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## Effects of Using Smartphone on Hand Grip, Pinch Strength and Neck Muscles Endurance among Novice Physiotherapists

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### KEYWORDS

Dominant Hand Strength  
Dynamometer  
Grip Strength  
Smartphone

### DECLARATIONS

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### ABSTRACT

**Background:** Overusing smartphones may diminish hand grip, pinch strength, and neck muscle endurance in new physiotherapists, which could affect their ability to do their jobs and their physical health. **Objective:** To determine the effects of using a smartphone on hand grip, pinch strength and neck muscles endurance among novice physiotherapists. **Methodology:** It was a cross-sectional study with a sample size of 195a and data was gathered from physiotherapists of Lahore. The study duration was from March 2024 to September 2024. Non-probability of convenience sampling technique was used. Novice physiotherapists, and active clinicians for 1-3 years after graduation practising in hospitals and clinics are eligible for participation with the demographics (Status, age, gender and weight). Both Gender, Students of university, Students who use the phone more than five hours a day and Participants with no known radiculopathy were included. Students with chronic back, shoulder or neck pain. Participants with a previous history of surgery and trauma of the neck and hand. Hand dynamometer, Jamar pinch gauge dynamometer and Extensor and flexor cervical test were used as assessment tools. A smartphone addiction questionnaire was used to assess smartphone addiction among participants. Ethical consideration was followed throughout the study. **Results:** The study found that the average power grip of the dominant hand was  $38.81 \pm 15.05$ , with a range of 11.30 to 64.00. The non-dominant hand had an average power grip of  $24.03 \pm 14.84$ , ranging from 6.00 to 51.00. The dominant hand had a tip-to-tip pinch strength of  $3.55 \pm 1.18$  and a jaw pinch strength of  $3.79 \pm 1.06$ , while the non-dominant hand had a tip-to-tip pinch strength of  $3.47 \pm 1.23$  and three jaw pinch strength of  $3.79 \pm 1.16$ . Smartphone addiction was negatively correlated with grip strength and pinch strength in both hands, as well as with cervical endurance tests ( $p < 0.05$ ). **Conclusion:** Concluded that there is a relationship between smartphone addiction with hand grip, pinch grip strength and neck muscle endurance of both flexor and extensor muscles among novice physiotherapists.

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## INTRODUCTION

Due to their accessibility and convenience, smartphones are increasingly being used by novice physiotherapists.<sup>1</sup> Smartphones are useful tools for communicating, accessing educational materials, and gathering patient information. Nevertheless, it's crucial to take into account any potential consequences of smartphone use, including diminished focus during patient encounters, potential diversions, and potential effects on physical health, including hand grip, pinch strength, and neck muscle endurance.<sup>2</sup> In healthcare, smartphones quickly become important tools for talking, learning, and working. New physiotherapy graduates use their phones for patient care, research, and medical apps, as well as for personal chats.

Although smartphones can boost learning and work efficiency, too much usage can negatively affect muscle health. Using a smartphone involves repetitive hand actions such as pinching, typing, and scrolling, which can strain hand and thumb muscles and may eventually lead to weaker grips over time. These musculoskeletal problems are becoming more widely acknowledged as serious work-related risks for young professionals who use mobile devices extensively. Even though these problems are becoming more well-recognized, there isn't much focused study on how smartphone usage affects physiotherapists' hand and neck musculoskeletal characteristics.<sup>3</sup> This study aims to bridge this gap by examining how prolonged smartphone use affects the hand grip strength, pinch strength, and neck muscular endurance of inexperienced physiotherapists.

By identifying these relationships, we may better understand the ergonomic and health concerns associated with telephones and direct the creation of countermeasures.<sup>4,5</sup> A cell phone is the most mainstream gadget utilized among young people for sharing information, using the internet, watching videos, using social media, playing gaming, and doing many other daily activities. It is prevalent in teenagers.<sup>6</sup> One of the primary issues brought on by the increased use of telephones is hand and wrist weakness. Constant flexion and extension of the wrist, thumb, and fingers result in this weakening and a major musculoskeletal disorder. The

relationship between the strength of the hand and pinch grips and the duration of smartphone use (using the phones' screen time tracking capabilities) is not well documented. Smartphone addiction was very common among physiotherapists, with females showing more addiction, and it was strongly associated with discomfort in several bodily regions. The neck and cervical spine have a complex anatomical relationship. It has made it easier for the spine, muscles, bones, and nerves to be organized.<sup>7,8</sup> A physiotherapist's practice often involves intensive manual therapy techniques which can put a sustained strain on their hands. In physiotherapy, hand grip and pinch strength are essential, as effective thumb and finger movements are required during typing, scrolling or tapping.

