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COMPARISON OF ACTIVE KNEE EXTENSION TEST AND STRAIGHT LEG RAISE ANGLE IN VISUAL DISPLAY TERMINAL OPERATORS WITH OR WITHOUT LOW BACK PAIN

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ABSTRACT

Background: Low back pain is a common musculoskeletal problem1. It is the leading cause of disability. Low back pain among office workers have become the subject of growing concern with the expanding use of Visual Display Terminals (VDTs) (Shahab, 2012).
Objective: To find out the comparison of active knee extension test and straight leg raise angle in visual display terminal operators with or without low back pain.
Study Design: Non-experimental design and observational type.
Procedure: 101 subjects were selected based upon the inclusion criteria and exclusion criteria. Both the active knee extension test and straight leg raising test had been carried to the subjects by using digital inclinometer and pressure biofeedback unit and the reading was noted.
Results: The mean value of Active Knee Extension angle is 166.00 and the mean value of Straight leg raise angle is 8.20. The significant value is 0.274 since the p value >0.05 and hence the correlation between the active knee extension test and straight leg raise angle is not significant. There is no correlation of AKE angle and SLR sciatic angle with the gender, low back pain, years of experience, working hours and there is non-significant results thereby p value >0.05.
Conclusion: The study concludes that there is no correlation and sensitivity exists between both the active knee extension test and straight leg raise in visual display terminal operators with or without low back pain.

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INTRODUCTION

Visual display terminal operators are the workers who operate computers (visual display terminals or VDTs) on daily basis in work place and are exposed to hazards related to continued usage. Due to increased use of computers, there has been increased prevalence of musculoskeletal problems among visual display terminal operators. The ergonomic injuries and illness has been increased in the computer workstation (Shahab, 2012).

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There is an increased prevalence of low back pain in the body due to increased use of visual display terminal (VDT) use. The poor workstation design in the work set up has led to an increased risk for developing the symptoms (Shahab, 2012).
Prolonged static muscle load, workstation factors have been identified as risk factors for musculoskeletal diseases. In the computing environment, incorrect computer workstation set up, prolonged work in an awkward positions, seated static work and overuse have been identified as a major risk factor for low back pain (De A Seneviratne *et al.,* 2001). The symptoms adversely affect the worker's quality of life, efficiency of work and result in decreased productivity.

Prolonged working hours and number of years of experience in terms of occupational exposure have been found to be associated with low back pain (Supreet Bindra *et al.,* 2014). According to the report of WHO in 2002, low back pain estimated of about 37% of all occupational risk factors which occupies first rank among the disease complications caused by work. Such high prevalence of complications at international levels has made the World Health Organization to name it as "decade of campaign against musculoskeletal problems as the silent epidemic" (WHO 2005) (Supreet Bindra *et al.,* 2014). Some important postural control muscles are inactivated when the visual display terminal operators were subjected to prolonged sitting in a standard chair, while the other muscles act overtime (Bruce Thomson 2003). The hamstring muscles are inactive during office chair sitting and results in shortening which is considered to be the major cause for tightness of hamstring muscles. There is an increased load on the lumbopelvic region due to prolonged sitting which results in shortening of muscles which occurs due to reduced circulation of blood to the lower extremities (Valachi and Valachi, 2003). The factors which contributes the low back pain are the tissues either the muscle or nerve that present around the lumbopelvic region. The lumbar spine and static or dynamic posture of pelvis are affected due to hamstring shortening (Valachi, 2003).

The hamstring muscle length were assessed by various methods but all these methods do not provide adequate hamstrings isolation[6]. For this purpose while testing, the pelvis and the spine should be adequately stabilized. The straight leg raise test is often used to measure the hamstring muscle length, and this test do not control the movement of pelvis (Rakos Shaw *et al.,* 2001). The active knee extension test is used to measure the length of the hamstring muscle and the advantage is that through stabilization, the movement of hip joint, sacroiliac joint and lumbar spine are controlled (Rakos Shaw *et al.,* 2001). This study focusses on the comparison of the active knee extension test and straight leg raise angle in visual display terminal operators with or without low back pain. The hamstring muscle length is measured by using active knee extension test. To measure sciatic nerve tension the straight leg raise test is used. This study emphasized on the comparison of the active knee extension test and straight leg raise angle. This study has been carried out to find out the sensitivity of the active knee extension test and straight leg raise angle. The application of active knee extension test and straight leg raise angle had been applied to the visual display terminal operators who were prone for prolonged sitting with awkward postures (Aaras *et al.,* 1997). So, this study was carried out to find out the impact of both these tests on the visual display terminal operators with or without low back pain.

