

EVALUATING THUMB PAIN AND GRIP STRENGTH AMONG SMART PHONE USERS BETWEEN THE AGE GROUP OF 18-25 YEARS

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Abstract

Background: Smart phones are not just system of oral communication but a word processor a gaming machine or a device to surf the web, becoming a small personal computer. A thumb can sweep most of the screen on all but the most oversized phones. Thumb is responsible for 60% of functioning of their hand. High-frequency use of smart phones, iPods, could lead to Musculo skeletal problems as handheld electronics may require prolonged grips, repetitive motion on small buttons and awkward wrist movements.

Purpose: The purpose of the study was evaluating the probability of thumb pain and to measure the functional outcome of grip strength among the smart phone users between the age group of 18-25 years.

Methodology: 400 unrelated, healthy individuals aged 18-25 years randomly recruited from Chennai between the time period of March 2022 - May 2022. The participants were divided accordingly in groups in the two-year age interval such as 18-19, 20-21, 22-23, 24-25. The thumb pain was measured by Michigan hand outcome questionnaire. Grip strength was measured using Jamar dynamometer.

Result: Majority of the participants were male (84.5%). The mean score of thumb pain was high between the age group of 20-21 (97.97 ± 16.40). The maximum mean grip strength was recorded among the right hand dominant male participants between the age group of 24-25 years.

Conclusion: This study concludes that the high usage of smart phone increased the risk of thumb pain and reduces the grip strength among the young adults between the age group of 18-25 years.

Keywords: Smartphone use, Grip Strength, thumb pain, Jamar Dynamometer
Michigan hand outcome questionnaire.

INTRODUCTION

Smart phones are becoming a small personal computer. It's not just system of oral communication but a gaming machine or a device to word processing and communicate the world surf through web, although smartphone have made our lives easier, an increasing number of people have complained of finger, hand and elbow as a result of using other devices and its abuse has been associated with occurrence of tenosynovitis.

A thumb can sweep most of the screen on all but the most oversized phones, the thumb zone flips from left to right but this left-versus-right distinction isn't especially crucial, since most of us switch hands easily depending on text⁽¹⁾.

Full function and adequate strength of hand are preconditions for dealing with demands of daily life⁽²⁾. Hand grip strength is the result of forceful flexion of all finger joints, thumb with maximum voluntary force that subject is able to exert under normal biogenetic conditions⁽³⁾.

The thumb and wrist weakness are due to repetitive movement of flexion and extension over the wrist and fingers, which is increased with more duration spent over Smartphones, eventually causing pain and fatigue⁽⁴⁾.

Many daily functions and sporting events require high activity levels of the forearms and hands' flexor musculature, and grip strength is essential. High usage of smart phones, iPods, could lead to Musculo skeletal problems as handheld electronics may require prolonged grips, repetitive motion on small buttons and awkward wrist movements⁽⁵⁾.

Among thumb plays an important role in human life with delicate motion control and represents as most important functional and versatile organ in human hand. It has its unique actions of thumb circumduction and opposition abilities; these features differentiate humans from other hominids and its anatomy and function is risk of overloading due to excessive activity.

Also, people held the phone with one hand and use one thumb, implying increased repetitive movements in hand and finger leading to stress maximally on thumb consequently repeated stress injury tendon of thumb. Activity in cellular phone usage observing that it has greater thumb abduction of the thumb, faster movements and fewer pauses. All of these can be considered as casual factors of joint overload and the appearance of thumb.

Grip strength was correlated positively with gender, body weight, height, mid-arm and mid-forearm circumference and negatively correlated with age, triceps skin fold thickness. Men found to be more powerful than women in grip strength in different age groups.^[6]

This study aimed to evaluate the effect of Smartphone use on thumb pain and grip strength among the young adults between the age group of 18-25 years.

METHODOLOGY

Participants

Four hundred participants from Chennai volunteered to participate in the study. Participants were approached in different and multiple locations for a single measurement. Inclusion criteria included using a smart phone between the age group of 18 and 25 years old. Exclusion criteria included individuals with Work-related musculoskeletal disorders affecting the upper limb. Neurological, Orthopedic or vascular disorders of the upper extremity. Subjects with history of any earlier injury of upper limb. Subjects undergoing strength/ athletic training or undergone strength/ athletic training within 1 year for upper extremity of hand or wrist injury.

Procedure

The present study was based on the sample of 400 unrelated, healthy individuals aged 18-25 years randomly recruited from Chennai between the time period of March 2022 - May 2022. A brief interview preceded the testing to determine whether or not subjects met the criteria. Hand grip strength was measured using a standard adjustable-handle Jamar dynamometer and was set at the second position for all subjects. All the subjects were seated with the feet flat on the floor, the shoulder in adduction and neutral rotation, elbow flexed at 90 degrees, forearm in neutral position, wrist between 0 degrees and 30 degrees of dorsiflexion and 0 and 15 degrees of ulnar deviation (As given by American Society of Hand Therapists).

Arm should be unsupported by the examiner or by an armrest. The dynamometer should be presented vertically and in line with the forearm to maintain the standard forearm and wrist position. It will be held lightly around the readout dial by the examiner to prevent inadvertent dropping.

