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Effect of prolong sitting on hamstring flexibility on schoolchildren: An observational study

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Abstract

Background and Objective: Sedentary lifestyle has emanated as a new attention for research on exercise and health. Information Technology and computer technology advancement has increased the sitting time of people. People can do all their work like reading, writing and attending meetings without leaving desks. In the sitting positions biomechanics of the person also changes. When the person sits from 6 to 8 hours, he/she faces mechanical stresses which can be short term or long term. The high rate of people suffering from tight, inflexible hamstrings is related to occupations that require sitting for long hours. Hamstring tightness occurs in early childhood and it tends to increase with age.

Methods: 200 schoolchildren with age of 10-15 years were selected on the basis of inclusion and exclusion criteria from various schools of Kamrej. Demographic data and consent were taken and straight leg raise test and Active knee extension test were performed. The degree of hip and knee joint were measured by using universal goniometer.

Results: Data were analyzed by using SPSS software 15.00 by t-test which showed significant effect in SLR and AKET in school children due to prolong sitting on hamstring flexibility.

Conclusion: The effect of prolong sitting can affect hamstring flexibility in schoolchildren.

Keywords: hamstring tightness, popliteal angle, prolonged sitting, straight leg raising test, active knee extension test

Introduction

Flexibility is the ability to move a single joint or series of joint smoothly and easily through an unrestricted, pain free Range of Motion (ROM). Flexibility is related to the extensibility of a muscle-tendon unit that cross a joint, based on their ability to relax or deform and yield to stretch force [1]. Flexibility is a vital component of fitness required for most desirable musculoskeletal functioning and maximizing the performance of physical activities [2].

Information Technology and computer technology advancement has increased the sitting time of people. People can do all their work like reading, writing and attending meetings without leaving desks [3]. Sedentary lifestyles are an undesirable hallmark of modern society, affecting a significant proportion of the population [4]. Prolonged sitting (a form of sedentary behavior) has progressively become the norm with computerization in the work place, transportation modernization and advances in domestic technology [5]. These developments are not only detrimental for physiological health and well-being with rising levels of obesity, diabetes and cardiovascular disease [6]. In the sitting positions biomechanics of the person also changes. When the person sits from 6 to 8 hours, he/she faces mechanical stresses which can be short term or long term [3].

Nowadays children spend increasingly more time in a seated position both at school during class and at home in front of a computer or television. Children aged 4-15 year are sedentary for an average of 7-8 hours day. Incontrast to walking and running, muscle are not actively used while sitting. Muscular inactivation over long periods of time leads to the weakening of corresponding muscle [7].

Hamstring tightness occurs due to decreased muscle flexibility and ability to deform which results in reduced range of motion (ROM) around a joint. Inelasticity is actually a deformation of the muscle fibres which in turn leads to decrease range of motion of the joint [8].

Repetitive prolonged sitting eventually leads to shortening of hamstring muscles [9]. In six to eight hours of sitting, degeneration and atrophy of the muscles start which leads to the shortening, tightness and reduced flexibility of hamstring muscles [10].

Hamstring tightness occurs in early childhood and it tends to increase with age. The progressive decline in flexibility with age has been attributed to change in elasticity and decreased level of physical activities [11, 12].

The hamstring flexibility is influenced by a number of factors like age, gender, Body mass index (BMI), occupation and physical inactivity [13].

Many reasons can lead to the development of hamstring tightness such as genetic predisposition, injury to muscle and adaptive shortening due to some chronic condition. [14]

The prolonged sitting hours required in most of the jobs and educational setups can affect flexibility of soft tissues, especially two joint muscles. Reduced flexibility generates a vicious circle of range reduction and resulting in increased postural problems. Tight muscles also compress the blood vessels and lead to reduced optimal performance [15].

The hamstring muscles are commonly linked with movement dysfunction at the lumbar spine, pelvis and lower limbs and have been coupled with low back pain and gait abnormality [16]. Of all these, reduction in hamstrings flexibility was found to be one of the causes for development of low back pain [17]. Hamstring muscle tightness leads to decreased range of motion of lumbar flexion and pelvic tilt. This can alter the biomechanics of lumbar spine and may lead to back pain [18]. Hamstring strain is one of the most commonly suspected complaints resulting from hamstring tightness [19].

