



Original Article

Association of Smartphone Usage and Subjective Musculoskeletal Symptoms Among Adolescents; A Cross-Sectional Survey

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ABSTRACT

Background: Hamstrings tightness is commonly found among obese individuals and athletes. Many factors can result in hamstrings tightness such as overuse, bad posture and sports activities. It can result in major muscle imbalance which can predispose a person to muscle injuries.

Objective: To evaluate the effectiveness of plantar fascial mobilization and static stretching on hamstrings flexibility in overweight individuals. **Methods:** This quasi-experimental study was conducted at the Physiotherapy department of Shalamar Hospital, Lahore for six months. About 50 participants were selected after meeting eligibility criteria through non-probability purposive sampling. The participants were divided into two equal groups, Group A received static stretching of the hamstrings and Group B received plantar fascial mobilization for three consecutive days. Pre and post-treatment readings of the numeric pain rating scale and active knee extension were recorded in this study. Overweight individuals with having body mass index between 25 to 30 and age ranging from 18 to 35 years presented with hamstring tightness (at least 20 degrees of active knee extension (AKE) were included in this study. Patients were excluded if they showed any red flags such as rheumatoid arthritis, fracture, tumor, osteoporosis, history of steroid use, lower limb injuries or surgery. The normality of the data was assessed through the Shapiro-Wilk test. The difference between pre and post-treatment readings was calculated using paired sample t-test for this parametric data. Difference between groups, independent sample t-test was estimated. **Results:** Patients presented in both groups had an age between 18 and 50 with a mean age of 38.56 ± 9.243 . Data were analyzed through independent sample t-tests and paired sample t-tests. The results showed that plantar fascial mobilization along with static stretching was superior in improving hamstring flexibility (83.20 ± 1.65) and reducing pain (1.96 ± 1.48) than static stretching alone in improving hamstring flexibility (76.40 ± 0.02) and in reducing pain (3.45 ± 1.45). **Conclusion:** It concluded that both the treatment techniques, plantar facial mobilization and static stretching were effective in improving hamstring flexibility by increasing active knee extension and decreasing pain intensity however plantar fascial mobilization along with static stretching was superior to static stretching alone in improving the hamstring flexibility in overweight individuals.

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INTRODUCTION

The number of individuals who possess cell phones has increased dramatically during the past 10 years.¹ Smartphones are used by individuals of all ages, from college students to the elderly. Smartphone users often surf the Internet, communicate with others, utilize social networking services (SNS), compose papers, and do other chores while looking at the small screen.^{2,3} They may acquire musculoskeletal disorders because of doing these activities repeatedly in the same posture. Adults in their teens and twenties are also more prone to developing serious musculoskeletal illnesses, which may cause weariness and discomfort in the neck, shoulders, arms, wrists, back of the hand, fingers, and waist since they use cell phones more than people in their seventies and eighties.^{4,5}

When the user moves a lot in one area, it slows down the flow of blood, prevents nutrients from reaching the muscles, and makes the user fatigued and painful.^{6,7} Doing the same action repeatedly or placing a little amount of stress on muscles for lengthy periods are common causes of musculoskeletal disorders.⁸ Bad posture also causes fatigue, which may lead to issues such as impaired physiological function, autonomic nervous system issues, daily difficulties and effects on the visual and musculoskeletal

systems, which can cause headaches and stress.⁹ When you use a smartphone, you move your hands, wrists, and arms a lot, which may lead to musculoskeletal illnesses such as muscular fatigue and tension in the muscles in your neck and shoulders. As a result, discomfort in the neck, shoulders, and arms, stiffness, decreased pain sensitivity, and tremors may occur.¹⁰ People who perform the same tasks over and over again for more than six months are more likely to develop shoulder-arm-neck dysfunction.

Previous research on musculoskeletal problems has, for the most part, focused its attention on how students utilize computers.¹¹ There have been several investigations carried out to discover the reasons behind the visual display terminal issue that affects adolescents.^{12,13} However, since smartphones are portable and simple to use, many students use them for longer periods and more often than desktop computers.¹⁴ Nonetheless, little study has been conducted on the association between smartphone usage, pain, and posture, as well as how smartphone use affects the muscles and bones in each section of the body. Therefore, the purpose of this study was to determine the association between smartphone usage and subjective musculoskeletal symptoms among adolescents.