It is noted that with excessive use of smartphones, the users experience a decrease in their grip strength and even pinch power which are strongly related to the overuse of their associated muscles and tendons. Similarly, repetitive strain injury of the hand during smartphone usage could lead to microtrauma that results in de quervain's tenosynovitis. Achieving dexterity needed in clinical practice could be impeded by the rows of smart device overuse. It has been suggested that it is the use of small smartphone screens which 'worsens' these problems, it is due to the use of greater thumb and finger force as well. Other effective preventive measures include ergonomic incorporation of the devices alongside hand strength training.

In addition, young physiotherapists shall be active in their usage of smartphones which requires an extended cervical flexion that has now been popularly termed 'text neck' violence. This pattern of posture leads to a degree of oversensitivity of the cervical spine and its surrounding muscles. There is evidence that continuous lounge squatting compromises neck extensor muscle enduring capacity. Neck muscle endurance is very important for physiotherapists as it helps them maintain the correct angle while treating or examining their patients. Overuse of mobile phones has been reported to cause early stages of neck pain and changes in the cervical muscle system, which can hinder professional activities. For instance, previous literature showed that the neck.

extensor muscles of individuals who spent excessive time on smartphones of more than three hours a day were significantly lower than those who engaged in moderate usage. Bodies of these physiotherapists, on the other hand, appear to be under stress and further overuse of neck muscles can cause additional tension-related headaches and discomfort.<sup>9</sup> Apart from clinical implications, poor neck muscle endurance may have other far-reaching effects on the physiotherapy professions and loss of position control are some of their other complications. To ameliorate these adverse effects, there are some recommendations that novice physiotherapists can follow.

These include keeping mobile phones at eye level to reduce the amount of neck flexion that occurs. Taking frequent short breaks, stretching and strengthening the wrists and neck muscles can help prevent some of the problems mentioned. Manual resistance could be used to increase muscle endurance and strength.<sup>10</sup> Use of smartphones often causes repetitive movement of the fingers especially while texting which limits the muscle movement of the hand.<sup>11, 12</sup> This repetitive movement over time can result in weakness of the hand grip strength.<sup>13</sup>

Similarly, pinch strength is also affected by smartphone addiction due to constant scrolling and texting as this requires a lot of repetitive finger movement which results in straining of the muscles.<sup>14</sup> Texting posture also impacts the pinch and hand grip strength as the forward or texting posture may impair the medial nerve in the cervical region which may compromise the supply towards the muscle of the hands and fingers resulting in weak hand and pinch grip strength.<sup>15</sup> Several cell phone users are about 75 to 80 percent which was last reported in 2013.<sup>16</sup> It is more commonly present in children than adults.<sup>17</sup> It has been assessed that about 79% of the populace aged between 18 to long-term keep their cell telephone with them untouched with the exemption of two hours when they go for a walk.<sup>18</sup>

## METHODOLOGY

It was a cross-sectional study. Data was gathered from physiotherapists in Lahore. A sample size of 195 cases is calculated with a 95% confidence level, by the following standard formula. The study duration was from March 2024 to September 2024. Non-probability of convenience sampling technique was used. Novice Physiotherapists and

active Clinicians for 1-3 years of graduation practising in hospitals and clinics are eligible for participation with the demographics (Status, age, gender and weight). Both Gender, Students of university, Students who use the phone more than five hours a day and Participants with no known radiculopathy were included.

Students with chronic back, shoulder or neck pain. Participants with a previous history of surgery and trauma of the neck and hand. The student with any joint or congenital posture abnormality and Participants who have any neurological disorder were excluded. Hand dynamometer, Jamar pinch gauge dynamometer and Extensor and flexor cervical test were used as assessment tools. A smartphone addiction questionnaire was used to assess smartphone addiction among participants. Ethical consideration was followed throughout the study. SPSS version 24 was used for statistical analysis.

## RESULTS

The results showed that the mean value of age was  $24.75 \pm 1.28$  with a minimum value of 23.00 and a maximum value of 29.00 (Table 1). The results showed that the mean value of the Smartphone Addiction Scale was  $129.77 \pm 2.48$  with a minimum value of 36.00 and a maximum value of 197.00 scores. Results showed that there is a negative correlation between smartphone addiction and the power grip of the dominant hand ( $p < 0.05$ ,  $r = -.591$ ). It was seen that the greater the smartphone addiction the greater the power grip of the dominant hand, there is a negative correlation between smartphone addiction and the power grip of the non-dominant hand ( $p < 0.05$ ,  $r = -.596$ ). It was seen that the greater the smartphone addiction the greater the power grip of the non-dominant hand. Results showed that there is a negative correlation between smartphone addiction and tip-to-tip pinch strength of the dominant hand ( $p < 0.05$ ,  $r = -.823$ ). It was seen that