Aim of the study

- The Aim of the study is to compare the active knee extension (AKE) test and straight leg raise (SLR) angle in visual display terminal operators with or without low back pain.
- To find out the sensitivity of active knee extension test (AKE) and straight leg raise (SLR) angle in diagnosis of low back pain in visual display terminal operators.

Need for the study

This study is to emphasize that both the active knee extension test and straight leg raise angle provides a diagnostic tool that indirectly contributes to diagnosis of low back pain. Visual display terminal operators usually have decreased hamstring length and increased sciatic nerve tension which may influence the active knee extension (AKE) test and straight leg raise (SLR) angle in order to diagnose low back pain. Usually in physiotherapy assessment we use straight leg raise test to find the nerve tension involved with low back pain. But subjects with shortened hamstrings also found to report positive for this test. This study concerns whether both the active knee extension test and straight leg raise angle indirectly contributes to the diagnosis of low back pain. Hence this study is to find out the sensitivity of active knee extension test and straight leg raise angle among visual display terminal operators.

MATERIALS AND METHODS

Study design: Non-experimental design, STUDY TYPE - Observational type

Sampling Method: Convenient sampling,

Sample Size:101

Study Setting: Information Technology Park, University Building, SRM UNIVERSITY, Kattankulathur

Inclusion Criteria

Age 20-30 years, Both men and women, Low back pain – Both Yes and No, Years of experience
Working hours – 4 and more than 4 hours

Exclusion criteria

Recent fracture in spine, Tuberculosis of spine, Pregnant women, Recent hip or knee surgery.

Materials used: Goniometer, Ruler**,** Digital inclinometer**,** Pressure biofeedback unit**,** Straps.

Procedure

The study included about 101 subjects. The informed consent were obtained from the subjects and the subjects were selected based upon the inclusion and exclusion criteria. In general population of visual display terminal operators the subjects were taken as with or without low back pain.

The procedure was explained to the subjects and both the active knee extension test and straight leg raise angle has been carried to the subjects.

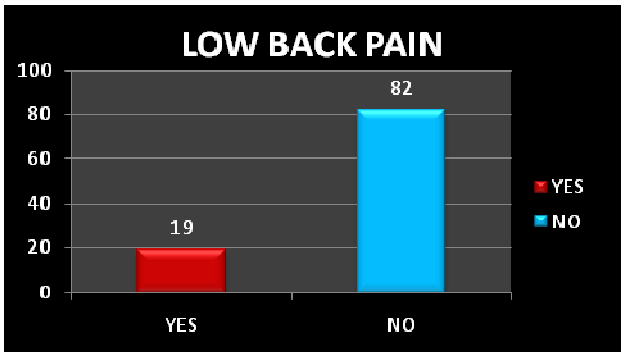
Active knee extension test

The active knee extension test is used to measure hamstring muscle length in the dominant lower limb. The dominant lower limb is assessed by asking the subject to kick a ball. The subject's preferred leg for kicking a ball is considered to be the dominant lower limb for the subject. Gajdosik and Lusin advocate AKE test as it is more selective for measuring hamstring length than passive SLR. The subject was made to lie in a supine position.

A goniometer is placed in the greater trochanter and subject flexed the hip to 90 degrees and the position is maintained. To prevent the compensated movement in the lumbopelvic region the pressure biofeedback unit is placed between the testing table and the lumbopelvic region (L4 – S1). An optimum pressure of about 40 mmHg is inflated in the pressure biofeedback unit in the adopted position. A pressure drop of about 10 mmHg is acceptable. An inclinometer along with the ruler is attached to the line from the lateral epicondyle of femur to the lateral malleolus. In the testing position, after adjusting the inclinometer to 0 degrees the subject is asked to extend the knee until they could feel the hamstring muscle resistance. At that point, AKE angle was indicated as the hamstring muscle length which was measured by the digital inclinometer. The angle of knee extension is defined as AKE.