According to Gajdosik *et al.*, (2011) pelvic as well as thoracic angle and range of motion are affected by hamstring flexibility in forward bending. Hamstring tightness also influences the lumbar pelvic rhythm. [20] Hamstring tightness is also associated with the development of plantar fasciitis [21] as well as patellar tendinopathy and patella femoral pain syndrome [22]. An association between hamstring tightness and mechanical low back pain is also found in studies showing a positive correlation between hamstring tightness and severity of low back pain [23].

Tight hamstring muscles limit anterior tilt of the pelvis in spinal flexion resulting in aggravated muscle and ligamentous tension in the lumbar region which leads to significantly higher compressive loads on the lumbar spine [24]. Other postural changes associated with tightness of hamstrings can influence stability of sacroiliac joint in an indirect way [25]. Hence, flexibility of hamstring muscles is crucial for overall wellbeing and optimal physical fitness [26].

Tight hamstring muscles increase the patellofemoral compressive force because of the increased passive resistance during the swing phase of ambulation and running [27].

Hamstring tightness may be measured using the active unilateral SLR test [28], the passive unilateral SLR test [29] the sit and reach test, [30] and the active knee extension test (AKET) [31]. The active-knee-extension test (AKE) and the straight-leg-raise test (SLR) are two of the most commonly used measures for flexibility assessment [32].

The need of study is to verify the notion that prolonged sitting can lead to tightness of hamstrings in children. Now a days children increasing more time in seated position, both

at school during class and at home in front of a computer or television. This study will help to create awareness about the lack of normal flexibility maintenance, especially among students.

The aim of study is to find out Effect of prolong sitting on hamstring flexibility in school children. Objectives were to check the effect of prolong sitting on hamstring by using straight leg raise test and active knee extension test in both legs.

Methodology

Study design: An observational study

Sampling technique: Simple convenient sampling

Sample size: 200 students

Source of data: Various Schools, Kamrej

Study duration: 1 day

Selection Criteria

Inclusion criteria

Age group: 10-15 years. Healthy school children. Student who has 6 hour and > 6 hour sitting

Exclusion criteria

Student with history of recent trauma. (within last 3 months). Acute spasm of hamstring muscles, previous surgery, any spinal deformity or any limb length discrepancy. Congenital or acquired anomalies, or neuromuscular disorder of lower extremity. Uncooperative children.

Materials to be used

Universal Goniometer, Consent form, Pen, Paper, Plinth

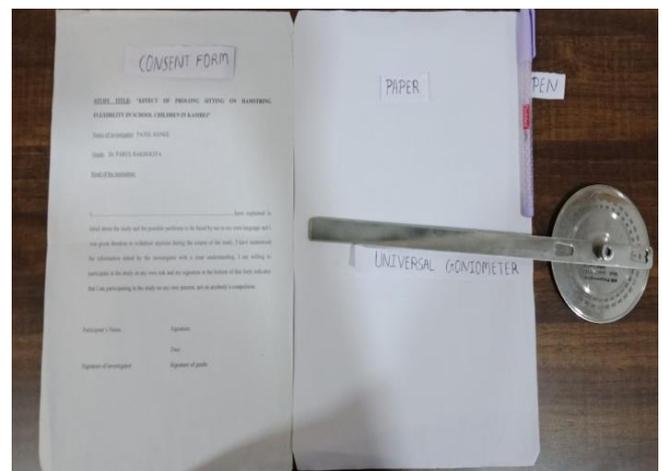


Fig 1: Materials Used In The Study

Methodology

Two hundred students fulfilling the inclusion criteria were participated in study. After taking consent and necessary personal data including name, age, sex, and sitting hours per day were inquired.

Procedure

Straight Leg Raise test and Active Knee Extension test were performed by therapist and student respectively for hamstring tightness.

Straight leg raise Test

Angle of SLR was measured with the help of a universal goniometer. The straight leg raising test is done with the patient completely relaxed. it is passive test and each leg is tested individually. With the patient is in supine position, the hip medially rotated and adducted and knee extended, the examiner flexes the hip until the patient complains of pain or tightness in the back or back of leg [33].

