Research Article

iMedPub Journals
www.imedpub.com

Journal of Physiotherapy Research

2023
Vol.7 No.4:165

Efficacy of Halo Digital Goniometer versus Conventional Goniometer for Assessing Range of Motion in Hip Joint

Deepali Patil* **and Om Wadhokar**

Department of Musculoskeletal Physiotherapy, Ravi Nair College of Physiotherapy, Datta Meghe Institute of Medical Sciences, Sawangi (M), Wardha, Maharashtra, India

***Corresponding author:** Deepali Patil, Department of Musculoskeletal Physiotherapy, Ravi Nair College of Physiotherapy, Datta Meghe Institute of Medical Sciences, Sawangi (M), Wardha, Maharashtra, India, Tel: 919990238972; E-mail: dvjphysio@gmail.com

Received date: November 16, 2022, Manuscript No. IPPR-22-14886; **Editor assigned date:** November 21, 2022, PreQC No. IPPR-22-14886 (PQ); **Reviewed date:** December 06, 2022, QC No. IPPR-22-14886; **Revised date:** April 12, 2023, Manuscript No. IPPR-22-14886 (R); **Published date:** April 19, 2023, DOI: 10.36648/IPPR.7.4.165

Citation: Patil D, Wadhokar O (2023) Efficacy of Halo Digital Goniometer versus Conventional Goniometer for Assessing Range of Motion in Hip Joint. J Physiother Res Vol:7 No:4

Abstract

Hip joint is a synovial ball and socket joint with three degrees of freedom this joint provides great stability and less mobility the articulation is formed by acetabulum and the distal articulation is formed by head of femur. Conventionally the range of motion is assessed by using universal goniometer and after that various smartphone based applications which use sensors like accelerometer, magnetometer for range of motion assessment in recent years a digital goniometer is developed which uses laser, accelerometer and magnetometer for assessment of range of motion. The aim of our study is to compare the reliability and validity of universal goniometer versus halo digital goniometer for assessing the hip joint range of motion in healthy individuals. In this study total 30 individuals are enrolled who are assessed for the hip ROM with universal and halo digital goniometer on the same day. After data collection and statistical analysis, the result of the study will be concluded. They will give us the efficient tool for assessment of range of motion of the joints. On the basis of the data obtained conclusion will be drawn.

The hip joint's Range of Motion (ROM) is an important clinical parameter used in hip assessment. Hip flexion is one of the hip motions that can be measured with a goniometer. The goniometer can simply measure the joint angles. It has some limitations not allowing the clinician to analyse the ROM and track the hip joint during e.g. walking or maximum squat. Motion capture devices are mainly used to analyse the patient's gait and assess the condition of the joints and bones.

Keywords: Hip joint; Goniometer; Halo digital goniometer; Physical therapy; Range of motion

Introduction

Range of motion assessment is an important step in evaluation of patient the assessment is usually done by the conventional method by using universal goniometer which is having considerable inter and intra rater reliability, however validity of the goniometer can be affected by the incorrect use or inexperienced therapist. A study conducted on to compare the efficacy of the universal goniometer versus an I-phone application [1]. The result of the study showed that intra observer reliability of ± 9.6* and inter observer reliability of ± 8.4* for the universal goniometer, and an intra observer reliability of ± 4.6* and inter observer reliability of ± 2.7* for the I phone application. Reflecting significant difference between both tools [2]. As mentioned earlier the reliability and validity of the universal goniometer is multi-factorial such as placement, handling of the therapist, experience of the therapist, underlying condition, secondary complications, Etc.

The hip joint is a ball and socket joint which provide great stability and less mobility, it is surrounded by strong well balanced musculature it is a structural link between axial skeleton and lower body [3]. The stability to the joint is provided by the three strong ligament iliofemoral, ischiofemoral and pubofemoral ligaments.

In recent years due to advancement in the technologies various smart phone applications are used to assess the ROM of the joint and these methods are gaining popularity [4]. Johnson, et al. found that magnetometer based goniometer has equivalent reliability compared to a universal goniometer for passive shoulder abduction ROM whereas active ROM was not assessed [5].

