to assess flexibility of spine and length of the hamstring muscle. The purpose of this study was to describe hamstring length by the use of posterior pelvic tilt (PPT) in sit reach test position.

Methods: The participants were 219 individuals. Each subject performed SLR, SRT, in the final position of sit reach test, posterior pelvic tilt was measured using bubble inclinometer.

Results: There was a weak correlation between SRT, SLR and PPT measurements ($P < .05$)

Discussion: The result suggests significant difference in hamstring length using PPT ($P < .05$). Although scores of SRT, SLR and PPT were weakly correlated, we prefer to assess hamstring muscle length using posterior pelvic tilt because these scores are not influenced by anthropometric factors or spinal mobility.

KEYWORDS : Flexibility, hamstring muscle length, sit and reach test, straight leg raise test, and posterior pelvic tilt.

INTRODUCTION

The sit and reach test or modified version is typically used to evaluate flexibility of the hamstring muscle.^[1] Hamstring flexibility is an important component of fitness. Sit and reach test are the most widely used lineal measures of flexibility with moderate criterion related validity.^[2] The term flexibility refers to the ability of hamstring muscle to be lengthened to their end range. It is typically characterized by the maximum range of motion in a joint or series of joints.^[3] However, SRT involves movement of the whole body, it has been suggested that the position of the fingertips does not give valid information about hamstring extensibility. The main factors that affect the validity of SRT to estimate hamstring extensibility are the differences in length proportion between the upper and lower limbs, the position of the head and the ankles. Shortened hamstring muscle may create imbalance in joints and faulty postural alignments that may lead to joint dysfunction. Authors reported that the SRT has moderate criterion-related validity when used to reflect hamstring muscle length does not appear to provide a valid assessment of back motion.^[4] Several authors contend that anthropometric factors, such as disproportionate length of the limbs relative to the trunk, may influence the results of SRT.

Hopkins estimated that scapular abduction during the SRT may account for 3-5cm of variation in the final score. The factors include various combinations of back motion and hamstring muscle length such as normal or increased motion in the back and increased hamstring muscle length, decreased or normal back motion combined with decreased hamstring length ; anthropometric factors such as long arms or short legs relative to the trunk; scapular abduction, which increases the reaching distances of the arms. The reliability of sit and reach test is 0.89. [2]

The supine straight leg raising test and the supine knee extension test with the hip 90 degrees of flexion are performed on one lower extremity while the other lower extremity is resting in hip and knee extension. 1 Hip flexor shortness may pull pelvis in anterior pelvic tilt. Use of this faulty starting position could result in an inaccurate assessment of short hamstring length. The reliability of this test is 0.87. [3]

Lack of hamstring muscles extensibility results in decreased pelvic mobility. To confirm if hamstring is lengthening the pelvis must

move in anterior pelvic tilt according to Kendall. Anatomically pelvis is a component of 2 iliac bones and the sacrum is a whole unit of fibrocartilagenous structure. Thus permitting no movement between the SI joints. So it is valid enough to say that the sacrum moves in the same angle the pelvis moves throughout the hip joint and thus it appears sensible to measure movement of pelvic position over the hip joint in the horizontal plane which will happen as the hamstring lengthens.

The purpose of our study is to assess hamstring muscle length by posterior pelvic tilt in sit reach test position as an alternate method of measurement in relation to straight leg raise test and sit reach test because contributing factors has impact on the outcome as we are concentrating on relative movement of body rather than the compensatory movement. Hence it can be expected to have no relation between them. Accordingly, the Null Hypothesis shall be H0: The posterior pelvic tilt will have no correlation with sit reach test and straight leg raise test as hamstring plays a key role in providing increased values in forward bending due to stretch (lengthening of muscle while performing test), hence it is more likely to have some relation between all the three tests. Accordingly the alternate hypothesis shall be H1: The posterior pelvic tilt will have correlation sit reach test and straight leg raise test.

METHOD

The participants from physiotherapy OPD, Dr. D. Y. Patil College of physiotherapy, Pune were approached and explained about the study. It was performed at the outpatient department during working hours from 9am to 5pm. Subjects fulfilling the inclusion and exclusion criteria were selected from target population by simple random sampling with snowball method. 229 subjects were screened, out of which 219 subjects were evaluated and 212 subjects were included in the study. 17 subjects were excluded from the study. All 212 subjects willingly participated in the study and their written informed consent form was taken. Demographic data of the individual was recorded. Detailed assessment was taken from each individual using order to chits. Demonstration of test was done prior conducting the test. The number of trials to be done was explained to the subjects. The data was recorded in data recording sheets. After recording the demographic data, the following procedure was done.

PROCEDURE

Sit Reach Test

A standard sit and reach box was used to position the subjects for the test, and the sliding ruler centered on the top of the box was used to obtain the SRT scores. Each subject was seated on the floor with the knees fully extended and ankles in neutral dorsiflexion (heel firmly) against the box. The subject were instructed to place their hand over the other, with long fingers even, and reach as forward as possible by sliding their hands on the measuring board while keeping the knees extended. The hands were kept aligned evenly as the subject reaches forward along the surface of the box. A tape measure on the top of the measuring board indicated in centimeters how far beyond the toes each individual reached. The score in centimeters is the distance contacted by fingertips past the toes. 3 trials were performed, and the average was used for data analysis.

