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Smartphonopathic Hand: An Observational Study on the Relationship Between Smartphone Addiction and Hand Muscle Function in Young Adults

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Abstract

Background: Heavy, repetitive smartphone use puts ongoing mechanical stress on the upper limb, but little research has jointly examined how compulsive phone use and total screen exposure connect to hand strength and to how freely the wrist muscles move.

Objective: To determine whether being addicted to a smartphone, and how many hours a person spends on it each day, correspond to measurable differences in hand strength and wrist muscle flexibility in a young-adult population.

Methods: A sample of 156 students, ages 18 to 25, was drawn by convenience sampling from Acharya Institutes in Bengaluru, India. Each completed the Smartphone Addiction Scale-Short Version (SAS-SV) questionnaire and recalled their total screen time from the prior day. Investigator then measured hand strength and wrist muscle flexibility, and these outcomes were compared against SAS-SV results.

Results: The typical participant was 21 years old with a BMI near 21.4 and logged close to five hours of screen time a day. There was no notable link between SAS-SV scores and hand or wrist strength. Screen time, on the other hand, tracked with muscle-flexibility outcomes: 44% of the group tested positive for shortened wrist-extensor muscles.

Conclusion: More screen time per day corresponded with a higher chance of a positive wrist muscle-length test, while addiction severity did not predict either strength or flexibility outcomes.

Keywords: Smartphone Addiction; Screen Time; Grip Strength; Pinch Strength; Wrist Muscle Length; Young Adults

Introduction

What began as a simple calling-and-texting device has turned into a pocket computer used for browsing, gaming, photography, video, and social apps. As a result, people now spend long stretches staring at small screens, repeatedly flicking their thumbs and fingers while their wrists and forearms stay locked in one position. This everyday habit carries a downside: heavy users report sore arms, weaker hand function, and muscle fatigue that builds up from doing the same motion again and again [1, 2].

"Addiction" in this context means a use pattern that has stopped being helpful - the person struggles to cut back, and the habit starts eating into schoolwork or friendships. Worldwide, phone ownership hit roughly 6.97 billion in 2024, and young adults use their devices more than almost any other age group. Given how many hours they log daily, this group may be particularly exposed to cumulative strain on the hand and arm [3].

A cluster of hand and wrist problems tied to overuse has come to be known as "smartphonopathic hand": pain at the thumb and wrist, repetitive-strain symptoms, altered hand posture, an enlarged median nerve, and greater odds of carpal tunnel syndrome. In work by Inal and colleagues, addicted

users showed median nerve changes, and it was the severity of the addiction - not simply how long they used the phone - that best predicted this [4]. A later study by Hasib and colleagues likewise found that heavier users had both a larger median nerve and poorer hand function [2].

Grip and pinch strength are the usual yardsticks for hand-muscle capacity and everyday function. It's plausible that constant phone handling shifts tendon behavior, median nerve shape, or how the thumb and wrist line up, any of which could in turn affect strength scores. But phone use is mostly thumb-driven, low-force, and held in a fixed wrist posture - quite different from a maximal grip effort - so it isn't obvious that more use would actually show up as reduced strength [5].

A separate issue is the length of the wrist muscles themselves. The typical phone-holding posture bends the wrist forward, angles the forearm toward the little-finger side, and keeps the thumb moving constantly - a combination that could place the wrist muscles under sustained load and gradually shorten how far they stretch. Clinicians can estimate this by passively moving the wrist and feeling for resistance, though these only measures resistance to stretch rather than confirming true structural shortening [6, 7].

Much of the existing literature has looked at pain, nerve shape, or hand function on their own, one at a time [2, 8].

What's missing is a single study that looks at addiction severity, screen time, hand strength, and wrist flexibility together in one group of addicted young users. That gap is what this study set out to address.

Methods

This was a cross-sectional, observational study run over eight months at Acharya Institutes in Bengaluru, Karnataka, India, designed and reported according to the STROBE checklist for cross-sectional research.

Ethical considerations

Before any data collection began, the Institutional Ethics Committee reviewed and approved the protocol (reference IEC/ANRIPT/25/4/2025). Every participant was told what the study involved, what would be asked of them, and any risks, and understood that taking part was optional. Signed consent was collected from each person, and all records were anonymized before analysis.

Convenience sampling was used to recruit currently enrolled Acharya Institutes students between 18 and 25 years old.