Currently there is only one electric device which uses laser, accelerometer and magnetometer to guide alignment with anatomical landmarks. A study for assess the rotation of the shoulder joint was conducted in 15 healthy individuals, this study found out the reliability of 0.97-0.98 suing HALO digital goniometer. However more researches shoulder be done to assess the reliability and validity of HALO digital goniometer on various joints.

Therefore, the aim of our study is to assess the intra and inter rater reliability and concurrent validity of the laser guided digital goniometer for measuring active hip ROM. In this stud we assess active hip flexion, extension, abduction, adduction, internal and external rotation in healthy individuals.

Materials and Methods

Materials required

- Plinth, pillow.
- Halo digital goniometer.
- Conventional goniometer.
- Pen and paper for recording the assessment.

Methodology

Study type: Cross sectional study type.

Study design: Comparative.

Study setting: Department of musculoskeletal OPD, Ravi Nair college of physiotherapy, Datta Meghe institute of medical sciences, Sawangi, Wardha, India.

Study population: Normal healthy individual.

Sample size calculation: Sample size formula for difference between two means:

$$n = \frac{(z\alpha + Z\beta)2(\delta 1^2 + \delta 2^2/K)}{\Delta^2}$$

Zα is the level of significance at 5% *i.e.* 95% confidence interval=1.96

Zβ is the power of test=80%=0.84

δ1=SD of external rotation in goniometer group=10

δ2=SD of external rotation in inclinometer group=11

Δ=Difference between two means=100-92=8

K=1

n=((1.96 +0.84)2(10*10+11*11/1))/(8*8)

=27.07

=30 patients needed in each group.

Study reference: Morey J Kalber, et al.

Statistical formula: Chisanare test, student's t-test.

Software used: SPSS 27.0 version graph pad prism 7.0 version.

Sample size: 60

Inclusion criteria: Normal healthy individual with no under lying condition the patient must be cognitively sound to follow verbal command and the inclusion with age group more than 18 years age and the individuals who have signed the informed consent form.

Exclusion criteria: Individuals who have undergone any surgical procedure or any pathological conditions of hip.

Participants timeline: Measurements took place on two separate days, 24 h apart (the first measurement was made using the goniometer, and after 24 h the measurement was repeated with the Hawk), by the same evaluator. The order of participants and the measurement sequence were randomized. The evaluator was previously trained according to a predefined measurement protocol, including both the use of the classical goniometer and the digital goniometer.

Procedure

After gaining approval from ethical committee, assessment of the patient was started after approval from the concerned authority individuals are first screened on the basis of inclusion and exclusion criteria, the individuals fulfilling the criteria were then explained about the purpose of the study and written informed consent is taken from the patient.

For assessment of the accurate range of motion demonstration of the desired movement is done by the therapist followed by the subject to do the movement twice this repetition serves as a warm up for the hip joint this warm up period to teach the patient about the range of motion is first asked or perform the active hip ROM, as an initial stretch through that ROM to minimize an increase in range obtained by repeated motions. The patient is asked to maintain the end position then the assessment first measured by HALO followed by universal goniometer.

Then instruct the patient to take the limb to the starting position and then same procedure is repeated for extension, abduction, internal and external rotation. The range of motion for a hip joint is assessed in supine, and prone. All measurements were repeated for each motion of hip joint directed by verbal instruction [6]. While assessing the movement of the second time the warm up period repetition was not done as the warm up phase will loosen the structure further increasing the ROM between the trials.

Outcome measures

Range of motion: Range of motion is the capability of a joint to go through its complete spectrum of movements. Range of motion of a joint can be passive or active.

Data management

Data collection: Information about study given at time of recruitment (elaborating the purpose, nature, procedure, benefits and after effects of the intervention) with all baseline tests and assessment will be repeated on 2 more occasions.

Results

In this study the range of motion of three volunteers including flexion, adduction and internal rotation in 90℃ of flexion was measured using both the video tracking (motion capture) technique and the goniometer instrument. The range of motion of each volunteer was measured at least three times and the average result of each person was used for comparison. All volunteers were female age 28 years old with normal hips. There are no major differences between both motion capture and goniometer methods and the results are in agreement with previously published results [7]. Furthermore, the standard deviation of repeatability of motion capture method was

relatively smaller than goniometer method which shows the video tracking method is more reliable to measure the ROM of the hip joint (Figure 1).