Straight Leg Raise Test

Supine with the legs extended and low back and sacrum flat on the table. The therapist holds one thigh firmly down to prevent posterior pelvic tilt. The subject was instructed to raise the other leg. Greater trochanter of femur was the reference point for digital goniometer and the angle was measured and recorded.

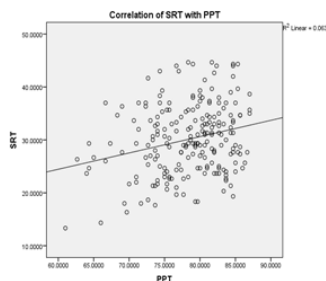
Posterior Pelvic Tilt

The subjects were seated in a long sitting position with knees fully extended and ankles in neutral dorsiflexion. The subjects were instructed to place hand aligned evenly and slowly reach forward as far as possible while keeping the knees extended and touch the fingertips to the toes. The inclinometer was placed at the sacrum (S2) (aligned at the center of midpoint of PSIS) and the posterior pelvic tilt was measured and recorded.

STATISTICAL ANALYSIS

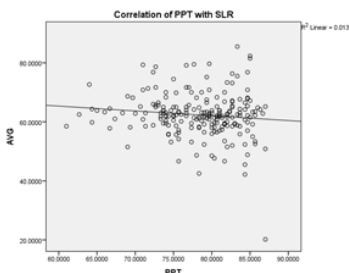
Data was analysed for its statistical significance using appropriate software. Spearman's correlation was done to correlate SRT, SLR, and PPT.

GRAPH-1: Scatter diagram representing correlation between Sit reach test and posterior pelvic tilt.



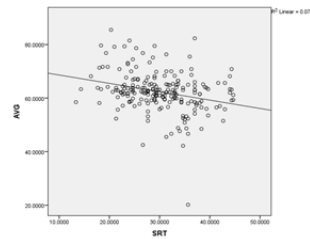
Interpretation: Above graph shows only 6% (0.063) of SRT values are related to PPT values. Correlation is significant at the 0.01 level

GRAPH-2: Scatter diagram representing correlation between Straight leg raise test and posterior pelvic tilt



Interpretation: Above graph shows only 13% (0.013) of SRT values are related to PPT values. Correlation is significant at the 0.01 level.

GRAPH-3: Scatter diagram representing correlation between Sit reach test and straight leg raise test



Interpretation: Above graph shows only 7% ($r=0.075$) of SLR values are correlated with SRT values. Correlation is significant at the 0.01 level.

DISCUSSION

Present study was conducted on 212 young individuals. The purpose of this study was to assess the flexibility of hamstring muscle through posterior pelvic tilt and to correlate the posterior pelvic tilt with straight leg raise test and sit reach test in order to find the efficiency of the three tests in assessing hamstring flexibility. The results of this study showed significant pelvic tilt scores when compared with sit reach test and straight leg raise test.

Hamstring muscle flexibility is an important factor from the perspectives of health and fitness. Sit reach test (SRT) and Straight leg raise test (SLR) were included in the study to assess hamstring muscle flexibility. There was a weak correlation between straight leg raise test and sit reach test. There was also negative correlation between posterior pelvic tilt and straight leg raise test. This shows that the findings of SLR and are not related to findings of PPT and SRT.

There was a weak positive correlation between posterior pelvic tilt and sit reach test. The comparison between both suggests that both reflect hamstring muscle length. The SRT however reflects on the distance of the fingertip to the toes as final measure.

According to several authors SRT was not found as a valid measure of hamstring flexibility for subjects with reduced hamstring muscle extensibility. Thus lower extensibility presented higher thoracic angle during the flexion movements and it indicates compensation for pelvic restrictions.

The correlation was found weak between Posterior pelvic tilt and straight leg raise test with significant scores ($p < .05$). According to Kendal, pelvis is maintained by maintaining the low back and sacrum flat on the table. If the pelvis is in anterior tilt and low back hyperextended, the hip joint is already in flexion. When measured by the angle of the leg with the table because this measurement does not include the amount of hip joint flexion due to anterior pelvic tilt. The hamstring will appear longer than their actual length if the pelvis is in posterior pelvic tilt which could give false results.

Pelvic tilt is conditioned by hamstring flexibility because the hamstring muscle originates on the ischial tuberosity of the pelvis; the tension in the hamstring has a direct influence in pelvic tilt during flexion movements, especially with extended knees. Thus this term was used as an alternate measure to assess hamstring muscle flexibility in normal individuals. It could be a method of measurement to be used other than Sit reach test. It is easily applicable on subjects. It also represents amount of sacral and pelvic mobility.

CONCLUSIONS

The present study concludes weak correlation exist between posterior pelvic tilt, straight leg raise test and sit reach test.

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