Original article:

Intrarater and interrater reliability of Active Knee extension test in Indian youngsters

Dr. Bhagyashree K. Koli[1], *Dr. Deepak B. Anap[2]

[1]Post graduate student (Department of musculoskeletal sciences)
[2]Prof and HOD (Department of musculoskeletal sciences)
DVVPFS College of Physiotherapy, Ahmednagar. 414111
Corresponding author*

Abstract:

Background: Hamstring muscle injury is one of the commonest sports injuries among athletes. Different methods are available to evaluate tightness of the hamstring muscle such as, straight-leg-raising (SLR) test, sit and reach (SR) test, and active knee extension (AKE) test. The AKE test attempts to indicate hamstring musculotendinous length by measuring the angle of knee flexion during active knee extension while the hip is held at 90^{o} of flexion. The purpose of this study was to assess intrarater and interrater reliability of Active Knee extension test in indian youngsters

Method: In this cross sectional study, 16 participants were included using purposive sampling. The tightness was measured by AKE test bilaterally. Three measurement were taken and average of three readings was noted.

Result: The interrater reliability intraclass correlation coefficients ICC was 0.99 for the dominant knee and for non dominant knee with 95% confidence interval. There was a significant difference in dominant and non dominant knee (p=0.000) with respect to hamstring tightness.

Conclusion: Our study demonstrated that AKE have excellent interrater and intrarater reliability for assessing hamstring tightness by using simple portable and inexpensive stabilizing apparatus.

Key words: AKE**,** Interrater, Intrarater, Reliability

Introduction:-

Hamstring muscle injury is one of the commonest sports injuries among athletes. Based on the literature, risks of hamstring muscle injury include previous injury, strength imbalance, older age, inadequate warm-up, poor quadriceps flexibility and muscle fatigue and tightness of the muscle causes lordotic posture.[1]

There are different methods available to evaluate tightness of the hamstring muscle such as, straight-leg-raising (SLR) test, sit and reach (SR) test, and active knee extension (AKE) test. SLR test is widely used for measuring the tightness and for evaluating neurological conditions. AKE an alternate method of measuring hamstring musculotendinous length. Because of the long moment arm created by the lower extremity during the SLR test, the AKE test may be preferred over the SLR test in patients with weakness of the hip or trunk flexors. The AKE test attempts to indicate hamstring musculotendinous length by measuring the angle of knee flexion during active knee extension while the hip is held at 90" of flexion.[1,2]

Some testers have found intra-tester reliability of the AKE test to be high using a metal rig to assist in measurement and straps to limit pelvic and leg motion as per the literature reliability was not found for

youngster's. Hence, The purpose of this study was to assess Intrarater and interrater reliability of Active Knee extension test in Indian youngsters

Method:-

It is an observational study, which was conducted to assess the intrarater and interrater reliability of Active Knee extension test in indian youngsters. Purposive sampling method was used.16 college going students within the age group of 18 to 25 years, volunteered to participate in this study. All participants were free from any orthopaedic or neurological disorders of lower limb.

The AKE testing procedure was explained and demostrated to all the participants, and written informed consent was obtained. The AKE measurements were taken for both knees. The dominant knee was determined based on the participant's preferred leg when kicking a ball, while the other knee was considered the non-dominant knee. Participants were assessed on a plinth in the supine position with both lower extremities extended. Both anterior superior iliac spines were positioned by aligning them with the vertical bars of the apparatus. The lower extremity not being measured was secured to the plinth using a strap across the lower third of the thigh. Each assessor marked the lateral knee joint line with washable ink. From there, two lines were drawn. The first was drawn to the greater trochanter, and another to other was drawn to the apex of the lateral malleolus. The participants were told to flex their hip until the thigh touched the horizontal bar (90°). While maintaining the contact between the thigh and horizontal bar, the participants were asked to extend the knee as much as possible while keeping their foot relaxed and to hold the position for about 5 seconds. A standard universal goniometer was placed over the previously marked joint axis, and the goniometer arms were aligned along the femur and fibula.

