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ASSESMENT OF THE PASSIVE HIP JOINT FLEXION, EXTENSION AND ABDUCTION; A COMPARISON BETWEEN THE ELECTRONIC AND UNIVERSAL GONIOMETER AMONG THE HEALTHY UNDERGRADUATE STUDENTS OF IPRS LUMHS, JAMSHORO, PAKISTAN

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ABSTRACT

Objective: To compare the passive range of motion (flexion, extension and abduction) of hip joint by using electronic and universal goniometer among healthy undergraduates students of iprs Lumhs, Jamshoro, Pakistan. **Methodology**: A cross sectional survey was conducted in institute of physiotherapy & rehabilitation sciences, Liaquat university of medical & health sciences, Jamshoro Pakistan from February to August 2018. Flexion, extension and abduction of hip joint was measured by the electronic and universal goniometer among 200 participants and SPSS version 23 was used to analyze the data. **Results:** The majority were (n=157, 78.5%) female and having mean age of 21.4 ± 1.6 years. By using the electronic goniometer the mean scores were hip flexion were 122 ± 1.50, extension 112.9 ± 1.43 and abduction 44.1 ± 1.20, while measuring with universal goniometer the mean scores were hip flexion were 120 ± 1.42, extension 110.7 ± 1.08 and abduction 43.0 ± 1.77. The correlation between the electronic and universal goniometer in hip flexion were (flexion=0.300, extension=0.184, abduction=0.189). **Conclusion**: This Study concluded that both the electronic and universal goniometer are equally valid and reliable in order to measure the passive flexion, extension and abduction of hip joint.

KEYWORDS: Goniometry, Hip Joint, Jamshoro, Pakistan.

INTRODUCTION

The capacity of a joint to move through a specific range is called range of motion, it can be assessed actively as well as passively and the measuring of joint range is known as goniometry.[1] Movement of a joint performed by an individual by actively contracting his muscles through a specific range is called active range of motion.[2] The movement assessed by the examiner through unrestricted range without the involvement of individual muscle is known as passive range of motion.[1] Range of motion is significant in many aspects, the evaluated ranges are documented in patient's history as they are widely accepted as a tool to evaluate impaired mobility.[2] Additionally, range of motion is also a parameter to evaluate functionality of musculoskeletal system.[3] In the clinical setup, it is one of the most common quantitative variable assessed in various conditions. American Academy of Orthopedic Surgeon and a Guide to Goniometry by Norkin and White are most frequently referred sources for assessing normal ranges of joints.[1]

Moreover, the mobility of joint differs from person to person, age, sex, recreational activity participation, functional limitations and power of muscle while assessing range of motion actively by the examiner.[4] Decreased range of motion leads to functional impairment and decreased range is the contributing cause

to increase chance of injury to the musculoskeletal system.[5]

Additionally, the fundamental quantitative component to evaluate the flexibility of hip joint is hip range of motion.[6] The hip joint is the large and have more stability among all the joints. This ball and socket joint moves in variety of axis and in anatomic classification it is known as enarthyroidal diarthosis.[6] This large joint contributes to the movement of human body performs variety of movements such as flexion, extension, abduction, adduction, internal and external rotation and circumduction.[7,8] Hence, this large joint contributes as an important factor in the movement of human body. Therefore, limitation or modification in the degree of range of motion alters that movement pattern.[8]

The Number of methods to measure the range motion have been recorded in the clinical setup including visual estimation, high speed cinematography Goniometry, inclinometry, flexicurves, wire tracing, tape measures electrogoniometry, digital imaging, three dimensional motion analysis system and smart phone based goniometery.[9-11] Despite others methods, in physical therapy settings universal and electronic goniometers are more frequent in practice for measuring the mobility of body segments in various planes such as sagittal, frontal, transverse and rotational. Range of Motion (ROM) is the manual goniometry which was first used to treat injured soldiers during the first world war and has been developed ever since.[12] In history, over the past 6 decades with the development of the profession of physical therapy and rehabilitation the concurrent use of the goniometer has taken its own importance, physiotherapist must have command to access the joint objectively and to measure the ranges accurately.[9,13]

MATERIALS AND METHODS

Study Design, Settings, and Duration
A cross sectional survey was conducted from February to August 2018 and data was collected from the under graduate students of Institute of Physiotherapy & Rehabilitation Sciences, Liaquat University of Medical & Health Sciences, Jamshoro, Sindh.

