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To Determine the Association of Mobile Usage on Postural Stability, Hamstring Flexibility and Trunk Extensor Muscle Fatigue

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Abstract

Repeated and prolonged use of smart phones has negative impacts on the human body. The purpose of this study was to determine the association of Mobile usage on Postural Stability, Hamstring Flexibility and Trunk Extensor Muscle Fatigue in women. A total of 100 voluntary participants were selected randomly for this study. The female students who uses mobile for at least 3 hrs daily for last 1 year with age group of 18-25 years were included in this study. Static stability, Dynamic stability, Hamstring flexibility and Trunck extensor muscle fatigue were measured by one leg standing balance test, Functional reach test, sit and reach test and Trunk muscle fatigue induced used method using Borg Scale respectively. The mean age, height and weight of all the participants were 20.96 years (±1.96±), 156.17 cm (±15.96) and52.92 kg (±10.29) respectively. All the participants were examined for their fatigue by Sorensen test and the average fatigue time was 90.99 sec (±46.35). Then the perceived rate of exertion were assessed for all the participants and its mean score was 17.05 (±1.28). The sit and reach test of all participants were also examined whose mean score was 21.80 cm (±6.97). This study has revealed the prevalence of flexibility issues in population of female students who are frequent users of cell phone.

Keywords : Postural Stability; Hamstring Flexibility; Muscle fatigue; Mobile Usage.

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Introduction

Postural control is said to be required to perform our daily routine activity effectively. The state in which all forces acting on a human body are balanced by center of gravity (COG) within the limits of base of support are necessarily required for postural control[1]. Muscles fatigue causes imbalance in our postural control. Muscle fatigue occurs due to sitting in a slouching posture or by not relaxing our back extensor muscles. Due to which static and dynamic balances are impaired[2]. Static balance in human helps to balance in rest and the dynamic balance helps human to balance in motion. However previous research shows that muscles fatigue occurs due to inappropriate postural control and these studies are done using laboratory measures. Single leg stance improves our postural stability, and single leg stance occurs frequently in our daily routine. Single leg stance checks our static stability, while in muscle fatigue single leg standing posture is somehow different without muscle fatigue[3]. Hamstring flexibility is an important component of athletic fitness. Sometimes in order to improve fitness athletes used to indulge in drug abuse substances also[4]. Functional reach test is used to

check dynamic balance. In this test, if the person has muscle fatigue his body posture will be different from the person without having muscle fatigue. In our daily life both of the activity happens a lot therefore clinical measures are appropriate for our study[5]. Trunk muscle weakness leads to tightness in hamstring muscle[6,7].

Smart phone is an electronic device that modern people use the most. A smart phone is a mobile phone with various functions and it enables use of many social networking services like Twitter and Facebook etc which has the functions of calling and texting. It requires more concentration than a traditional mobile phone[8]. Repeated and prolonged use of smart phones has negative impacts on the human body. One study has noted that walking and using a smart phone had a negative effect on the lumbar spine[9], and one study has reported that the muscular activity of the muscles around the shoulders increased due to smartphone usage[10]. In addition, Kim et al. (2015)[11] stated that when using a smartphone, individuals with minor neck pain tend to bend their neck slightly more than individuals without neck pain.

But there are lack of study which has reported any association of smart phone uses on posture stability, flexibility and muscle fatigue in women. Therefore, the purpose of this study is to determine the association of Mobile usage on Postural Stability, Hamstring Flexibility and Trunk Extensor Muscle Fatigue in women.

Methodology

A total of 100 voluntary participants were selected randomly for this study. The female students who uses mobile for at least 3 hrs daily for last 1 year with age group of 18-25 years were included in this study.

The participants willing to participate in the study first filled the consent form. The participants were asked to present on a prescribed date and time. Then the height and weight had been measured. Static stability, Dynamic stability, Hamstring flexibility and Trunck extensor muscle fatigue were measured by one leg standing balance test, Functional reach test, sit and reach test and Trunk muscle fatigue induced used method using Borg Scale respectively.

One leg standing balance test : (OLST)[12] used to assess the static stability. The dominated leg was first determined by asking kicking limb. Subject was then asked to stand on their dominated leg for OLST. Test was performed under eyes closed condition to avoid vision form interfering with the task of postural control. Time of one leg standing was recorded in second using a stopwatch. Test was terminated when the subject away from the standing limb, touched the floor, moved the weight bearing foot to maintain balance or opened eyes.