The AKE measurement was defined as the degree of knee flexion from terminal knee extension. Each knee was measured thrice, and the mean angle of the AKE test was used for analysis. All participants attended two testing sessions, one day apart to allow for establishment of test-re- test reliability of the method.[1]

Result:-

Data analysis was done using SPSS 25.0 version of IBM software, with the statistical significance level was set at $p<0.05$. In this study there were 16 participants, 1 male, and 15 females, whose anthropometric data was collected before assessing hamstring tightness. The mean of the anthropometric data is mentioned in table 1. The scale from Bland and Altman was used in the classification of the reliability values (≤0.20 poor, 0.21–0.40 fair, 0.41–0.60 moderate, 0.61–0.80 good, and 0.81–1.00 excellent).

Anthropometric data of the participants are shown in Table 1.

Table 1. Anthropometric Data

Anthropometric	Mean ±SD
Age (years)	21.625± 0.59
Weight (kg)	51.75±9.03
Height (cm)	159.03±5.78
BMI (kg/cm^2)	20.38±2.30

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Table 2. Interclass correlation coefficient for Dominant Side

Intraclass correlation Coefficient							p value
	Intraclass correlation	95% confidence interval		F Test with true value 0			
		Lower Bound	Upper Bound	Value	df 1	df 2	0.000
Single Measures	.973[a]	.939	.990	108.925	15	30	
Average Measures	.991[c]	.979	.997	108.925	15	30	

The Intraclass correlation coefficient AKE value for dominant side was 0.99 which was excellent according to Bland and Altman classification with 95% confidence interval. p value was 0.000. (table 4)

Table 3. Interclass correlation coefficient for non dominant Side

Intraclass correlation Coefficient							p value
	Intraclass correlation	95% confidence interval		F Test with true value 0			
		Lower Bound	Upper Bound	Value	df 1	df 2	0.000
Single Measures	.975	.944	.991	119.049	15	30	
Average Measures	.992	.981	.997	119.049	15	30	

The Intraclass correlation coefficient AKE value for dominant side was 0.99 which was excellent according to Bland and Altman classification with 95% confidence interval. p value was 0.000. (table 3)

Discussion:

Concerning the association of poor hamstring flexibility and the risk of hamstring muscle injury, assessment of hamstring flexibility should be routinely conducted. Hamstring flexibility assessment is useful, especially in deciding an athlete's readiness to return-to-play following injury.[5,6] The AKE test is considered to be the gold standard for hamstring flexibility assessment.

But, there is a lack of literature on assessment of hamstring tightness in Indian population which made us to think about this research. The objective of the research was to find out the intrarater and interrater reliability of Active Knee extension test in Indian youngsters.

The AKE test involves less motion in the lumbar spine and pelvis and so was chosen for this test. It should be noted that the AKE test relies on the subjects perception of exertion at full range and this is a limitation of the test.

All participants attended two testing sessions of AKE one day apart with the aid of a simple stabilizing apparatus and a universal goniometer. The test-retest reliability in this study was excellent, with ICC values of

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0.99 and 0.99 with 95% confidence coefficient were found for the dominant and nondominant knees respectively.

Our result are similar to the study done by Gajdosik who reported a Pearson product-moment correlation coefficient for the AKE test of 0.99 for both lower extremities in which population describe.[7]

Another study which was done on interrater and intrarater reliability of the active knee extension test by Mohamad Shariff A Hamid in healthy adults concluded that active knee extension test was more reliable for assessing hamstring tightness.[8]

Gabbe reported excellent test-retest reliability, with ICC values of 0.94–0.96 by using the mean value of AKE measurements from both knees.[8] In contrast to Gabbe et al., the current study evaluated each knee separately to explore any potential differences between the dominant and non dominant knees, and such differences in method may explain the wider ICC values noted in this study. Further, the current study found significant difference in AKE measurement between the dominant and non dominant knee in Indian youngsters (p=0.000).[9]

Rakos et al. performed the AKE test with the aid of an intricate stabilizing apparatus and demonstrated a good interrater reliability with an ICC of 0.79 among children

age 10 to 13 years old.[10]

Limitation of our study was number of males were less then females and sample size was small.

Conclusion:-

Our study demonstrated that AKE have excellent interrater and intrarater reliability for assessing hamstring tightness by using simple portable and inexpensive stabilizing apparatus in ypungsters.

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