Inclusion criteria:

- Between 18 and 25 years old
- Male or female
- Currently a student at Acharya Institutes
- Gave written consent
- Scored at or above the sex-specific SAS-SV cutoff (31+ for men, 33+ for women) [9]

Exclusion criteria:

- A current wrist or hand injury
- Any past fracture in the upper limb
- An implant or prior surgery in the upper limb
- A neurological condition affecting the limb
- Ongoing upper-limb pain or a diagnosed inflammatory joint disorder
- Difficulty understanding or completing the testing procedures

Sample size

The target sample was worked out from a previously published correlation ($r = 0.23$) linking smartphone-use duration to grip strength [6]. Applying Fisher's Z-transformation at a two-sided alpha of 0.05 ($Z\alpha = 1.96$) and power of 80% ($Z\beta = 0.84$) produced a minimum requirement of about 146 participants [5]. To allow for incomplete responses and add a margin of precision, the study enrolled and analyzed 156 participants in total.

Study procedure

Students were approached on campus and checked against the eligibility list. Those who cleared the SAS-SV addiction cutoff filled out a background questionnaire and reported their daily screen time; a single trained therapist then carried out the hand-strength and wrist muscle-length testing, one after the other.

Because the therapist could see each participant's SAS-SV score and reported screen time beforehand, blinding was not possible - a limitation the authors treat as a possible source of measurement bias.

Outcome measures

Smartphone addiction: Addiction severity came from the 10-item SAS-SV, scored on a six-point scale per item for a possible total of 10 to 60 - higher numbers meaning more severe addiction. The scale's original validation set cutoffs of 31 (men) and 33 (women) [10].

Daily screen time: Participants estimated their average daily screen time in hours, drawing on their phone's built-in usage tracker for the past week wherever available, covering calls, texting, social apps, gaming, video, and general browsing. They also indicated whether they mostly held the phone in one hand, two hands, or switched between the two; this detail was logged but excluded from the main statistical analysis [11].

Grip strength: A Jamar hydraulic dynamometer was used to test grip strength. Each participant sat upright in a chair with no armrests, shoulder held at the side, elbow bent to 90°, forearm in a neutral twist, and wrist somewhere between 0° and 30° of extension, with the device lined up against the thigh and the arm left unsupported [5].

Effort was applied steadily rather than in a sudden burst, over three attempts at one handle setting, with a full minute of rest in between; the three readings were averaged for analysis.

Pinch strength: A pinch dynamometer, used in the same seated position as the grip test, captured both key and tripod pinch strength [12].

Key pinch: thumb pad pressed against the side of the index finger onto the gauge.

Tripod pinch: thumb pad met the tips of the index and middle fingers together on the gauge.

Each pinch type was tested three times with 30 seconds of rest between attempts, and the three readings were averaged [13].

Wrist flexor and extensor muscle-length tests: Muscle length at the wrist was assessed on the dominant arm using a passive-

stretch technique, with the participant lying on their back, elbow straightened, and forearm supported.

For the flexor test, the examiner straightened the fingers first, then extended the wrist while holding the forearm still; a positive result meant the wrist stopped short of full range with a firm muscle-stretch end-feel, or resistance appearing sooner than it should.

The extensor test mirrored this in reverse - fingers flexed first, then the wrist - using the same criteria for a positive result: an early, firm end-feel or premature resistance limiting the range.

One therapist carried out every test the same way, marking each as positive or negative. Since these are passive tests, a positive score was read as a sign of extra tension or reduced give in the muscle, not proof of permanent structural shortening [6].

Statistical analysis

Data were analyzed in IBM SPSS Statistics version 27.0. For continuous measures - age, BMI, daily screen time, SAS-SV score, and grip, key pinch, and tripod pinch strength - medians and Interquartile Ranges (IQR) were reported, reflecting their skewed distributions. Sex and the flexor/extensor test outcomes, being categorical, were summarized as counts and percentages.

Shapiro-Wilk testing confirmed that the continuous variables deviated significantly from a normal distribution ($p<0.05$), so non-parametric statistics were used throughout. Spearman's rho (ρ) tested the relationship between SAS-SV scores, daily screen time, and each strength outcome.

The flexor and extensor findings were coded as binary (0 = negative, 1 = positive) and examined against daily screen time using Spearman correlation as an exploratory step.

A two-tailed p-value under 0.05 was treated as statistically significant.