The ICC value found for SLR tests was .93-.97. A moderate to strong, and significant, correlation between AKE and SLR was determined for the dominant limb ($r = .71$) and the non-dominant limb ($r = .67$) [34].



Fig 2: Starting Position of Straight Leg Raise Test



Fig 3: Ending Position of Straight Leg Raise Test

Active Knee Extension Test

For the measurement of popliteal angle, active knee extension test was used. After proper positioning, the hip was flexed at an angle of 90°, and the participant was asked

to extend his/her leg at the knee joint. The angle subtended at the knee joint was measured. The measurement was taken for both lower extremities and then mean was recorded [35].

The ICC values found for AKE was .87-.94. A moderate to strong, and significant, correlation between AKE and SLR was determined for the dominant limb ($r = .71$) and the non-dominant limb ($r = .67$) [34].



Fig 4: Starting Position of Active Knee Extension Test



Fig 5: Ending Position of Active Knee Extension Test

Statistical Analysis

The statistical analysis was done by using SPSS 15 version for windows software. t-test were used to determine the value of outcome measure that effect of prolong sitting on hamstring tightness in school children.

Results

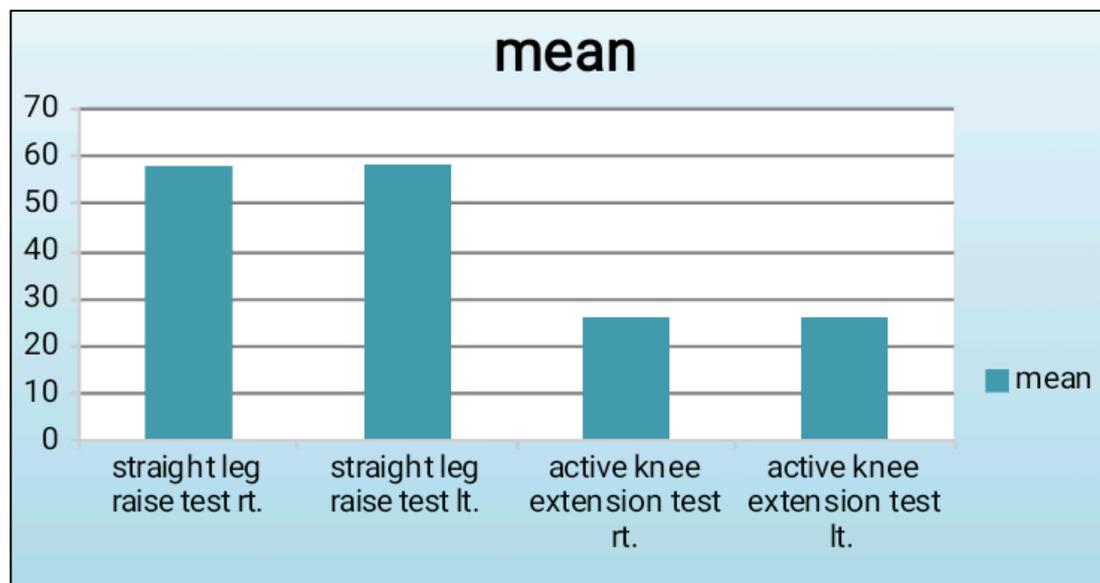
Table and Graph

Table 1: Analysis of Straight Leg Raise Test and Active Knee Extension Test of Right Side and Leftside In Schoolchildren

| | Straight Leg Raise Test Rt | Straight Leg Raise Test Lt | Active Knee Extension Test Rt | Active Knee Extension Test Lt |
|--------------|----------------------------|----------------------------|-------------------------------|-------------------------------|
| Mean | 58.05 | 58.525 | 26.35 | 26.35 |
| Variance | 54.7211055 | 47.4365578 | 91.3844221 | 93.3944724 |
| Observations | 200 | 200 | 200 | 200 |
| Df | 199 | 199 | 199 | 199 |
| t Stat | -3.727968 | -3.0286594 | 9.39404504 | 9.29240515 |
| P value | 0.00025157 | 0.00278195 | 0.00000 | 0.0000 |

Above table 5.1 shows analysis of straight leg raise test of right side and left side and analysis of active knee extension test of right side and left side. P-value of straight leg raise test of right side and left side are 0.000 and 0.002

respectively which shows significant difference in hamstring flexibility. P-value of active knee extension test of right side and left side are 0.000 and 0.000 respectively which shows significant difference in hamstring flexibility.