Functional reach test[13]: used to assess the dynamic stability. The subject standing next to, but not touching a wall, with dominant arm closer to the wall at 90 degree of shoulder flexion with a closed fist. The subject was asked to reach forward as far as possible without taking a step. The distance between the start and the end position was measured using the head of the third metacarpal as a reference point and was recorded in inches.

Sit & Reach test[14]: used to measure hamstring flexibility. Data was collected by observation on a meter scale of a customized sit and reach box, set on an exercise mat on a firm floor surface. Initially the subject was in long sitting, facing the sit and reach box, with bare feet touching the box. Then on the researcher's instruction the subject was to reach forwards slowly with both hands, one placed on the other and facing downwards, as far as possible on the scale of the sit and reach box. The researcher observed and took note of the farthest point reached on the scale. Three trials were taken and the measurements recorded for each subject

Trunk muscle fatigue induced used method[15]: Subject made to perform dynamic extension until maximum exhaustion. For this task, subject lay prone on a bench with the lower half of the body below the level of anterior superior iliac spine with the upper body unsupported in the horizontal plane and the lower limb secured to the bench with the straps at the hip, knee and ankle. During the test the arms were held across the chest the subject was instructed to raise her upper body to a horizontal position with the head and neck in neutral position. Maintain the trunk in neutral alignment for as long as possible. Measure the time subject could maintain this position using a stopwatch. The criteria for termination of test were fully explained to the subjects. Subject terminating the test because of excessive fatigue, subject terminating the test if pain or other symptoms were too great, and rather terminating the test because the subject did not maintain the upper trunk in neutral. At the termination of the test recorded the holding time and the reason for test termination. Borg scale is used to measure the subject exertion level for the fatigue[9].

Results & Analysis

A total of 100 female university students aged between 18-25 years were voluntarily participated

in this study. The participants were selected randomly based on the inclusion and exclusion criteria. The mean age, height and weight of all the participants were 20.96 years (±1.96±), 156.17 cm (±15.96) and52.92 kg (±10.29) respectively. The mean waist and hip measurement of all the participants were 33.32 inches (±3.30) and 35.71 (±3.64) respectively. See table 1.

Table 1: Descriptive Statistics.

	Min	Max	Mean	Std. Deviation	Skewness		Kurtosis	
					Statistic	Std. Error	Statistic	Std. Error
Age	18.00	25.00	20.96	1.76	.58	.24	.16	.47
Height (KG)	150.00	170.00	156.17	15.96	-8.73	.24	83.23	.47
Weight (CM)	50.00	95.00	52.92	10.29	-.05	.24	6.36	.47
Waist Measurement (Inches)	28.00	46.00	33.32	3.30	1.09	.24	1.50	.47
Hip Measurement (Inches)	28.00	48.00	35.71	3.64	.83	.24	.89	.47

The average mobile usage by all the participants was 6.54 hours (±4.04) daily. 57 out of total 100 participants were using the mobile phone for 5 or more hours daily.

All the participants were examined for their fatigue by Sorensen test and the average fatigue time was 90.99 sec (±46.35). Then the perceived rate of exertion were assessed for all the participants and its mean score was 17.05 (±1.28). The sit and reach test of all participants were also examined whose mean score was 21.80 cm (±6.97). See table 2.

Table 2: Descriptive Statistics.

	Mean	Std. Deviation	N
Mobile usage	6.5400	4.04375	100
Fatigue time	90.9900	46.35840	100
Perceived Rate of Exertion	17.0500	1.28216	100
Sit & Reach Test	21.8050	6.97394	100

The Pearson correlation was applied between Mobile usage, Fatigue time, Rate of Perceived Exertion and Sit & Reach test. See table 3.

Table 3: Correlations between Mobile use, fatigue time, perceived rate of exertion, sit and reach test.

	Mobile Usage	Fatigue Time	Perceived Rate of Exertion	Sit & Reach Test
Mobile usage	1	-.177	-.040	-.348**
Fatigue time	-.177	1	-.619**	.377**
Perceived Rate of Exertion	-.040	-.619**	1	-.213*
Sit & Reach Test	-.348**	.377**	-.213*	1

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

*. Correlation is significant at the 0.05 level (2-tailed).