Results

Participant Characteristics

A total of 156 participants were included in the study. The mean age was 20.76 ± 1.74 years, the mean body mass index (BMI) was 22.16 ± 3.96 kg/m², and the mean daily smartphone screen time was 5.68 ± 2.36 hours. Females constituted 51.3% of the study population, while males accounted for 48.7%.

The demographic characteristics of the participants are presented in Table 1 and Figure 1.

Test of Normality

The normality of continuous variables was assessed using the Kolmogorov–Smirnov test with Lilliefors significance correction and the Shapiro–Wilk test. All variables demonstrated statistically significant deviations from normality ($p < 0.05$). Accordingly, non-parametric statistical analyses were used. Results of the Kolmogorov–Smirnov and Shapiro–Wilk Tests of Normality for Study are presented in Table 2.

Distribution of Smartphone Addiction Scores and Hand Function Measures

The median Smartphone Addiction Scale–Short Version (SAS-SV) score was 36 (interquartile range [IQR]: 33–37.5). The median grip strength, key pinch strength, and tripod pinch strength were 35 kg (IQR: 29–44.58 kg), 6.73 kg (IQR: 5.6–8.5 kg), and 6.60 kg (IQR: 5.6–8.3 kg), respectively. These findings are presented in Table 3.

The distributions of smartphone addiction scores and hand function parameters are illustrated in Figure 2.

Table 1: Demographic Characteristics of the Participants (n = 156).

Variable	Mean ± SD
Age (years)	20.76 ± 1.74
BMI (kg/m²)	22.16 ± 3.96
Daily screen time (hours)	5.68 ± 2.36

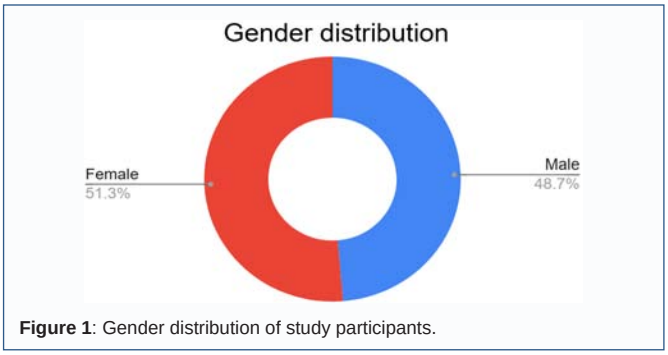


Figure 1: Gender distribution of study participants.

Table 2: Results of the Kolmogorov–Smirnov and Shapiro–Wilk Tests of Normality for Study.

Variable	Kolmogorov-Smirnov			Shapiro–Wilk		
	Statistic	df	p	Statistic	df	p
SAS-SV Score	0.14	156	<0.001	0.93	156	<0.001
Grip Strength (kg)	0.1	156	<0.001	0.98	156	0.01
Key Pinch Strength (kg)	0.13	156	<0.001	0.94	156	<0.001
Tripod Pinch Strength (kg)	0.13	156	<0.001	0.94	156	<0.001
Wrist Flexor Muscle Length Test	0.36	156	<0.001	0.64	156	<0.001
Wrist Extensor Muscle Length Test	0.37	156	<0.001	0.63	156	<0.001

Table 3: Median and Interquartile Range of Smartphone Addiction Score and Hand Function Parameters.

	SVS-SV	Grip strength (kg)	Key Pinch strength (kg)	Tripod Pinch strength (kg)
Median	36	35	6.73	6.6
IQR	33-37.5	29 - 44.58	5.6-8.5	5.6-8.3

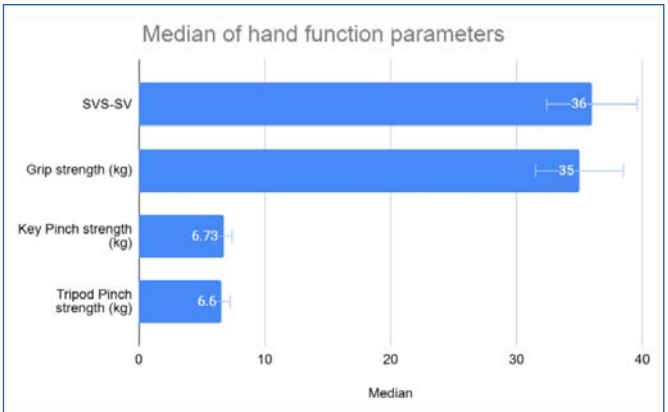


Figure 2: Distribution of Smartphone Addiction Scale–Short Version (SAS-SV) scores among study participants.

