ORIGINAL ARTICLE

Reliability Of Digital Goniometer for The Measurement of Acetabulofemoral Joints Range of Motion

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Abstract

Objective: The study aimed to measure the reliability of a digital goniometer to measure acetabulo-femoral joint's range of motion.

Study Design: Cross sectional study

Setting: Data was collected from general population of Lahore from January 2022 to June 2022

Methodology: It was a cross-sectional study. After taking written consent and IRB from UOL, this study was conducted on healthy mid-age people of Lahore. Healthy males and females of above 18 years of age were included. People with lower extremity injuries, Amputated leg people, Total hip replacement (THR), Osteoarthritic patients, and post-traumatic hip pain were excluded. Internal consistency and test-retest reliability of digital goniometer was measured by using it on hip joint passively by the examiner.

Results: In this current study total of 87 participants included with a mean age of 41.57. In this study, 45(51.7%) males and 42(48.3%) females participated for the study. The table shows the internal consistency of the digital goniometer on flexion, extension, internal and external rotation (PROM) of the hip joint, which is significant as an ICC value indicates moderate reliability between 0.5 and 0.75.

Conclusion: The finding of this study concluded that internal consistency and test-retest reliability of digital goniometer are reliable. According to this study, Hip joint range of motion (PROM) can be calculated by using a digital goniometer.

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Key Words: *Digital goniometer, Hip joint, Internal consistency, reliability, Passive range of motion.*

Introduction

The hip consists of the pelvis and the femoral head, where the femoral head articulates with the acetabulum pelvis, creating the hip joint, also referred to as the Acetabulofemoral joint.[1]

The term "range of motion" refers to the amount of movement around a particular joint or body part. [2,3] The femoral head is the center of the movement in three axes that are all perpendicular to each other and subject to severe forces in the hip joint [4].

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The clinical criterion of range of motion is frequently used for diagnosis, assessing the disease's severity, readiness to return to work, and evaluating the results following therapeutic or surgical intervention.[5] Numerous methods, including but not limited to direct visual estimate, indirect visual estimation, and other methods, can be used to quantify it [6]. Hip joint instability has been identified as a significant problem that interferes with healthy hip function. An increasingly recognized cause of pain and hip dysfunction is traumatic hip instability[7]. Hip joint instability has been identified as a significant problem that interferes with healthy hip function. An increasingly recognized cause of pain and hip dysfunction is traumatic hip instability.[8] The maximum mobility possible at a joint with extra pressure (with muscles relaxed) is known as ROM and is measured with a goniometer.[9] Hip movements in all three cardinal planes include flexion, extension, abduction, adduction, medial, and lateral rotation. These motions can be performed by moving the femur against the pelvis or the pelvis against the femur[2].

The assessment of particular beginning locations and the documentation of particular starting positions are considered when measuring the ROM. Positions, proper patient positioning, and goniometer usage instructions. A goniometer is considered more accurate and reliable than a subjective judgment. It is easy to use, non-invasive and gives the data proven to be a valid assessment of joint ROM.[11] The accuracy of goniometric joint motion measurement has been evaluated under various circumstances for various joint movements.[12] The assessment of particular beginning locations and the documentation of particular starting positions are considered when measuring the ROM. Positions, proper patient positioning, and goniometer usage instructions.[13] Manual goniometers for evaluating a passive hip range of motion in patients with femoro-acetabular impingement have shown validity and test-retest reliability in the previous study.[14] This study highlighted the reliability of a digital goniometer to measure PROM in the hip joint. In this Test-Retest, reliability and internal consistency have been found; this digital goniometer is reliable for measuring the ROM of any joint.

Material & methods:

A cross-sectional study after taking consent and IRB from UOL under number 810. The sample was selected according to previously defined inclusion and exclusion criteria from the general population to observe the reliability of the digital goniometer. The inclusion criteria for this study were healthy mid-age people of Lahore, healthy males, and females of 18 above age. Exclusion criteria included people with lower extremity injuries, amputated leg, total hip replacement (THR), osteoarthritic patients, and post-traumatic hip pain. The digital goniometer measured the passive ROM of the hip joint. The hip's flexion, extension, internal rotation, and external rotation were measured by a digital goniometer. Internal consistency and test-retest reliability of digital goniometer has been measured with the help of SPSS. 1st reading indicates R1, and the second reading was taken after some time and donated as an R2 value.

