

A Correlation Study on Smartphone Usage Duration with Hand Grip Strength in Young Adults

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Abstract: *Background:* Smartphone are indispensable tool for people of all ages around the world today. In this context, smartphones have become an essential part of life, not only in matters related to communication, but also as essential social accessories. Frequent smartphone use without taking regular rest period may result in cumulative trauma disorders to the neck, shoulder, hands and wrist. These disorders may occur because smartphone use requires thumb and finger interaction with the screen. Repetitive static motion of the hand may decrease blood supply of it and prevent nutrient's being delivered to muscle thus leading to pain & muscle fatigue. Thus, this study aimed to determine the correlation between smartphone usage duration and hand grip in Mumbai among young adults. *Method:* 123 young adults participated in the study. The procedure was explained in the language best understood by the participants. Smartphone usage duration was recorded using daily average screen time. Hand - grip strength measurement was assessed using a Hand - Held Dynamometer. *Results:* Average daily usage of smartphone (in hours) and hand grip strength (kg) among the participants was 5.6 ± 1.6 and 23.7 ± 11.1 respectively. There was a weak but significant correlation between the variables i. e. the more the screen time weaker the hand grip strength. *Conclusion:* This study provides an insight into potential association between excessive device use and physical health. Thus, we can conclude that increase in screen time has a negative effect on the hand grip strength.

Keywords: Grip strength, hand held dynamometer, smartphone usage

1. Introduction

Modern technology plays a key role in daily human life. This involves keeping pace with rapid changes in field of communication technology. In this context, smartphones have become an essential part of life, not only in matters related to communication, but also as essential social accessories. [2] Smartphone are indispensable tool for people of all ages around the world today and it has become difficult to imagine everyday life without smartphone. For adolescents who are particularly sensitive to new technology and media use smartphone has become important part of their life According to recent study adolescents are susceptible to smartphone usage the prevalence rate for adolescent was 30.2% which is higher than that of adults at 18.8% [3]

Frequent smartphone use without taking regular rest period may result in cumulative trauma disorders to the neck, shoulder, hands and wrist. These disorders may occur because smartphone use typically requires thumb and finger interaction with the screen. [2] Repetitive static motion of the hand may decrease blood supply of it and prevent nutrient's being delivered to muscle thus leading to pain & muscle fatigue. [2]

Complications and adverse effects of smartphones' excessive usage may include dry eyes, computer vision problems, neck and shoulder problems, De Quervain's tenosynovitis, and weakness of the thumb and wrist [4] Further, this repetitive flexion and extension of the wrist are also known to be among the leading causes of carpal tunnel syndrome. [5] These complications would limit the hand's functionality over time and may lead to psychological problems such as low quality of life. [6]

Smartphone are used for variety of purpose including learning, information search, social communication and entertainment. Smartphone usage in evening seems to be associated with poor sleep quality and reduced work

engagement numbers shows about 36 - 40% smartphone owners use smartphone 5 mins before going to sleep. Thus, this technical device is omnipresent in everyday life. [7]

Muscular strength is an important indicator of health for both the sexes. Adequate muscular strength is required to perform daily activities and is considered a marker of overall health. Low levels of muscular strength have been associated with osteoporosis, metabolic syndrome, myocardial infarction, strokes, and cardiovascular mortality in adults of both sexes. Handgrip strength reaches its peak in our 40's followed by gradual decline in both the sexes due to muscular atrophy in ageing [8]

Hand grip - A grip requires firm control and gives greater flexor symmetry to hand. It is during grip that the ulnar side of the hand works with radial side of hand to give stronger stability. With hand grip the digits maintain object against the palm the thumb may or may not be involved and extrinsic forearm muscle are more important. For a grip to be formed fingers are flexed and wrist is in ulnar deviation and slightly extended.

Example of hand grip are

Hook grip: this involves the interphalangeal and metacarpophalangeal joint (thumb is not involved).

Cylindrical grip: thumb is involved and entire hand wrap around an object.

Spherical grip: here there is more opposition and hand wrap around the sphere.

Pinch grip - it is used whenever accuracy and precision is required. The intrinsic muscle is more important in precision than in power grip. The thumb is essential for pinch grip as it provides stability and control of direction. There are three types of pinch grip

- 1) Pulp to pulp: opposition of thumb and finger is necessary this grip is also called precision grip with power
- 2) Lateral prehension: the thumb and lateral side of index finger comes into contact.