Wrist Muscle Length Test Findings

Positive wrist flexor muscle length test findings were observed in 73 participants (46.8%), whereas 83 participants (53.2%) demonstrated negative findings. Positive wrist extensor muscle length test findings were present in 69 participants (44.2%), while 87 participants (55.8%) had negative findings.

The distribution of wrist flexor and extensor muscle length test findings is presented in Table 4 and Figure 3.

Association Between Smartphone Addiction and Hand Function

Spearman's rank correlation analysis demonstrated no statistically significant associations between SAS-SV scores and any of the measured hand function parameters.

The correlation coefficients were weak for grip strength (ρ = −0.102, p = 0.203), key pinch strength (ρ = −0.074, p = 0.359), tripod pinch strength (ρ = −0.070, p = 0.385), wrist flexor muscle length test findings (ρ = 0.091, p = 0.260), and wrist extensor muscle length test findings (ρ = 0.055, p = 0.496). These findings are presented in Table 5.

Association Between Daily Smartphone Screen Time and Hand Function

Daily smartphone screen time was not significantly associated with grip strength (ρ = 0.091, p = 0.261), key pinch strength (ρ = −0.113, p = 0.160), or tripod pinch strength (ρ = −0.109, p = 0.177). These findings are presented in Table 6.

However, a statistically significant moderate positive correlation was observed between daily smartphone screen time and wrist flexor muscle length test findings (ρ = 0.372, p < 0.001), as well as wrist extensor muscle length test findings (ρ = 0.408, p < 0.001).

Discussion

This study set out to see whether smartphone addiction severity and daily screen time track with hand strength and wrist muscle-length findings in 156 young, phone-addicted adults. What emerged was that screen time - not addiction severity - was significantly tied to positive flexor and extensor muscle-length results. Neither variable showed any link to grip, key pinch, or tripod pinch strength. Taken together, this points to duration of use and addictive severity capturing two different things about smartphone behavior where musculoskeletal health is concerned [1, 2].

Table 4: Distribution of Wrist Flexor and Extensor Muscle Length Test Findings (n = 156).

Muscle Length Test	Positive n (%)	Negative n (%)
Wrist Flexor	73 (46.8)	83 (53.2)
Wrist Extensor	69 (44.2)	87 (55.8)

Table 5: Spearman's Rank Correlation Between Smartphone Addiction Scores and Hand Function Parameters (n = 156).

Hand Function Parameter	Spearman's ρ (r)	p-value
Grip Strength	-0.102	0.203
Key Pinch Strength	-0.074	0.359
Tripod Pinch Strength	-0.07	0.385
Flexor Muscle Tension	0.091	0.26
Extensor Muscle Tension	0.055	0.496

Table 6: Spearman's Rank Correlation Between Daily Smartphone Screen Time and Hand Function Parameters (n = 156).

Hand Function Parameter	Spearman's ρ	p-value	Interpretation
Grip Strength	0.091	0.261	Very weak positive, not significant
Key Pinch Strength	-0.113	0.16	Very weak negative, not significant
Tripod Pinch Strength	-0.109	0.177	Very weak negative, not significant
Flexor Muscle Tension	0.372	<0.001	Moderate positive, significant
Extensor Muscle Tension	0.408	<0.001	Moderate positive, significant

Participants logged a median of 5.00 hours of screen time daily (IQR: 4.00-7.00) - a substantial daily load. This lines up with earlier work: Berolo and colleagues linked handheld-device use to arm and neck symptoms in college students [1], and a systematic review by Eitivipart and colleagues tied smartphone use to musculoskeletal discomfort more broadly [9]. That said, self-reported discomfort in those earlier studies is a different kind of outcome than the clinician-measured muscle-length findings reported here, so the comparison is more about context than direct replication [1, 9].

Correlations between addiction severity and strength were weak and not significant - grip (ρ = -0.102, p = 0.203), key pinch (ρ = -0.074, p = 0.359), tripod pinch (ρ = -0.070, p = 0.385). Screen time performed no better: grip (ρ = 0.091, p = 0.261), key pinch (ρ = -0.113, p = 0.160), tripod pinch (ρ = -0.109, p = 0.177). A likely explanation is that phone use is repetitive and low-force, held in a fixed wrist posture, rather than resembling a maximal grip effort - so it makes sense that heavy use wouldn't necessarily erode peak strength. This null result is broadly consistent with earlier studies on phone use and hand strength, though differences in populations, exposure definitions, and outcome tools make exact comparisons difficult [4, 5, 7].