For grip strength measurement, then patient was asked to press the handle of dynamometer with maximum strength. Three trials were conducted, beginning with the dominant hand, alternating right and left hands, with one-minute rest between two attempts to overcome the fatigue. The mean of three successive trials was recorded for each hand in kilograms. The calibration of the instrument was tested periodically during the study.

For measuring thumb pain a Performa was developed pretested and used for data collection. The variables included were age, duration of pain, factor causing Pain, duration of smart phone use and smart phone activity. The Performa was in simple tick box format. Close ended questions were asked by direct method and entered on Performa.

Outcome measures:

Hand grip strength was measured by Jamar Dynamometer in kilograms.
Thumb pain was measured by Michigan hand outcome questionnaire.

Statistical Analysis:

The collected data were tabulated and statistically analysed using descriptive and inferential statistics in spss 17.0 version.

Results:

Among the total 400 participants mean age of the participants was 21.05 ± 2.5 . And the majority of the participants were male (85%). Overall, right-hand dominant subjects form (94.33%) and left-hand dominant subjects form (5.67%). From the table 1 age group 20-21 years has the maximum mean thumb pain score of 97.97, followed by age group 22-23 years, age group 18-19 years, and age group 24-25 years. In case of males, a gradual increment of right- and left-hand grip strength found from 18 to 25 years of age. Lowest grip strength was found to be in 18–19-year age group. Peak grip strength was found to be in 24–25-year age group. (Peak right hand grip strength of 44.71 kg in 24-year male; Peak left hand grip strength of 43.16kg in 25-year male.) In case of females also, a gradual increment of right- and left-hand grip strength found from 18 to 25 years of age. Lowest grip strength was found to be in 18–19-year age group. Peak grip strength was found to be in 24–25-year age group. (Peak right hand grip strength of 32.91kg in 25 years female; Peak left hand grip strength of 31.23kg in 24 years female). The table 3 represent there was significant difference in the grip strength between the different age groups.

TABLE1: Mean comparison between the thumb pain and age group.

Age in years	Mean±SD	F value	Df	Sig
18-19	95.74±9.63	5.84	3	0.001
20-21	97.97±16.40			
22-23	96.88±16.34			
24-25	89.64±18.79			

TABLE 2: Descriptive Statistics Of Grip Strength

Age	Hand	Males		Females	
		Mean	SD	Mean	SD
18-19	Right	32.61	12.14	23.25	11.83
	Left	31.52	12.56	22.74	10.65
20-21	Right	33.15	13.41	24.43	12.77
	Left	32.08	12.85	23.82	11.12
22-23	Right	34.24	14.51	25.51	13.53
	Left	33.25	13.77	24.28	12.61
24-25	Right	35.58	14.86	26.16	12.88
	Left	34.45	13.45	24.91	11.46

TABLE3: Mean comparison of right hand grip strength and age group.

Age in years	Mean±SD	F value	Df	Sig
18-19	27.93±6.61	2.43	3	0.004
20-21	28.79±6.16			
22-23	29.875±6.17			
24-25	30.87±6.66			

Discussion:

Results shows that on comparing 4 age groups 20- 21 category smart users have more prevalence to thumb pain in earlier stages .

The result of present study is similar to study of Bilalumer et al., in which they found out that 58.07% subjects , with mean age of 22.43 years using smart phones had developed De Querveins syndrome , which leads to thumb pain and inflammation⁽⁷⁾ . Another study conducted comparable findings that excessive smart phone use leads to thumb pain among 44.5% of young people⁽⁵⁾ . In other study results shows that Finkelstein test was positive in 40% of subjects which showed thumb pain and inflammation⁽⁸⁾ .

Smart phone manufactures and designers can use the findings of study to design customized smart phone that cater to users with large thumbs , this may decreases overloading of thumb⁽⁹⁾. A research by Minkyung Lee et al., on similar topic effects of smart phone use on upper extremity muscle

activity and pain threshold shows similar results of smart phone uses and frequency of thumb pain⁽¹⁰⁾

The speed of typing also places a greater demand on the musculoskeletal system . Faster typing speed has been found to increase the range of thumb movement and to decrease the intermittent pauses for the resting of muscles ⁽¹¹⁾

This study results interpret when the age increased the mean grip strength also increased in the both genders. Previous studies on children have established that there is positive relationship between hand grip strength and age ^{(12),(13),(14)}.

Likewise the finding that male hand grip strength are higher than female scores was consistent with previous studies except for Bowman and Katz who reported that male grip strength is significantly stronger in the left hand but not the right hand of 6-9 year olds^{(12),(14)}.

Burmeister et al grouped subjects by grade, whereas this study grouped subjects by age. Different schooling experiences and cultural experiences (gesture habits, mobility, sports, etc) may also affect scores. The different age groupings might also be a factor ⁽¹⁵⁾

Some studies found high frequency use of smartphones was impact with weaker ulnar nerve conduction velocity, worse neck pain, and reduced forward head angle movement: However, those studies show there was no association of mobile usage and grip strength. And also those studies there was no significant difference between the smart phone users and non-smart phone users^(16,17). Basavaraj Motimath et al study also concludes the high usage of smart phones to have a positive correlation grip and pinch strength respectively. The similar results were observed in the current study⁽¹⁸⁾.

Conclusion:

This study concludes that the increased use of smart phone caused thumb pain and also reduced the grip strength among the young adults between the age group of 18-25 years.

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