

INTER TESTER AND INTRA TESTER RELIABILITY OF A SELF-DESIGNED PELVIC INCLINOMETER IN ASYMPTOMATIC POPULATION: A PILOT STUDY

¹ B. Reddi Harini, ² Vinod kumar .K.C, ³ Anil T John

¹Master of Physiotherapy, ²Assistant Professor,³Principal,

Department of Physiotherapy,

Dayananda Sagar College of Physiotherapy, Bangalore, Karnataka, India

ABSTRACT:

BACKGROUND: Pelvic tilt angle is defined as the angle between the horizontal plane and the line passing through the center of the PSIS and center of ASIS. Clinically use of a pelvic inclinometer to measure pelvic inclination angles is a quick, non-invasive, user-friendly method. In the present study we have devised a similar method of measuring pelvic tilts by means of a self-designed pelvic inclinometer.

METHODOLOGY: A self designed Pelvic inclinometer was used to measure pelvic inclination angle. All the subjects were explained the purpose of the study, Inclusion and exclusion criteria were assessed, informed consent was obtained and ethical clearance was obtained from the institution. For this, a pilot study was done with 10 asymptomatic people aged between 18 to 30 years. Pelvic inclination angle of Rt. And Lt. innominate bone was measured to test intertester and intratester reliability.

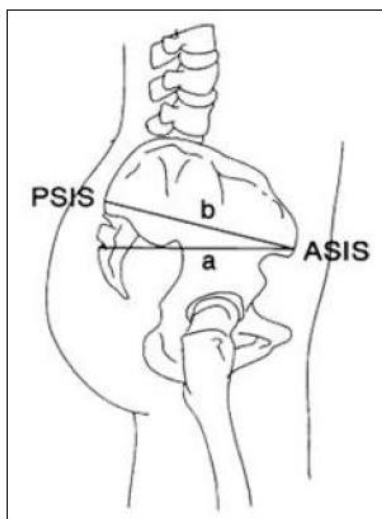
RESULTS: A significant and positive correlation was observed between tester 1 and tester 2 scores of pelvic tilt right side ($r=1.0000$, $p=0.0001$) and left side ($r=0.7101$, $p=0.0001$) and significant and positive correlation was observed between test and retest scores of pelvic tilt right side by tester 1 ($r=1.0000$, $p=0.0001$) and left side by tester 1 ($r=0.7986$, $p=0.0001$).

CONCLUSION: Pelvic inclination angle recorded by Self designed Pelvic inclinometer is highly reliable to use clinically.

KEYWORDS: Pelvic tilt, inclinometer, reliability

INTRODUCTION

Pelvic tilt angle is defined as the angle between the horizontal plane and the line passing through the center of the PSIS and center of ASIS. It is normally measured using pelvic inclinometer(1)



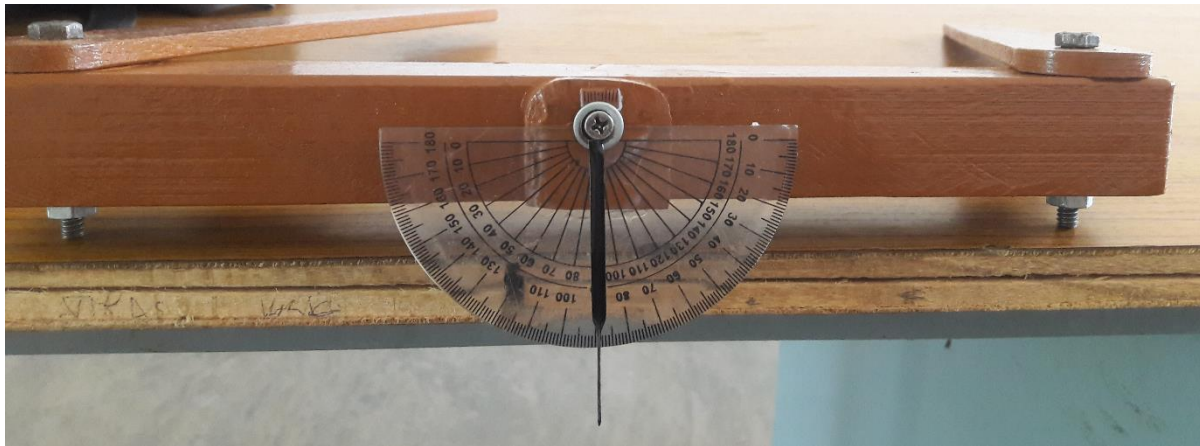
Schematic diagram of the pelvis. The pelvic inclination angle is defined as the angle between the horizontal and a line drawn between the ASIS and the PSIS.