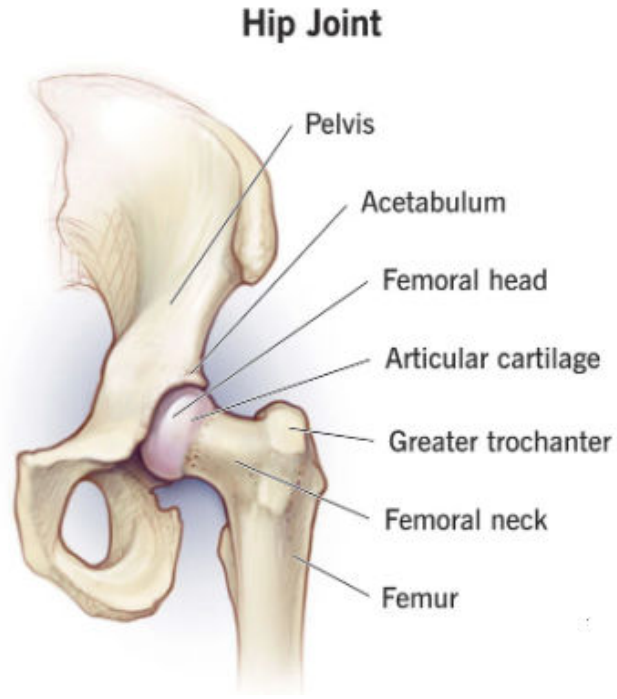

Figure 1: Image describe about hip joint.

Discussion

The protocol will be conducted to assess the reliability and validity of halo digital goniometer versus universal goniometer the assessment of the hip range of motion is done in supine and prone lying. The patient is first instructed how to perform the ROM.

Ethical approval and dissemination

The participant individuals of the study and DMIMSU who will fund it will be able to retrieve findings of study. After completion of study and publication of results data will be stored in the DMIMSU data repository.

Patient consent

Principal investigators will obtain the written informed consent from the participant on a printed form (local language) with signatures and give the proof of confidentiality.

Confidentiality

The study program will be explained to the participant, the principal investigator will take subjective information. The consent form will include the confidentiality statement and signatures of the principal investigator, patient and a witness. If required to disclose some information for the study, consent will be taken from the patient with complete assurance of his confidentiality.

Conclusion

The range of motion of three volunteers (including flexion, adduction and internal rotation in 90℃ of flexion) was measured using both motion capture and goniometer methods. The focus during motion of the hip joint was on the femoroacetabular impingement zone. The study measured the ROM of the hip joint at the end points using both methods, and no major differences between the results were found. Furthermore, the video tracking data displayed a minimum repeatability error in comparison with the goniometer technique.

Declaration of Interests

The authors declare no conflicting interest.

Funding

No direct support will be taken for funding this research from any public and private organizations.

References

1. Norkin C, White DJ (1995) Measurement of joint motion: A guide to goniometry. 5th edition. FA Davis Company, Philadelphia. 241-241
2. Riemann BL, Witt J, Davies GJ (2011) Glenohumeral joint rotation range of motion in competitive swimmers. J Sports Sci 29:1191-1199
3. Jones A, Sealey R, Crowe M, Gordon S (2014) Concurrent validity and reliability of the simple goniometer iPhone app compared with the universal goniometer. Physiother Theory Pract 30:512-516
4. Mitchell K, Gutierrez SB, Sutton S, Morton S, Morgenthaler A (2014) Reliability and validity of goniometric iPhone applications for the assessment of active shoulder external rotation. Physiother Theory Pract 30:521-525
5. Gajdosik RL, Bohannon RW (1987) Clinical measurement of range of motion: Review of goniometry emphasizing reliability and validity. Phys Ther 67:1867-1872
6. Laupattarakasem W, Sirichativapee WI, Kowsuwon W, Sribunditkul S, Suibnugarn CH (1990) Axial rotation gravity goniometer: A simple design of instrument and a controlled reliability study. Clin Orthop Relat Res 251:271-274
7. Dent PA, Wilke B, Terkonda S, Luther I, Shi GG (2020) Validation of teleconference based goniometry for measuring elbow joint range of motion. Cureus 12:6925