Straight leg raise angle

To measure sciatic nerve tension of the dominant lower limb the straight leg raise test has been used. The subjects asked to lie in a supine position with both legs straight and an inclinometer along with a ruler was placed on the lower leg from the lateral epicondyle of femur to the lateral malleolus. After the inclinometer was adjusted to 0 degrees the test is performed with the ankle in relaxed position. With 15 degrees dorsiflexion of ankle, (SLR modification) is performed and the angle was measured. There is a visual monitoring of angle of hip, knee, ankle during the tests. The test is considered to be failure when there is an external rotation of hip, knee flexion or the ankle in plantarflexion. The expression of sciatic nerve tension is $SLR_{sciatic}$ angle.



Graph 1. The graphical representation of 101 subjects with and without low back pain

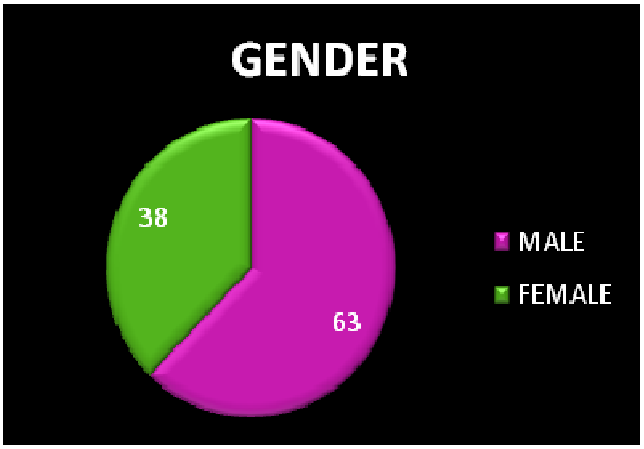
Outcome Measures: Active Knee Extension test and Straight leg raise angle.

Data Analysis: The data were analyzed using IBM SPSS Statistics 20. The Pearson correlation and chi square tests were used to find out the correlation between the active knee extension test and straight leg raise angle.

RESULTS

Graph 1. Shows the 101 subjects with and without low back pain which includes the subject with low back pain is 19 and subjects without low back pain is 82.

Graph 2. Shows the gender distribution of 101 subjects which includes 63 males and 38 females.



Graph 2. Graphical representation of gender distribution of about 101 subjects with or without low back pain

Graph 3. Shows the years of experience of 101 subjects with or without low back pain, Most of them are with 2 years of experience (32 numbers).

Graph 3. Graphical representation of years of experience of 101 subjects with or without low back pain

Graph 4. Shows the working hours of 101 subjects with or without low back pain. Most of them work five hours a day (23 Numbers). The table 1 depicts the correlation between the Active knee extension angle and Straight leg raise angle. The mean value of Active knee extension angle is 166.00 and the mean value of Straight leg raise angle is 8.20. The significant value is .274 since the p value >0.05 and hence the correlation between the active knee extension test and straight leg raise angle is not significant. Table 2 shows The Chi square tests has been used to find out the correlation of AKE angle and $SLR_{sciatic}$ angle between the Gender, Low back pain, Years of experience and Working hours.

Table 1. Correlation between the active knee extension angle and SLR sciatic angle among 101 subjects with or without low back pain

VARIABLES	N	MEAN	Df	STD DEVIATION	PEARSON CORRELATION	SIG VALUE
AKE ANGLE	101	167.00	99	11.04	1	.274
$SLR_{SCIATIC}$ ANGLE	101	8.20	99	6.002	110	

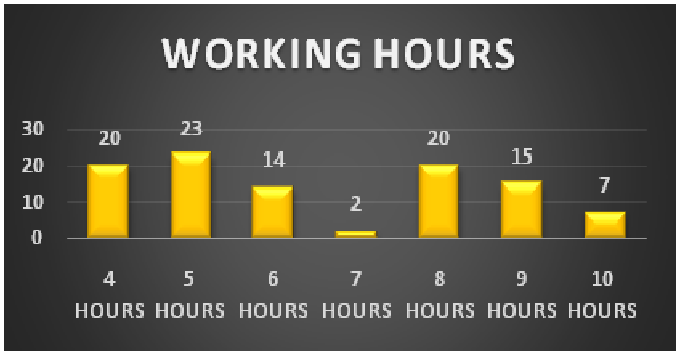
p>0.05

This table shows that the mean of AKE angle is 167.00 and mean of SLR SCIATIC angle is 8.20 and there was a no significant correlation between AKE angle and SLR SCIATIC angle(p>0.05)

Table 2.