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- 3) Tip to tip: prehension with positioning the tip of thumb is brought into opposition with tip of another finger^[9]

The condition in which hand grip gets reduced or affected

- 1) Due to age and sex: Difference in grip and pinch strength between age group was significant. A linear rise in grip was noted from age 6 - 18 years. Boys demonstrated greater grip and pinch strength compared to girls^[10]
- 2) Reduced strength following tendon repair: Grip strength was reduced after tendon injury but was especially reduced when there was concomitant damage to median or ulnar nerve.^[11]
- 3) Carpel tunnel syndrome: who have carpel tunnel syndrome lose their grip strength and higher level of CTS lead to greater reduction in grip strength.^[12]
- 4) Peripheral neuropathy: with increasing prevalence of diabetes and the
- 5) Prolongation of the life span of diabetic patient, the prevalence of diabetes in elderly is rising. the people with peripheral neuropathy showed worse thumb - middle fingertip pinch strength and thumb little fingertip strength in dominant hand^[13]
- 6) Arthritis: OA is most common joint disease in older adults; its main symptom are pain and joint deformation. It has been noted people with hand OA with narrow joint space has low grip strength^[14]

Despite the benefits of smartphone usage, such as improved social networking and increased productivity, depression, anxiety, accidents, poor sleep, poor academic performance, exhaustion, and high stress have all been linked to this smartphone addiction.^[15] Overuse has also been shown to have negative impacts on physical and mental health. Neck pain symptoms are an example of negative bodily impacts.^[14] individuals with minor neck pain who often bend their neck considerably more than their healthy counterparts might have musculoskeletal symptom due to prolonged usage of smartphones.^[17]

The observation made us believe that the increased time that the young generation is spending on smartphones is making them more addicted to smartphones.^[14] This study investigates the interaction effect between level of smartphone use and hand dominance on hand grip & pinch grip. As modern technology plays a key role in daily human life smartphone have become an essential part of life not only in matter related to communication but also as essential social accessories. Youth are specifically at higher risk for smartphone addiction due to strong attraction.^[18]

Despite such widespread smartphone use the possible effect on hand function have not been defined. Few studies have investigated the effects of extensive smartphone use on hand function among children. This study therefore assessed the interaction effect between the level of smartphone use & hand dominance usage on hand grip in young adult.^[16]

2. Aim and Objectives of the Study

Aim

To determine the correlation between smartphone usage duration and hand grip in Mumbai among young adults

Objectives

- 1) To find out hand grip strength using hand held dynamometer.
- 2) To find out the correlation between smartphone usage duration and hand grip with hand held dynamometer in young adults

Methods

Type of study: A Correlational Study.

Study setting: Mumbai.

Study population: Age 15 - 25 years.

Sampling method: Convenience sampling

Sample size: 123

Inclusion criteria:

- 1) Age 15 - 25 years.
- 2) Gender - both male and female.
- 3) Should be a smartphone user since 2 years.
- 4) Uses smartphone everyday. approximately for 3.5hour/day

Exclusion criteria:

- 1) Any previous history of fracture in upper limb.
- 2) Any deformity in upper limb.
- 3) Recent injury in upper limb.
- 4) Congenital abnormality.
- 5) Neuromuscular disorder.

Material used: Hand held dynamometer

Smartphone

Pen

Paper

3. Methodology

Ethical clearance was taken from institutional ethical committee. We informed the participants regarding the aims & objectives of the study and provided the consent form and asked them to participate in the study. Participants were identified and included according to inclusion and exclusion criteria. The procedure was explained in the language best understood by the participants and written consent was taken from the participants prior to data collection. Smartphone usage duration was recorded. (using screen time in IOS & in android go to settings tap digital wellbeing and parental control). Hand - grip strength measurement was assessed using a Hand - Held Dynamometer. Data was collected as per the sample size and recorded for analysis. Statistical analysis was done using SPSS - 20 and the result was obtained.

4. Statistical Method

Statistical analysis was performed using statistical package for social sciences (SPSS - 20). Normality of the variables was tested using Shapiro wilk normality test. Normally distributed variables were presented as mean and standard deviation. To assess the relationship between smartphone

usage and hand grip strength, bivariate correlation Pearson product - moment correlation analysis done.

The level of significance was set at ≤ 0.05 .