One important caveat: because every participant already met the addiction threshold, the range of SAS-SV scores in the sample was

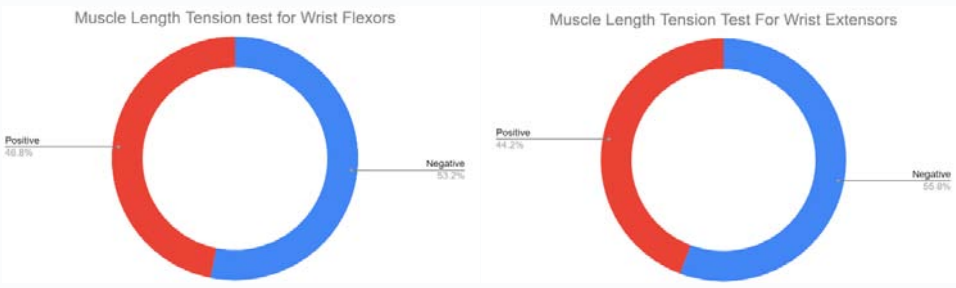


Figure 3: Distribution of positive and negative wrist flexor and extensor muscle length test findings.

narrow by design (median 36, IQR: 33-37.5). That restricted range may itself have masked any real relationship between addiction severity and hand function, so these null results say more about this particular addicted subgroup than about young adults generally. A sample spanning the full range of addiction scores would be a useful next step.

Screen time told a different story for muscle length: greater daily exposure tracked with a higher chance of a positive flexor (ρ = 0.372, $p < 0.001$) and extensor ($\rho = 0.408$, $p < 0.001$) finding. Because these outcomes are binary, the correlation reflects likelihood of a positive result rather than a continuous stiffness score. A reasonable mechanism is that the sustained wrist posture, forearm rotation, and constant thumb movement involved in phone use load the wrist and forearm muscles over time - but the cross-sectional design can't confirm which came first, and the underlying mechanism was not measured directly, so this remains a plausible rather than proven explanation [1, 9].

Earlier studies have connected phone use to hand-muscle performance and median-nerve changes [2, 4, 6], but those are different outcomes from the clinical muscle-length tests used here, so they should be read as background support rather than direct confirmation of these results [2, 4, 6].

A positive flexor result appeared in 73 participants (46.8%) and a positive extensor result in 69 (44.2%) - suggesting that some degree of wrist muscle restriction was common in this group. Even so, a positive passive-stretch test only shows resistance to movement; it doesn't on its own prove shortening, fibrosis, or greater tissue stiffness [6].

In sum, more screen time tracked with a greater chance of a positive wrist muscle-length finding, while grip and pinch strength stayed unrelated to either screen time or addiction severity - a reminder that wrist flexibility, not just strength, deserves attention in heavy young smartphone users [1, 5, 7].

Strengths and Limitations

Strengths of this work include a fairly large sample (156 participants), consistent testing procedures, and coverage of both grip and pinch strength alongside addiction severity and screen time. A single trained assessor conducted every test, which helped keep measurements consistent.

A few limitations should be noted. Because only already-addicted participants were enrolled, the SAS-SV score range was narrow, which may have hidden a genuine link between addiction severity and hand function. The assessor also knew each participant's SAS-SV score and screen time in advance, raising the possibility of measurement bias from lack of blinding. Lastly, wrist muscle length was judged clinically rather than with objective tools such as a goniometer, ultrasound, or elastography.

Future Research

Future work should include participants across the entire spectrum of phone use, not just those already addicted, and should use objective instruments to measure wrist range of motion and muscle stiffness. Pain, functional hand use, nerve changes, and real-world usage patterns during daily tasks are also worth studying. Longitudinal designs would help clarify the order in which screen exposure, wrist tension, strength loss, nerve changes, and an eventual "smartphonopathic hand" diagnosis might occur.

Conclusion

In this group of smartphone-addicted young adults, higher daily screen time was tied to a greater likelihood of positive wrist flexor and extensor muscle-length findings, while the severity of the addiction itself showed no clear connection to hand strength or wrist flexibility. Grip and pinch strength were unrelated to both screen time and addiction severity.

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Conflicting Interests

The authors declare that there are no conflicts of interest related to the research, authorship, and publication of this manuscript.

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