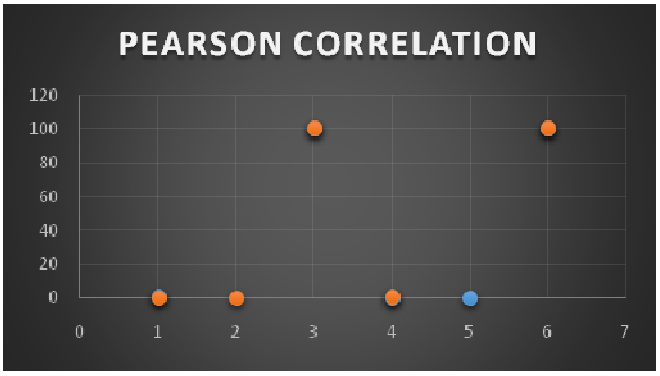
VARIABLES	GENDER		AGE	Df	VALUE X2	SIG.VALUE
	MALE	FEMALE				
GENDER Vs AKE ANGLE	63	38	20 – 30	34	40.16[a]	.216
GENDER Vs $SLR_{SCIATIC}$ ANGLE	63	38	20 – 30	20	15.466[a]	.749
LBA Vs AKE ANGLE	63	38	20 – 30	34	23.989[a]	.899
LBA Vs $SLR_{SCIATIC}$ ANGLE	63	38	20 – 30	20	25.099[a]	.198
YEARS OF EXPERIENCE Vs AKE ANGLE	63	38	20 – 30	408	450.938[a]	.070
YEARS OF EXPERIENCE Vs $SLR_{SCIATIC}$ ANGLE	63	38	20 – 30	240	249.158[a]	.329
WORKING HOURS Vs AKE ANGLE	63	38	20 – 30	204	212.725[a]	.323
WORKING HOURS Vs $SLR_{SCIATIC}$ ANGLE	63	38	20 – 30	120	112.050[a]	.685

Correlation of AKE and SLR sciatic angle with gender, LBA, years of experience and number of working hours among 101 subjects with or without low back pain



Graph 4. Graphical representation of the working hours of101 sub JECTS with or without low back pain

Graph 5. Shows the correlation of active extension angle and $SLR_{sciatic}$ angle with or without low back pain. The correlation of AKE angle with the gender shows the significant value of .216 since the p value > 0.05. The correlation of $SLR_{sciatic}$ angle with the gender shows the significant value of .274 since the p value >0.05 and hence the correlation of AKE angle and $SLR_{sciatic}$ angle with gender is not significant.



Graph 5. Correlation between the active knee extension angle and slr $_{sciatic}$ angle among 101 subjects with or without low back pain

The correlation of AKE angle with the low back pain shows the significant value of .889 since the p value> 0.05. The correlation of SLR $_{sciatic}$ angle with the low back pain shows the significant value of .198 since the p value >0.05. Hence the correlation of AKE angle and $SLR_{sciatic}$ angle with low back pain is not significant. The correlation of AKE angle with the years of experience shows the significant value of .070 since the p value>0.05. The correlation of SLR $_{sciatic}$ angle with the low back pain shows the significant value of .329 since the p value>0.05. Hence the correlation of AKE angle and SLR $_{sciatic}$ angle with the years of experience is not significant. The correlation of AKE angle with the working hours shows the significant value of .323 since the p value>0.05. The correlation of SLR $_{sciatic}$ angle with the working hours shows the significant value of .685. Hence the correlation of AKE angle and SLR $_{sciatic}$ angle with the working hours is not significant. The table shows non-significant results thereby p value >0.05

DISCUSSION

This study aimed to find out the comparison of active knee extension test and straight leg raise angle in visual display terminal operators with or without low back pain. Usually in physiotherapy assessment we use straight leg raise test to find the nerve tension involved with low back pain. But subjects with shortened hamstrings also found to report positive for this test. This study concerns whether both the active knee extension test and straight leg raise angle indirectly contributes to the diagnosis of low back pain and also to find out the sensitivity of both the tests. The results of this study shows that there is no correlation between the active knee extension test and straight leg raise angle. The prevalence of low back pain population in the study were 19 subjects and this is due to a fact that subjects were not exposed to more number of working hours and with the less years of experience. P Shahul Hameed in his study reported that Low Back Pain prevalence was 203 (51%) among the employees of about 400 subjects. It is noted that the subjects with low back pain have put in more hours of work per week. The study shows no correlation exists between active knee extension test and gender (p>0.05) which shows that there was no association between the gender and shortening of hamstrings. This results was in controversy with the authors like Gopi S Mistry, Neeta J. Vyas, Megha S. Sheth who proved that hamstring muscle length were found to be more in women than in men. The authors reported that difference is generally attributed to anatomical variations in the joint structures. Some authors like Yvonne Kane and Jay Bernasconi stated that.