Using portable, reliable, low price and safe measurement tools is necessary in clinical evaluation. Clinically use of a pelvic inclinometer to measure pelvic inclination angles is a quick, non-invasive, user-friendly method. This tool was used in many studies done in different nations by various researchers (2). Moreover, the inaccessibility of indigenously designed equipment in our nation restricted the physiotherapists in India to do complete clinical evaluation of patients. In the present study we have devised a similar method of measuring pelvic tilts by means of an self designed pelvic inclinometer .(3)

This instrument is made from a concept of measuring tilts using three carved wooden pieces in which middle one act as immovable arm and the other two acts as caliper ends. The middle arm, upon which the protractor and pendulum is mounted,

slides through the friction post and continually bisects the space between the arms of the calipers. Thus, the plane of the surface of the protractor always is parallel to a line that connects the tips of the calipers. Such inclinometer was designed in our exercise therapy lab at the college of physiotherapy, Dayanand Sagar University, Bangalore.

FIG 1: SELF DESIGNED PELVIC INCLINOMETER



II.METHOD OF CLINICAL MEASUREMENT OF PELVIC INCLINATION ANGLE

The examiner has to keep one tip of the calipers to the anterior-superior iliac spine (ASIS) of one of the subject's ilia; then the other tip to the posterior-superior spine (PSIS) of the same ilium; and, finally, examiner has to bring the closed end of the calipers to a position such that the pendulum hangs free over the protractor. In this position, the plane of the protractor is perpendicular to the floor and the therapist can thus measure the angle of inclination of that ilium from the protractor scale. (4)

Since 1936, clinicians have attempted to measure inclination of the pelvis by developing instruments that are sufficiently precise and methods that are sufficiently reliable to meet their need to document clinical theories. (5)(6)

Precision of instruments to measure innominate bone inclination is important because of the relatively small amount of excursion of the pelvis as a whole and the even smaller movement available between the two innominate bones. Also et al reported ranges of total pelvic tilt between 10.9 and 17.1⁰.(7) Precision is critical to measure asymmetrically inclined innominate bones which may differ, in position only from 1 to 11⁰ or a few mm. This excursion becomes even smaller after the third decade of life. It is clear, therefore, that clinical measures must achieve very small ranges of variability to detect changes in innominate bone inclination associated with dysfunction or in response to treatment. (7)(8)

Radiographic studies are generally accepted as providing the most accurate data on innominate bone inclination, but this method is generally regarded as "expensive and potentially harmful". Repeated radiographic studies are not feasible for ongoing clinical assessments of treatment effects.(2) Most visual and palpatory assessment methods, although widely used by physical therapists, are supported by little objective and verifiable data. Visual assessment of ASIS, PSIS and crest height used in combination were found acceptable to detect qualitative but not quantitative pelvic asymmetry.(9) Potter and Rothstein demonstrated that testers agreed on ASIS and PSIS levels only 3.538% of the time.(10)

The purpose of this study was to determine whether a method of measurement using a self-designed inclinometer would provide reliable measures of innominate inclination with a clinically acceptable degree of precision. Specifically, we determined the Intra tester and Inter tester reliability for our method of measurement of pelvic inclination using that self-designed inclinometer.