Table 1: Test for Normality

	Kolmogorov Smirnov ^a			Shapiro Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Grip Strength	.125	123	<.001	.944	123	<.001
Screen Time	.171	123	<.001	.906	123	<.001

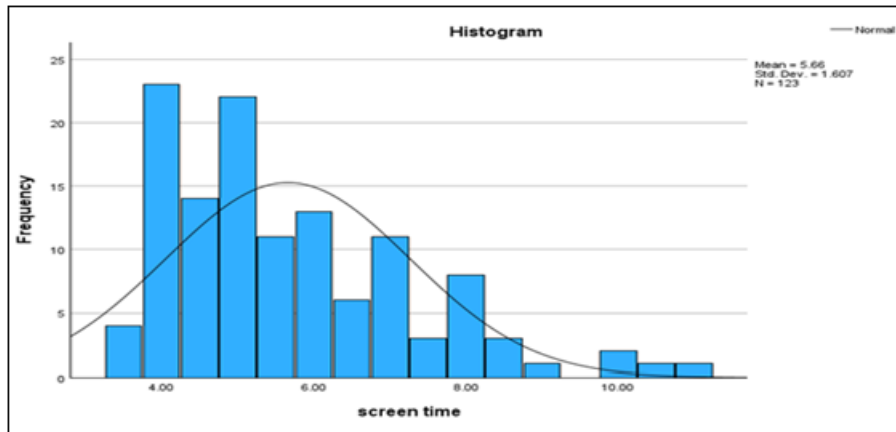
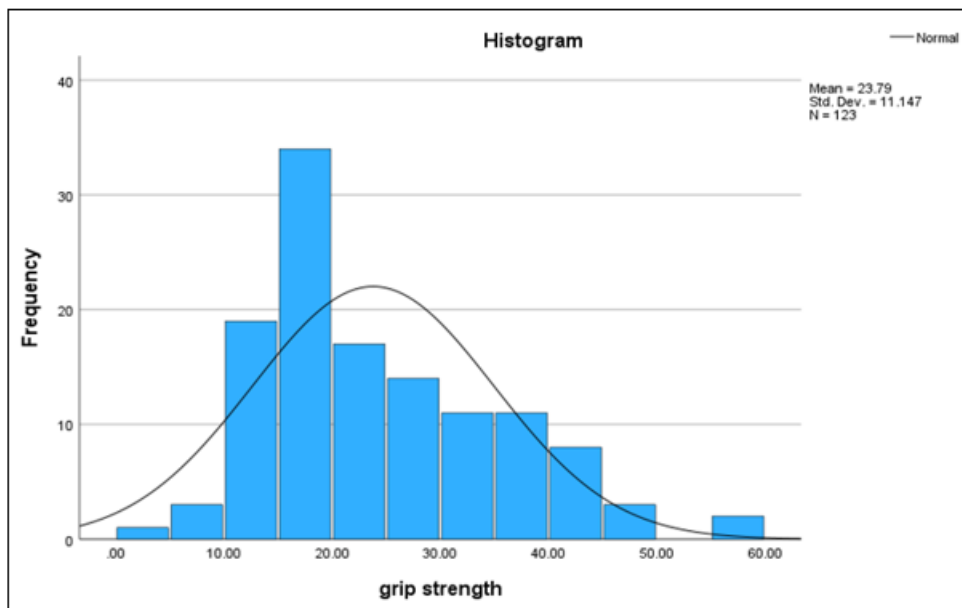


Figure 1: Normality Curve of screen time

Screen Time

Mean= 5.66
Std. Dev= 1.607
N= 123



Grip Strength

Mean= 23.79
Std. Dev= 11.14
N= 123

The primary outcome variables of 123 participants. Average daily usage of smartphone among the participants was 5.6 ± 1.6 . The average hand grip strength (kg) among the participants 23.7 ± 11.1 .