Graph 1: Mean of Straight Leg Raise Test and Active Knee Extension Test

Discussion

The major finding of present study was to investigate effect of prolonged sitting on hamstring flexibility in school children. The result of present study shows positive effect of prolonged sitting on hamstring flexibility. These findings demonstrate that prolonged sitting can affect the hamstring tightness.

This study providing basic information regarding impact of extended sitting on hamstring flexibility. The important finding was an alarming high rate of hamstring tightness among most of students, and a significant positive effect found among extended sitting hours and hamstring tightness [36].

The posture, working style and duration of work has impact on function and structure of muscle. Felipe Jose and Andriana Ribiero has reported the influence of prolonged sitting on hamstring extensibility and low back pain had reported in their study that prolonged sitting without breaks leads towards decreased flexibility of hamstring muscles which ultimately becomes risk factor for developing low back pain and decreased work efficiency.

In study it was observed that average time period of 6-8 hours of daily sitting had affected the hamstring muscle in regard of flexibility. The similar study reported that decreased hamstring flexibility had affected their work efficiency, ADL quality badly and even some patient reported the low back pain due to reduced hamstring flexibility [37].

It was also seen that the individuals who spent nil or no time in sports and extracurricular activities suffered from reduced hamstring flexibility and individuals who spent 2 to 4 hours per week in extracurricular activities were relatively better in regard of hamstring flexibility [38]. It is mentioned in their researches that 90% or more individuals face hamstring tightness only because of prolonged sitting in their work places and lack of sports and extra-curricular activities. They also described that sitting type also matters a lot, if the sitting is comfortable then there would be less chances of developing hamstring tightness [39].

Cinar suggested patella femoral pain syndrome due to lack of hamstring flexibility. Fitzgerald result edweak and unstable lower abdominals and spinal erectors result in hamstring tightness [40].

Reduction in hamstrings flexibility has been found to be one of the causes for development of low back pain.¹² Hamstring muscle tightness leads to decrease range of motion of lumbar flexion and pelvic tilt. This can alter the biomechanics of lumbar spine and may lead to back pain. Stiffness of one muscle group can cause compensatory movement at an adjoining joint that is controlled by muscles or joints with less stiffness [41].

It was hypothesized in the current study that tightness of hamstring is a very common problem in students, especially the students having prolonged sitting hours, and in results, it was seen that majority of the population have hamstring tightness [36, 42].

Adar also claimed prolonged sitting to be a main danger for the development of hamstring tightness, and according to the results of that study, a decrease in the range of hamstrings was seen with increase in the number of sitting hours and overall reduction in flexibility of the hip and pelvis was seen with increase in sitting hours [36].

Sheetal Mahadik conducted a study prevalence of hamstring tightness in youngster 18-25 years age a cross sectional study. In this study they conclude that prevalence of hamstring tightness in youngsters is 82% when assessed by using active knee extension test & prevalence of hamstring tightness is more in female than male [43].

Arab claimed that there is no impact of work setting and sedentary lifestyle in the development of hamstring tightness, especially in low back pain patients. Flexibility of hamstring muscles is not affected by the work environment or the lifestyle adopted [44]. The difference in findings with the current study can be due to a larger age range of 20-65 years and diverse population working indifferent work settings.

Limitation of the Study

Small sample size. Age group is 10-15 years

Further Recommendations

Homogenous population and Different age group can be considered. Hamstring flexibility check in other occupation who have prolonged sitting like office worker, bank worker, IIT worker etc.

Conclusion

It is concluded from the study that the subjects with six to eight hours of daily sitting with very fewer physical activities experience reduced hamstring flexibility.

The present study suggest that the tightness of hamstrings is observed in a majority of the students. Longduration sitting can be a contributory factor in hamstring tightness.

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