While measuring flexion of the hip joint person's one leg being brought passively upwards towards the body measured this angle by placing the goniometer on the side of the hip. The normal range of motion is 0- 120 degrees. While calculating the hip joint extension, the person was prone with the test side knee extended passively. The normal range of motion is 0- 30 degrees. While measuring the hip joint's internal rotation, the person was sitting with hip and knee flexed to 90 degrees on the test side. Non-test side away from the test. The normal range of motion is 0- 45 degrees. While measuring the hip joint's external rotation, the person was in sit with hip and knee flexed to 90 degrees. Non-test side away from the test. A digital goniometer was placed over the anterior aspect of the patella. The normal range was 0- 45 degrees.

Results

In this current study total of 87 participants participated with a mean age of 41.57. In this study, 45(51.7%) males and 42(48.3%) females participated for the study. Cronbach's Alpha of digital goniometer findings on flexion, extension, internal and external rotations. Cronbach's Alpha measures how closely a group of objects is linked or internal consistency. It is used to determine the scale's dependability.[15] According to this study, Cronbach's Alpha of the four items above is 0.68, 0.67, 0.7, and 0.9, significant.

Table- 1: Digital goniometer Measurements of Right Hip

Movement	Statistics	R1	R2
Flexion	Mean	73.74	76.60
	Std.	8.4498	6.10
	Range	60-110	60-110
Extension	Mean	28.18	74.60
	Std.	3.15	6.10
	Range	0-30	60-110
IR	Mean	27.29	28.12
	Std.	3.012	4.77
	Range	20-40	20-40
ER	Mean	27.29	28.21
	Std.	3.012	4.77
	Range	20-40	20-40

Table-2: Digital goniometer measurements of Left Hip

Movement	Statistics	R1 (16)	R2 (16)
Flexion	Mean	73.74	76.60
	Std.	8.4498	6.10
	Range	60-110	60-110
Extension	Mean	28.18	74.60
	Std.	3.15	6.10
	Range	0-30	60-110
IR	Mean	27.29	28.12
	Std.	3.012	4.77
	Range	20-40	20-40
ER	Mean	27.29	28.21
	Std.	3.012	4.77
	Range	20-40	20-40

Discussion

A goniometer is a device that measures angles and movement at joints. Previous research has shown that the goniometers for assessing a passive hip range of motion in patients with femoro-acetabular impingement have been shown to have validity and test-retest reliability.[17] Still, they did not determine the reliability of a digital goniometer on healthy individuals' hip joint passive range of motion. However, they did not find the reliability of the digital goniometer on the hip joint. [18] This study highlighted the reliability of a digital goniometer for determining the hip joint's passive range of motion (PROM). In this Test-Retest, reliability and internal consistency have been found; this digital goniometer is reliable for measuring the ROM of any joint.

The present study shows the internal consistency of the digital goniometer on flexion, extension, and internal and external rotation (Passive range of motions PROM) of the hip joint, which is significant as the ICC value between 0.5 and 0.75 indicate moderate reliability[16]. It suggests that a digital goniometer is reliable for measuring ROMs. According to a different study, therapists should use standardized testing procedures and interpret and disseminate goniometric results as measurements of ROM alone rather than measurements of additional variables that can influence ROM.

Tables 1 and 2 show R1 (reading 1) and R2 (reading 2) in test-retest reliability in this study. R1 and R2 (intra-rater reliability) are associated, found on a digital goniometer. So Digital goniometer is the best tool to measure passive ROMs in joints and give significant results [19, 20].

Another research was done to determine the accuracy of an external measuring system (the Hawk goniometer). Compared to the universal goniometer for measuring the range of motion in healthy individuals, this digital instrument measures joint fields. They concluded that The Hawk goniometer is a useful and accurate tool for determining the range of motion of the common objective.

Conclusion

This study concluded that digital goniometers' internal consistency and test-retest reliability are reliable. According to this study, a digital goniometer can calculate the hip joint range of motion (PROM).

Author Contributions
Conception and design: *Ayesha Yaqoob*
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Analysis and interpretation of the data: *Faiqa Yaqoob*
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Critical revision of article for intellectual content: *Ayesha Yaqoob*
Statistical expertise: *Faiqa Yaqoob*
Final approval and guarantor of the article: *Ayesha Yaqoob*
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