There is a support of the clinical observation that women have greater hamstring flexibility than males and this is due to a fact that females have greater knee extension and less pelvic motion than males. This study also shows no correlation between SLR and gender ($p>0.05$) which shows that there was no association between sciatic nerve tension and gender. This results was in controversy with the authors like Benjamin S Boyd and Philip S Villa proved that the women had more SLR range of motion bilaterally compared to men. Authors like Eva sierra, Maria Torres Lacomba, and Pedro de la villa polo stated that the SLR hip range of motion is influenced by sex in asymptomatic individuals, leading to a greater hip range of motion in SLR in women. There is no significant correlation between the AKE angle and SLR sciatic angle with the low back pain as the statistical results were $p>0.05$ and this is due to the reason that low back pain population included in the study were smaller in size (19%) and also mostly it is a mechanical type of pain and the subjects symptoms were not significant. The study shows there is no significant correlation of AKE angle with the low back pain as there is no association of active knee extension angle with the low back pain. This results was in controversy with the authors like Richard Gajdosik and Gary Lusin stated that the hamstring tightness contributes to low back pain and the authors proved that active knee extension test should provide both clinician and researchers with a reliable method of measuring hamstring muscle tightness, and a reliable measurements will permit documentation of this hamstring tightness and change in muscle tightness after a specific course of treatment. This study also shows there is no significant correlation of $SLR_{sciatic}$ angle with the low back pain which shows there is no correlation of $SLR_{sciatic}$ angle with the low back pain. This results was in controversy with some authors like Lawrence M Urban BA, DPT proved that the straight leg raising test is routinely employed when assessing patients with low back pain. In most cases it is recorded as either positive or negative. A positive sign of unilateral straight leg raising is routinely interpreted as a ‘’disc problem’’ and it was found that a test has minimal value in isolating a patient with herniated disc which differs from other patients with low back pain and sciatica.

And some authors like Rebain *et al* stated that hamstring muscle were found to have a defensive role in protecting nerve roots by limiting the passive straight leg raise range of motion in cases of nerve root irritation. There is no correlation of AKE angle and SLR sciatic angle with the years of experience as the statistical results were $p>0.05$ and this is due to the reason that subjects included in the study were exposed to less years of experience like 2 years and future studies should look on subjects exposed to more number of years of experience.This is supported by Maryam rezaee *et al* stated that more than 10 years of working experience has found to influence low back pain. There is no correlation of AKE angle and SLR sciatic angle with the working hours as the statistical results were $p>0.05$ and this is due to the reason that the subjects included in the study were exposed to less number of working hours like 5 hours and future studies should look on subjects with more number of working hours. This goes in hand with Maryamrezaee, mohammad ghasemi, nematollah jonaidi jafari and morteza Izadi stated that the daily sitting time in the work place of 4-8 hours were found to influence the development of musculoskeletal pain. This study carried to find out the correlation of the active knee extension test and straight leg raise angle. But there is no correlation between the active knee extension test and straight leg raise angle.

There is no sensitivity between both the tests. Gajdosik and Lusin (1986) stated the active knee extension test have good interrater reliability and found to be effective when used with the stabilizing apparatus for measuring hamstring muscle length. Tiago Neto, Lia Jacobsohn, Ana I. Carita, and Raul oliveria stated that the straight leg raise test were found to have excellent intrarater reliability. The standard error measurements and minimal detectable differences recorded are also very encouraging for the use of these tests in subjects with flexibility deficits. Hence this study concludes that either active knee extension test or straight leg raise test can be used to assess low back pain. This study has some limitations like low back pain population included in the study were smaller in size and thorough history of low back pain has not been taken due to insufficient study duration. Future studies should look for more number of population with low back pain.

Conclusion

The study concludes that there is no influence and sensitivity between the active knee extension test and straight leg raise in visual display terminal operators with or without low back pain. Hence either active knee extension test or the straight leg raise test can been used to assess low back pain in visual display terminal operators

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