METHODS

This cross-sectional survey was conducted at the Link Medical Centre in Lahore to assess the musculoskeletal complaints shown by youngsters. When evaluating the basic characteristics of smartphone users, their gender and age were considered, along with the sort of smartphone they used, where and why they used it, and the average amount of time they spent using computers. The kind of smartphone used was recorded, and the setting in which it was classified as either a private residence, a public institution or some other site. There were a variety of reasons for doing this, including searching for information, writing, playing a game, communicating, and other activities. The average daily use may be less than one hour, four hours, or in increments of one hour. From July to December 2021, university students participated in this study.

Four hundred surveys were completed, and those that seemed to include unread or inaccurate replies were eliminated. Therefore, 365 completed questionnaires were used to analyze the data. This allowed us to learn more about students and mobile phones in general. Using a table of subjective musculoskeletal symptoms from the Korean Occupational Safety and Health Agency's Guideline of Harmful Factors Survey for Musculoskeletal Disorders, the severity of the students' complaints was evaluated. Using SPSS statistics version 25.0, the data were analyzed. The chi-square test was applied to assess if smartphone characteristics relate to subjective musculoskeletal pain. A p-value less than or equal to 0.05 was judged statistically significant.

RESULTS

The results regarding gender showed that there were 117 (32.05%) males and 248

(67.95%) females; regarding age, there were 54 (0.15%) participants from 18-21 years, 211 (57.81%) 22-24 years, 88 (24.11%) 25-28 years and 12 (3.29%) more than 28 years; regarding LCD size 272 (74.52%) having >5 inches and 93 (25.48%) having <5 inches. There were 18 (4.93%) participants using smartphones in the classroom, 133 (36.44%) in the library, 24 (6.58%) in the cafeteria, 162 (44.38%) in the home and 28 (7.67%) using other places. About 218 (59.73%) participants use mobile while sitting and 213 (58.36%) used smartphones to explore social media and 86 (23.56%) participants were using them for 3-4 hours and 142 (38.9%) for more than 4 hours daily (Table I). The results showed that the musculoskeletal symptoms were found in various regions in descending order of percentage as neck 24%, shoulder 25%, waist 15%, hands 10%, and arms and fingers 9% as shown in Figure I.

The statistics using the chi-square test showed that there was a significant correlation between less screen size and musculoskeletal symptoms in the Waist, Hands, Shoulders, Neck and Waist ($p < 0.05$) except those of leg and feet and arms ($p > 0.05$), while the same significant association was found with musculoskeletal symptoms in all regions except that it was not significantly associated with fingers (Table II).

DISCUSSION

This study sought to prevent musculoskeletal disorders caused or exacerbated by smartphone use. The majority of people preferred a large LCD panel. Eighty-seven percent of students use their smartphones for texting and Internet searches. The majority of students used cell phones at home (58.4%) and chose to sit (40%) or lie down (34.9%) when doing so. As seen by their seated and

supine positions, several respondents used cell phones in unsatisfactory working settings. Musculoskeletal issues are likely. A large number of smartphone users spend more than four hours each day on their devices, as compared to those who spend between three and four hours. About 80% of students utilized their mobile phones for over 2 hours every day. The long-term smartphone uses and poor posture at home may contribute to

musculoskeletal pain. Shoulder and neck pain may result from repeated static motions. Previous studies showed that the use of a display terminal increases the bending angles of the neck and waist bones.^{15,16} According to O'Sullivan et al., poor posture may diminish the function of waist muscles, resulting in waist pain.¹⁷ Musculoskeletal difficulties may result from prolonged sitting and smartphone usage.