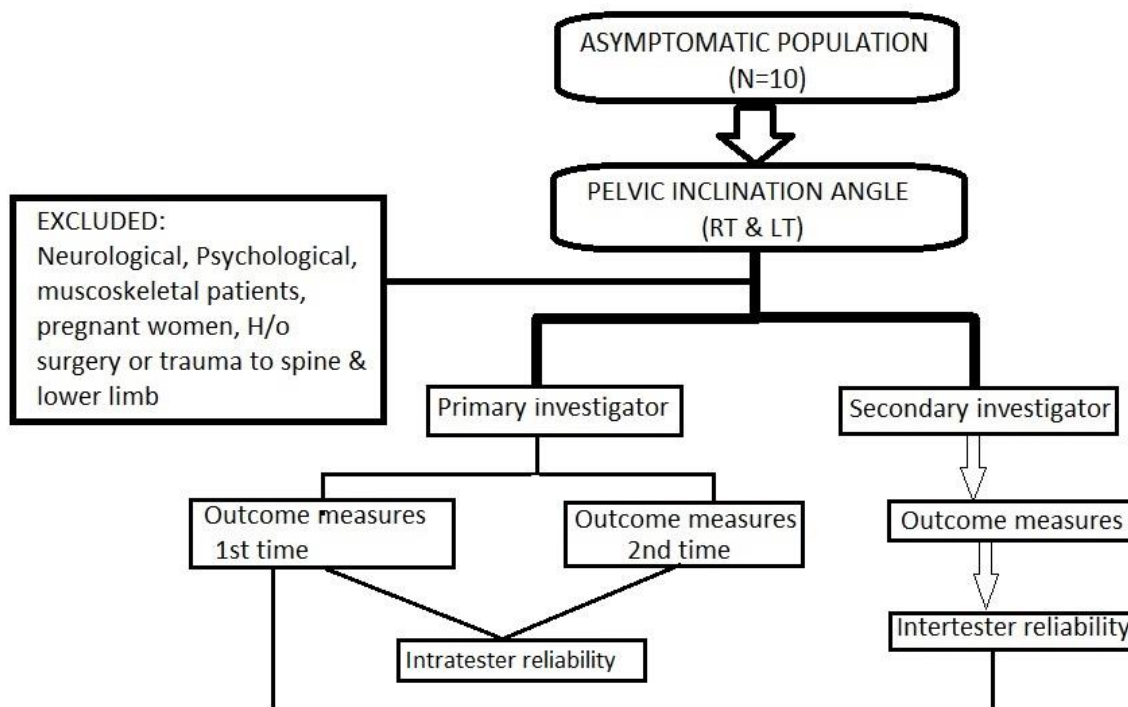
III.OBJECTIVES

To determine the intra-tester and inter-tester reliability of measures taken with a pelvic inclinometer designed indigenously.

IV.MATERIALS & METHODOLOGY

A self-designed Pelvic inclinometer and marker pens were used. All the subjects were explained the purpose of the study. A signed consent form was also procured prior to enrolling the subjects in the experiment. The Ethical committee of Dayanand Sagar University granted the permission to carry out the research. For this, a pilot study has been done with 10 asymptomatic people aged between 18 to 30 years. Pelvic inclination angle of Rt. And Lt. innominate bone was also measured clinically using the self-designed Pelvic inclinometer.

FIG 2: (FLOWCHART SHOWING THE METHODOLOGY OF THE STUDY)



Subjects adopted an erect posture with weight evenly distributed and arms crossed over their chest while the investigator palpated the ASIS and PSIS. Initial palpation of the ASIS was made by bringing the thumbs from inferior to superior and then on the most prominent protrusion of the ASIS, where it was marked with felt tip. The PSIS was then palpated and marked by tracing the iliac crest posteriorly and then moving the thumbs superiorly and laterally from the sacrum edge to the most prominent protrusion. Once palpated the caliper tips established position over the marked landmarks and were compressed to a firm resistance. The angle of inclination was directly read from the inclinometer by the investigator.(11) Three measurements were taken for each side to obtain an average. For intra tester reliability three readings on each side taken by prime therapist reading of whom are then compared twice for reliability. For inter tester measurements were taken by 2 investigators (prime therapist & second therapist) whose readings were then compared for reliability.

FIG 3: (METHOD OF MEASURING PELVIC INCLINATION ANGLE USING SELF DESIGNED PELVIC INCLINOMETER)



V.OUTCOME MEASURES

Pelvic Inclination Angle measured using self - designed pelvic inclinometer

VI.DATA ANALYSIS

We used paired t test to determine the difference between the repeated measures by tester 1 itself and the difference between the repeated measures by tester 1 and tester 2. Karl Pearson’s correlation coefficient was used to determine Correlation between tests and retest scores of pelvic tilt angles of right and left sides by tester 1 and to determine correlation between scores of pelvic tilt

angles of right and left sides by tester 1 and tester 2. In addition, the standard deviations and means for all of the measurements were computed, and agreement among testers was determined.