Sampling
Convenient Non-Probability Sampling Technique was used among 200 healthy male & females undergraduate

participants and who were agreed to participate in the study, While, Participants with any disability, pathology and unwilling to sign inform consent were excluded.

Data Collection Tool
A self-constructed proforma was used to collect the data, which include the demographic Characterstics (age, gender) while the included goniometric observational characteristics were of hip flexion, extension, abduction of (right) lower extremity.

Data Collection Procedure
During the assessment, participants were asked to lay on the examination bed in order to measure the range of motion. Therefore, individual should be in appropriate dressing ensuring the visualization of the body land marks. While the joint is moved the center of rotation of the joint varies therefore goniometric axis was accommodated in accordance .The accuracy in placement of goniometric arms along the body segment ensured that the goniometric axis was over the center of rotation of joint .On the other hand, arms of the instrument were longitudinally adjusted to the body segment. The alignment of fixed arms was remained proximally to the joint segment whereas, movable arm was aligned distally to the joint. The same procedure was performed with universal & electronic goniometer in order to compare the accuracy of results.[9, 10, 13, 14]

Data Analysis Procedure
Data was analyzed and presented in frequency and percentages for categorical variables, mean and standard deviations were presented for continuous variables & Spss (Statistical Package for Social Sciences) 23 version was used.

Ethical Consideration
As the approval was taken from the ethical review committee of Institute of Physiotherapy and Rehabilitation Sciences, Liaquat University of Medical & Health Sciences, Jamshoro, Sindh.

RESULTS

Demographic Characterstics
Gender is described in table 1, which states that the majority (n=157, 78.5%) were female and having the mean age of 21.4 $\pm$ 1.6 years.

Table 1: Demographic Characterstics (Gender).

Gender	Frequency	Percentage
Male	43	21.5
Female	157	78.5
Age	**Mean age**	**St deviation**
18 to 25 years	21.4	1.6 years

Electronic goniometer status
Ranges of motion of hip joint measured with Electronic goniometer are described in table 2, which describes that

in hip flexion the majority (n=51, 25.5%) of participants presented their range of 122 degrees followed by (n=40, 20%) 123 degrees. In measuring the hip extension the

majority (n=61, 30.5%) of participants were measured with the range of 114 degrees followed by (n=59, 29.5%) 113 degrees. While, measuring the abduction majority (n=100, 50%) of participants showed with 45 degrees (complete normal range) followed by (n=60, 30%) 44 degrees of abduction.

Table 2: Electronic goniometer status.

VARIABLE	Frequency	percentage
Hip flexion		
117	00	00
118	00	00
119	13	6.5
120	26	13
121	28	14
122	51	25.5
123	40	20
124	39	19.5
125	03	1.5
Hip extension		
109	00	00
110	19	9.5
111	20	10
112	21	10
113	59	29.5
114	61	30.5
115	20	10
Hip abduction		
40	00	00
41	19	9.5
42	00	00
43	21	10.5
44	60	30
45	100	50

Universal goniometer status
Ranges of motion of hip joint measured with Universal goniometer are described in table 2, which describes that in hip flexion the majority (n=54, 27%) of participants presented their range of 120 degrees followed by (n=53, 26.5%) 121 degrees. In measuring the hip extension the majority (n=82, 41%) of participants were measured with the range of 110 degrees followed by (n=60, 30%) 111 degrees. While, measuring the abduction majority (n=63, 31.5%) of participants presented with 44 degrees followed by (n=43, 22%) 45 degrees of abduction.