**Table 1: Descriptive Statistics**

	Mean	Minimum	Maximum
Age	$24.75 \pm 1.28$	23.00	29.00
Smartphone Addiction Scale	$129.77 \pm 2.48$	36.00	197.00

the greater the smartphone addiction less its tip-to-tip pinch strength. The result showed that there is a negative correlation between smartphone addiction and the tip-to-tip pinch strength of the non-dominant ( $p < 0.05$ ,  $r = -.719$ ) Results showed that there is a negative correlation between smartphone addiction and the three-jaw pinch strength of the dominant ( $p < 0.05$ ,  $r = -.705$ ). Results showed that there is a negative correlation between smartphone addiction and three jaw pinch strengths of the non-dominant ( $p < 0.05$ ,  $r = -.582$ ).

Results showed that there is a negative correlation between smartphone addiction and lateral pinch strength of the dominant ( $P < 0.05$ ,  $r = -.886$ ). Results showed that there is a negative correlation between smartphone addiction and lateral pinch strength of the non-dominant ( $P < 0.05$ ,  $r = .836$ ). It was seen that there was a relationship between smartphone addiction and the flexor cervical endurance test ( $p < 0.05$ ). It was seen that this relationship was strongly negative between the flexor endurance test and smartphone addiction ( $r = .975$ ). It was seen that the greater the smartphone addiction less the person's ability to cervical flexor muscles. It was seen that there was a relationship between smartphone addiction and the extensor cervical endurance test ( $P < 0.05$ ). It was seen that this relationship was strongly negative between the extensor endurance test and smartphone addiction ( $r = -.921$ ). It was seen that the greater the smartphone addiction less the person's ability of cervical extensor muscles.

## DISCUSSION

Adel Alshahrani et al. carried out a study in 2021 to investigate how using a phone affected neck muscular endurance, hand grip, and pinch strength. The study specifically focused on male participants, with a total of forty individuals selected for the research. Neck flexor and extensor endurance tests were employed to evaluate the endurance of the neck muscles. A smartphone addiction questionnaire was administered to assess smartphone addiction, while dynamometers were utilized to measure pinch and hand strength. The results indicated that smartphone addiction had a significant impact on the endurance of the neck flexor muscle ( $P < 0.05$ ). Consequently, the findings led to the conclusion that smartphone addiction is only associated with reduced endurance in the neck flexor muscle.<sup>19</sup> However, current studies have shown that both

extensor and flexor cervical muscles are impacted by an increase in smartphone addiction ( $p < 0.05$ ).

The findings revealed that the average duration for the Flexor cervical Endurance test was  $73.45 \pm 26.2$  seconds, ranging from 42 to 112 seconds. Similarly, the extensor cervical endurance test had an average duration of  $98.99 \pm 56.51$  seconds, with a minimum value of 48 and a maximum value of 246 seconds. The results indicated a significant negative association between smartphone addiction and the endurance of the cervical flexor muscles ( $r = -0.975$ ). It was observed that individuals with higher levels of smartphone addiction exhibited decreased ability in their cervical flexor muscles. Furthermore, there was a significant negative relationship between smartphone addiction and the endurance of the cervical extensor muscles ( $r = -0.921$ ). Greater smartphone addiction was linked to reduced ability in the cervical extensor muscles.

Another 2019 study on the health impacts of smartphone use by Glukus Regiani Bueno et al.

**Table 5: Correlations between different variables**

Correlations	Pearson Correlation	Sig. (2-tailed)
Smartphone addiction scale	-.576**	0.000
Power grip of dominant hand		
Smartphone addiction scale	-.928**	0.000
Lateral pinch strength dominant		
Smartphone addiction scale	-.878**	0.000
Lateral pinch strength non-dominant hand		
Smartphone addiction scale	.987**	0.000
Flexor cervical endurance test		
Smartphone addiction scale	.920**	0.000
Extensor cervical endurance test		

found that students who text are more likely to experience neck discomfort than students who use cell phones regularly but for shorter periods. Results showed that almost 43.87% of cases had neck pain and kept their neck to 45 to 60 degrees of flexion and used the phone more often.<sup>20</sup> Similarly, the current study also showed that smartphone use affects the endurance of the neck muscles ( $p < 0.05$ ). The current study also focused on the average duration for the Flexor cervical Endurance test was  $73.45 \pm 26.2$  seconds (range: 42 to 112 seconds). Similarly, the Extensor cervical Endurance test had an average duration of  $98.99 \pm 56.51$  seconds (48 to 246 seconds).

## CONCLUSION

It was concluded that there is a relationship between smartphone addiction with hand grip, pinch grip strength and neck muscle endurance of both flexor and extensor muscles among novice physiotherapists.

## 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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