Table I: Demographics and Smartphone Usage Characteristics

Variables	Frequency (%)	
Gender	Male	117 (32.05%)
	Female	248 (67.95%)
Age	18-21 years	54 (0.15%)
	22-24 years	211 (57.81%)
	25-28 years	88 (24.11%)
	> 28 years	12 (3.29%)
Smartphone LCD Size	>5 inches	272 (74.52%)
	<5 inches	93 (25.48%)
Smartphone use places	Classroom	18 (4.93%)
	Library	133 (36.44%)
	Cafeteria	24 (6.58%)
	Home	162 (44.38%)
	Others	28 (7.67%)
Smartphone using posture	Sitting	218 (59.73%)
	Lying	91 (24.93%)
	Standing	13 (3.56%)
	Prone lying	38 (10.41%)
	Others	5 (1.37%)
Smartphone use purpose	Social Media	213 (58.36%)
	Searching	8 (2.19%)
	Games	24 (6.58%)
	Documentation	8 (2.19%)
	Others	12 (3.29%)
Smartphone using hours	< 1 hour	29 (7.95%)
	1-2 hours	8 (2.19%)
	3-4 hours	86 (23.56%)
	5 or more hours	142 (38.9%)

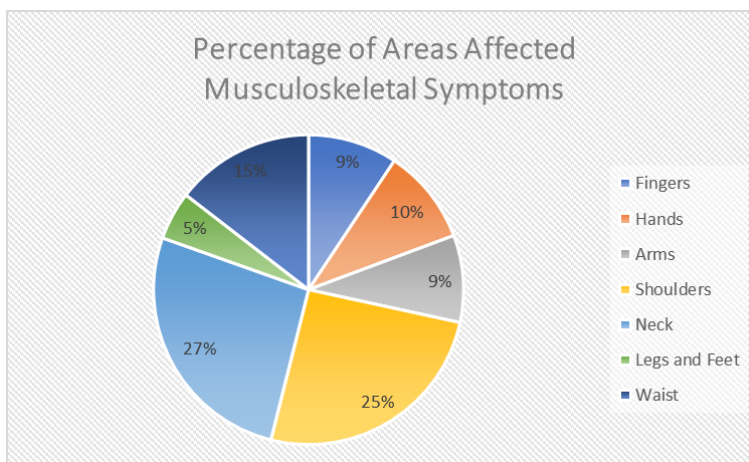


Figure I: Percentage of Areas Affected and showing Musculoskeletal Symptoms

Table II: Association of Variables

Factor	Variable	Areas	p-value
Smartphone LCD Size	<5 inches	Fingers	0.037
	<5 inches	Hands	0.044
	<5 inches	Arms	0.073
	<5 inches	Shoulders	0.018
	<5 inches	Neck	0.038
	<5 inches, > 5 inches	Legs and Feet	0.189
	<5 inches, > 5 inches	Waist	0.722
Smartphone using hours	-	Fingers	0.273
	3-4 hours or more	Hands	0.003
	-	Arms	0.127
	3-4 hours or more	Shoulders	0.033
	3-4 hours or more	Neck	0.021
	-	Legs and Feet	0.093
	3-4 hours or more	Waist	0.042

In this study, neck and shoulder soreness were the most prevalent. Straker et al. discovered an increase in neck and back bending angles.^{18,19} In this study, waist pain was connected to the

size of the LCD screen. Smartphone use was negatively associated with leg and foot pain;²⁰ however, there was no connection between LCD screen size and eye, neck, shoulder, arm,

hand, wrist, finger, or wrist pain. Larger LCDs are more pleasant and convenient, so fewer complaints of musculoskeletal disorders will result. Lee observed that when display terminal displays shrank, the bending angles of the neck and backbone increased.²¹ The larger the terminal screen, the fewer musculoskeletal symptoms are reported. The findings of this research are relevant in several ways. They begin by advising college students on smartphone use. LCD screen size is associated with physical pain. Third, the use of smartphones is associated with pain symptoms. This study was limited since only university students participated. Self-administered questionnaires may also have exacerbated response bias.

CONCLUSION

The study concluded that there was a significant association between higher duration of smartphone usage and small screen size with musculoskeletal symptoms in various body regions, especially the upper extremity and waist. It is essential to enhance their utilization and devise a preventative program to alleviate the discomfort produced by bone and muscle dysfunction. The upcoming smart glasses can also be a solution to such musculoskeletal issues.

DECLARATIONS

Consent to participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

Competing interests: None

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Authors' contributions: All authors read and approved the final manuscript.

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