VII.RESULTS

Table 1: Comparison of tester 1 and tester 2 with respect to pelvic tilt right and left sides by paired t test

Variables	Examiner	Mean	Std.Dv.	Mean Diff.	SD Diff.	Paired t	p-value
Pelvic tilt right	Tester 1	19.00	0.94	0.00	--	--	--
	Tester 2	19.00	0.94				
Pelvic tilt left	Tester 1	19.10	0.88	0.00	0.67	0.0000	1.0000
	Tester 2	19.10	0.88				

According to Table 1 there is no difference between tester 1 and tester 2 with respect to pelvic tilt scores at right side ($p=1.0000$). It means that, no difference was observed between tester 1 and tester 2 in assessment of pelvic tilt scores at right side. In other words, there is a perfect agreement was observed between tester 1 and tester 2 in assessment of pelvic tilt scores at right side. And there is no difference between tester 1 and tester 2 with respect to pelvic tilt scores at left side ($p=1.0000$). It means that, no difference was observed between tester 1 and tester 2 in assessment of pelvic tilt scores at left side. In other words, there is a perfect agreement was observed between tester 1 and tester 2 in assessment of pelvic tilt scores at left side.

Table 2: Comparison of test and retest pelvic tilt right and left sides by tester 1 by paired t test

Variables	Test	Mean	Std.Dv.	Mean Diff.	SD Diff.	Paired t	p-value
Pelvic tilt right	Test	19.00	0.94	0.00	--	--	--
	Retest	19.00	0.94				
Pelvic tilt left	Test	19.00	0.94	0.10	0.57	0.5571	0.5911
	Retest	18.90	0.74				

According to Table 2 there is no difference between test and retest pelvic tilt scores at right side ($p=1.0000$) by tester 1. It means that, no difference was observed test and retest pelvic tilt scores at right side by tester 1. In other words, perfect agreement was observed between tester 1 measurement values in assessment of pelvic tilt scores at right side. And there is no difference between test and retest pelvic tilt scores at right side ($p=1.0000$) by tester 1. It means that, no difference was observed test and retest pelvic tilt scores at left side by tester 1. In other words, perfect agreement was observed between tester 1 measurement values in assessment of pelvic tilt scores at left side.

Table 3: Correlation between tester 1 and tester 2 scores of pelvic tilt right and left sides by Karl Pearson's correlation coefficient

Variables	Correlation between tester 1 and tester 2 scores	
	R-value	p-value
Pelvic tilt right	1.0000	0.0001*
Pelvic tilt left	0.7101	0.0214*

* $p<0.05$

According to Table 3 a significant and positive correlation was observed between tester 1 and tester 2 scores of pelvic tilt right side ($r=1.0000$, $p=0.0001$) and left side ($r=0.7101$, $p=0.0001$).

Table 4: Correlation between test and retest scores of pelvic tilt right and left sides by tester 1 by Karl Pearson's correlation coefficient

Variables	Correlation between test and retest scores of tester 1	
	R-value	p-value
Right side	1.0000	0.0001*
Left side	0.7986	0.0056*

* $p<0.05$

According to Table 4 a significant and positive correlation was observed between test and retest scores of pelvic tilt right side by tester 1 ($r=1.0000$, $p=0.0001$) and left sides by tester 1 ($r=0.7986$, $p=0.0001$).

VIII. CLINICAL IMPLICATION

The results of this study clearly indicate that an experienced physical therapist can make reliable measurements of pelvic inclination angle with the pelvic inclinometer. This self designed pelvic inclinometer offers promise as a useful measurement device for the clinician who treats postural problems related to pelvic asymmetry and pelvic tilt angle. The precision of the procedure will allow for normative data collection. Clinicians must have knowledge of how much normal variation in measures may occur from day to day, what percent of asymmetry can be expected in both the normal and patient populations, and whether measured changes are significant enough to be attributed to treatment intervention. If a client has palpable landmarks and can stand for 2-4 minutes, then an objective assessment of his or her innominate pelvic inclination angle can be determined. Radiographic studies provide the most accurate data on innominate bone inclination, but this method is generally regarded as potentially harmful and expensive. Repeated radiographic studies are not much feasible for ongoing clinical assessments of treatment effects(12). There is a need for reliable, safe, portable and low price measurement tools in clinical evaluation. Clinically usage of a pelvic inclinometer to measure pelvic inclination angles is a quick, non-invasive, user-friendly method. Moreover, the unavailability of equipment in our country restricted the Indian physiotherapists to do complete clinical evaluation of patients. In the present study we have used a self-designed pelvic inclinometer to measure pelvic tilt angles

IX. CONCLUSION

Pelvic inclination angle recorded by Self designed pelvic inclinometer is highly reliable to use clinically.

X. ABBREVIATIONS/SYMBOLS

ASIS- Anterior superior iliac spine

PSIS- Posterior superior iliac spine

XI. REFERENCES

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