Discussion

The purpose of this study was to determine the effect of mobile usage on trunk extensor muscle fatigue, postural stability and hamstring flexibility. This study was designed to determine the prevalence of flexibility problems in people who habitually using cell phone and trunk muscle fatigue. Flexibility of the posterior trunk and hamstring muscles was measured using the sit and reach test procedure. The distance reached forwards by stretching of the posterior trunk muscles and hamstrings was measured and recorded as an indicator of their flexibility. The flexibility is assessed as a direct function of the numerical value measured from the sit and reach test procedure and that numerical value could be interpreted, based on its magnitude, as excellent, very good, good, fair and needs improvement.

Statically significant indirect correlation found between mobile use effect on the hamstring muscle flexibility which suggest that more mobile use indirectly proportional to hamstring flexibility a person who use more use mobile having tight hamstring muscle.

Pain development is another concern with poor posture; both duration and frequency of poor posture are factors. The intervertebral discs of spine do not have any direct arterial supply for nutrition uptake and therefore it rely upon dynamic motions (compression and decompression) to uptake nutritions, pretty similar to a sponge[16]. Due to this, if a static posture is being maintained for long-term then the ability of the intervertebral discs to uptake nutrients may reduce and thus can reduce their health. FlexP in any region of the spine will alter the natural loading patterns of spine and can change the wear-and-tear to the point of damage or failure. Early thought on pain (or disorder) development in

the low back was on acute or high load tolerance of the tissue[16].

Statically significant indirect correlation found between fatigue time on the hamstring flexibility which suggest that person more fatigue indirectly proportional to hamstring flexibility a person who more easily.

O'Sullivan et al., 2002[17] studied on Poor back muscle endurance and correlated to increased periods of sitting and lower physical activity. That is shown a relationship between passive slumped sitting postures and reduced back muscle activity. The findings of this study suggested that the measure of an individual's 'usual' spinal posture relative to their end of range may be a more significant factor than simply comparing spinal flexibility (back extensor endurance).

Statically significant indirect correlation found between perceived rate of exertion on the hamstring flexibility and fatigue time which suggest that person more perceived rate of exertion in indirectly proportional to fatigue time or hamstring flexibility.

Statically significant indirect correlation found between hamstring flexibility test on the mobile use, fatigue time which suggest that flexibity test indirectly proportional to mobile use, fatigue time who more fatigue time having more using mobile time. Feldman et al[18] has studied that decreased muscle flexibility and trunk strength have been postulated as risk factors for trunk muscle fatigue. Poor hamstrings flexibility has been associated muscle fatigue in cross-sectional studies in both adolescents and adults, although longitudinal research in a cohort of workers has not confirmed this finding. Thus, it may be that poor hamstrings flexibility is a result of muscle fatigue (possibly due to inactivity) rather than a cause.

Increased periods of sitting and lower physical activity shows the relationship between passive slumped sitting postures and reduced back muscle activity. The findings of this study suggest that the individual's 'usual' spinal posture relative to their end of range may be a more significant factor than simply comparing spinal flexibility (back extensor endurance) or posture[19].

Kendall et al, 1993[20] theoretically explained the relation between hamstring flexibility and back extensors endurance. Because the hamstring muscles attach to the ischial tuberosity, it is hypothesized that tightness of these muscles may induce posterior pelvic tilt, resulting in a trunk muscle fatigue.

However, this study shows moderately positive relation in between two variables. Reason is hamstring length, if it influences on pelvic tilt, only one of many factors that may lead to weak trunk muscle as seen as lower cross syndrome.

Conclusion

This study has revealed the prevalence of flexibility issues in population of female students who are frequent users of cell phone. A general state of decreased flexibility has been found. It can be clearly reasoned why many healthcare specialist have taken to the media to try to alert the general public about the health hazards of the cell phone.

The evidence of flexibility issues has highlighted the need for physiotherapists to consider the cell phone increase trunk muscle fatigue the patient as part of the musculoskeletal assessment in young females presenting with low back aches and musculoskeletal problems of hip, knee and spine.

However, future work needs to be completed before changes can be recommended with confidence. Furthermore, these results were restricted to only one factor of more use of cell phone, ignoring other features such as the using laptop and computers, slouching posture effect on the trunk.

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