Table 3: Universal goniometer status.

VARIABLE	Frequency	Percentage
Hip flexion		
117	13	6.5
118	14	7.0
119	27	13.5
120	54	27
121	53	26.5
122	39	19.5
123	00	00
124	00	00
125	00	00
Hip extension		
109	17	8.5
110	82	41
111	60	30
112	21	10.5

113	20	10
114	00	00
115	00	00
Hip abduction		
40	41	20
41	00	00
42	18	9.0
43	35	17.5
44	63	31.5
45	43	22

Mean and standard deviation for electronic and universal goniometer

Mean and standard deviation for electronic and universal goniometer are describes in table 4, which describes that the in hip flexion the electronic goniometer presented ($\mu=122$, $\sigma \pm1.505$) and universal goniometer presented ($\mu=120$, $\sigma \pm1.422$) mean and standard deviation. In hip

extension which describes that the in hip extension the electronic goniometer presented ($\mu=112$, $\sigma \pm1.438$) and universal goniometer presented ($\mu=110.7$, $\sigma \pm1.089$) mean and standard deviation. While in hip abduction the electronic goniometer presented ($\mu=44.1$, $\sigma \pm1.206$) and universal goniometer presented ($\mu=43.0$, $\sigma \pm1.775$) mean and standard deviation.

Table 4: Mean and standard deviation for electronic and universal goniometer.

VARIABLE	Electronic goniometer Mean+SD	Universal goniometer Mean+SD
Hip flexion	122+1.505	120+1.422
Hip extension	112.9+1.438	110.7+1.089
Hip abduction	44.1+1.206	43.0+1.775

Correlation between the electronic and universal goniometer ranges

Correlation between the ranges measured with electronic and universal goniometer are described in table 6, which states that there is positive relationship between the measurement of Hip flexion with electronic goniometer

Vs Hip flexion with universal goniometer (r=0.300, p<0.05), Hip extension with electronic goniometer Vs Hip extension with universal goniometer (r=0.184, p<0.05) and Hip abduction with electronic goniometer Vs Hip abduction with universal goniometer (r=0.189, p<0.05).

Table 6: Correlation between the electronic and universal goniometer ranges.

Variable	Correlation coefficient	p-value
Hip flexion with electronic goniometer Vs Hip flexion with universal goniometer*	0.300	0.000
Hip extension with electronic goniometer Vs Hip extension with universal goniometer*	0.184	0.009
Hip abduction with electronic goniometer Vs Hip abduction with universal goniometer*	0.189	0.007

*Correlation is significant at 0.01 level (2-tailed).

DISCUSSION

The current study discloses that both the electronic and universal goniometer are equally valid and reliable in measuring the passive ranges of hip joint specially flexion, extension and abduction of hip joint, both the instruments give almost same ranges and no any significant difference was found between the obtained ranges. The study supported by jones et al in 2014, Marques et al in 2017 and finalized that the both electronic and universal goniometer were equally valid for the measurement of the human body range of motion.[15,16] Similarly, studies were conducted by Johnson et al in 2015, Brosseau et al in 1997 and finalized that in measuring the passive range of motion specially of lower extremity, the readings of the both

universal and electronic goniometers were found equally valid and reliable.[17,18] However the studies had some contradictory results in line with current study, conducted by Herrero et al in 2011, Roach et al in 2013 that the electronic goniometer were found more accurate and reliable on comparison with universal goniometer[11,19], furthermore, Yaikwawongs et al in 2009 conducted a study in Thailand and disclosed that the range of motion measured through electronic goniometer is more valid and the electronic goniometer was found more reliable instrument then universal goniometer.[20] The opposite results either can be due to selection of younger age participants or measured passive range of motion of hip joint only.[21,22]

Recommendations

In future the both active and passive range of motions should be measured while comparing the results of electronic and universal goniometer.

Conflicts of Interest

The authors hereby declare there is no conflict of interest with this submission.

Author contributions

All authors contributed equally.

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