Correlation Analysis

Table 2: Descriptive Statistics of variable (grip strength and screen time)

Descriptive Statistics			
	Mean	Std. Deviation	N
Grip Strength	23.7927	11.14699	123
Screen Time	5.6585	1.60725	123

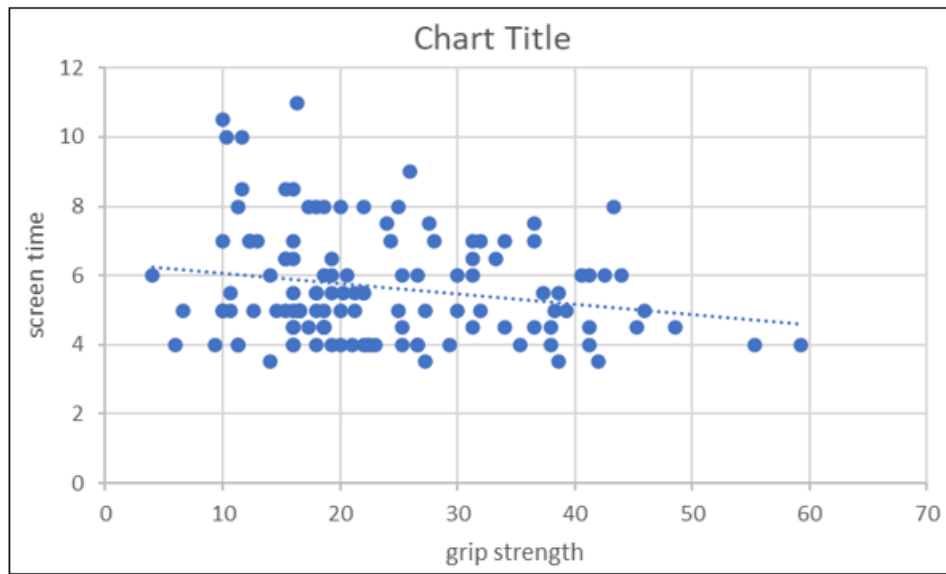
Table 3: Correlation analysis between screen time and hand grip strength

Correlation			
		Grip Strength	Screen Time
Grip Strength	Pearson Correlation	1	-.206*
	Sig. (2- tailed)		.023
	N	123	123
Screen Time	Pearson Correlation	-.206*	1
	Sig. (2- tailed)	.023	
	N	123	123

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

Correlation coefficient (r) = - 0.206

P value = 0.024

**Figure 3:** Correlation between smartphone usage duration and hand grip

Correlation analysis revealed a significant inverse relationship i. e. weak negative correlation between smartphone usage duration and hand grip strength. The younger people use their smartphone, the weaker the hand grip. Further analysis revealed that there was a significant correlation between smartphone usage duration and hand grip ($r = -0.2055$, $p = 0.024$)

5. Discussion

The current study explored the correlation between smartphone usage duration and hand - grip strength among young adult. There was a weak but significant correlation between the variables i. e. the more the screen time weaker the hand grip.

Many studies reported reduced hand function and multiple musculoskeletal problems a study that was conducted by Esra Erkol inal found that smartphone overuse on hand function, pinch strength, and the median nerve Smartphone overuse enlarges the median nerve, causes pain in the thumb, and decreases pinch strength and hand functions. ^[18]

Another study done by Adel Alshahrani aimed to explore the effect of smartphone usage on neck muscle (flexors and extensors) endurance, hand grip, and pinch strength among young, healthy college students. A decrease in neck flexor endurance time was observed in the smartphone - addicted group compared with that of the non - addicted group. ^[13]

In this study the participants age group is 15 - 25 for which the normal grip strength is 36.7 ± 7.6 and 40.1 ± 7.6 [Mean (Sd)] for age 15 - 19 and 20 - 25 respectively. The observed grip strength is 23.7 ± 11.1 which is less than normal value. Hence it can be said that increase in smartphone usage duration have impact on hand grip strength.

A study conducted by Kyu - Man Han reported that depressive symptom have been found to be associated with decreased hand - grip strength in adults. The findings indicated that there may be a stronger relationship between low handgrip strength in socioeconomically deprived older people ^[19]

Another study done by Xiaoguang Zhao aimed to explore relationship between handgrip strength and successful ageing and its specific dimension in older adults using nationally representative sample. The study suggested that there is a close association between handgrip strength and successful ageing ^[20]

A study conducted by Na Wu have examined association between handgrip strength and bone mineral density. High level of handgrip strength is associated with increased BMD. The association is independent of BMI and other potential co - founders. ^[21]

6. Conclusion

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This study provides an insight into potential association between excessive device use and physical health. thus, we can conclude that increase in screen time has a negative effect on the grip strength

7. Future Scope

Further studies can be done to find the confounding factors associated with reduced grip strength

8. Limitation of the Study

BMI was not taken into consideration. The criteria whether they use to hold their smartphone in one's hand or keep it on a table while watching videos was not considered.

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