International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Effect of Chronic Smart Phone Usage on the Pain & Range of Motion of Neck among Healthcare Professional Students

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Abstract: ***This cross-sectional study investigates the effects of chronic smartphone usage on neck pain and range of motion among 320 healthcare professional students aged 18-25 years from SVIMS and CKS Dental College. Using the Smartphone Addiction Scale (SAS), participants who used their phones for more than 4 hours per day were classified as chronic users. Neck pain was assessed using the Numerical Pain Rating Scale (NPRS), and the range of neck motion was measured with a universal goniometer. The study found a correlation between extended smartphone use and increased neck pain intensity and decreased cervical range of motion. This study highlights the need for awareness regarding the musculoskeletal impacts of prolonged smartphone usage, particularly among healthcare professionals who are often reliant on mobile technology for academic and clinical purposes.***

Keywords: smartphone addiction, neck pain, range of motion, healthcare professionals, chronic smartphone use

1. Introduction

- The individuals who provide patients with medical services, promote health, and treat a variety of medical conditions are known as healthcare professionals. Now - a - days improvement of complitarization and digitalization by medical care experts while utilizing innovative gear to limit blunders are important (1).
- Over the last few years mobile phone application has been utilised by the the Healthcare professional students for both clinical and academic purposes.
- A survey conducted between 2016 and 2021 found that six billion people worldwide use smartphones, with many more expected in the coming years. It was discovered that the United States, India, and the Chinese republic all have the highest rates of smartphone use (3).
- Incorporating mobile technologies into a variety of medicalrelated fields that are utilized by multiple disciplines has become a valuable and significant tool since their introduction in the early 1990s (Ranson et al.).2007). (2)
- Smartphone technology has significantly affected everyone from schoolchildren to seniors in a very short duration. Due to the abundance of downloadable medical applications pertaining to health and medical education, the percentage of professionals and medical students using smartphones is steadily rising. (1)
- As many healthcare professionals (HCPs) are using such devices for personal or recreational purposes, it is simple to argue that their use has been expanded to support HCPs' education and practice. (2)
- These huge utilizations of cell phone can lead to constant use (Ie multiple hrs) of PDA use Can insight emotional side effects.7
- Problems with the head and neck accounted for the highest percentage, which ranged from 17.3 percent to 67.8 percent. These complaints were found to be common among college students who use smart devices. (3)
- According to a systematic review by Xie et al., neck and back pain is the most common symptom among smartphone users.2017, which emphasized that musculoskeletal complaints were experienced by smartphone users at a rate of 1% to 67.8%. (3)
- These vast applications of smartphone can lead to Chronic usage (i - e more than 4 hrs) of smart phone use can experience subjective symptoms. The intensity of symptoms is dependent on the intensity of use of mobile phones.
- Past investigations have announced that cell phone clients are bound to grumble of neck torment, muscle weariness, and cervical scope of movement than typical telephone clients (3).
- This study focuses on the components, which are majorly affected by smart phone usage for more than 4 hours i. e pain and range of motion of neck.

Need of the study:

- As there are less studies on chronic mobile phone use and its consequences among health care professionals in India.
- The need arises to know the effects of Smart phone usage among healthcare professional students.

Aim of the study: -

To determine the effect of chronic smart phone usage on the pain and range of motion of neck among healthcare professional students.

Objectives:

- To observe the values of chronic usage of smart phone among healthcare professional Students.
- To observe the pain among chronic smart phone users
- To observe range of motion of neck among chronic smart phone users

2. Material and Methodology

Materials:

- Smart phone addiction scale (SAS scale)
- Numerical Pain Rating Scale (NPRS Scale).
- Universal goniometer.

Methodology:
- Study Design: Cross - sectional study.
- Sample setting: SVIMS - Students, CKS Dental college.
- Sample collection: SVIMS - Students, CKS Dental college.
- Sample Method: Convenient sampling.
- Sample size: 320.

Inclusion Criteria:
- Healthcare professional students using smart phone more than 4 hrs / day for the past 6 months.
- Age - 18 – 25 years.
- Both genders.

Exclusive Criteria:
- Head Injury, Migraine.
- Pathological conditions around spine & upper limb.
- Neurological (or) other Orthopaedic injury conditions.

Procedure:
- 320 male & female healthcare professional students, who will meet the inclusion criteria will be taken for the study.
- After explaining the procedure of study in detail, shared the google forms which will be obtained from them.
- Measurements of cervical Range of motion, Data regarding, Neck pain Numerical rating intensity of smart phone users among healthcare professional students.

Outcomes:
- Chronic smartphone users.
- Range of motion of neck
- Neck pain Intensity.

Chronic Smart phone use: -
- Smart phone Addiction Scale (SAScale) is used to determine the addiction of smart phone usage among healthcare professional students.
- If the score is high than He/she is considered Chronic Smart phone user.
- If score is less than Individual considered as moderate / Mild smart phone user.

Measurement of CVA: -
- In order to accurately measure the degree of Head posture. Goniometry was used to measure CVA on sagittal plane.
- Head from top to base of clavicle
- CVA measurements is defined as the angle a horizontal line passing the neural spine of es in relation line connecting the tragus and neural spine of C7.
- The greater the measured CVA value, the more serious the degree of Forward Head posture.
- The correlation between the degree of FHP. According to the CVA & Neck disability of neck in relation to neck pain.
- Universal goniometry between fixed & anatomical landmarks will compare with (ROM goniometer) which is used as reference standard.
- These finding are also fundamental in establishing musculoskeletal diagnosis, assessing possible determinants in mobility, determining functional limitation and evaluating the level of pain and Angle.

Measuring the presence of pain: -
- The Neck pain Rating scale is used to evaluate the Neck pain index, the participants Scale 1 to 10, 0 - No pain, 10 - Extreme pain. The Subjects were asked to mark average pain felt in last 24 hrs.
- By using pain intensity scale (Expresses pain in Simple way).

3. Description

- A cross - sectional study was conducted on 320 subjects consists of 64 males and 256 females in healthcare professional students between the age group of 18 to 25 years who are pursuing their graduation and postgraduation courses. The data was collected from march 2024 to august 2024. Subjects are enrolled based on smart phone addiction scale, inclusion and execution criteria of the study. All the subjects were using their smart phones form last 6 months or at least a period of 12 months.
- Individuals with history of pathological (traumatic, congenital and surgical) conditions around the spine and upper limb, head injury or migraine are excluded. Also, individuals have any other neurological or orthopaedic conditions were not included in the study.
- The subjects were briefed by responding to google forms consisting of their demographic data and smart addiction scale. For assessing the mobile phone addiction, smart phone addiction scale was chosen.
- Range of motion and neck pain were taken as the outcomes of the study. Range of motion was assessed by universal goniometer and pain was assessed by numerical pain rating scale (MPRS). The subjects were taken into to study by convenient sample method.
- Range of motion of neck was assessed to find at the degree of neck movements. In his/her standing posture the subjects were asked to stand relaxed with their arms resting on the side of body.
- Range of motion of neck measured between the horizontal plane passing from c7 and a line extending from the tragus of ear.
- Where as pain was assessed by asking the patients about the pain based on numerical pain rating scale. The score obtained was then divided into normal, mild and severe.

Descriptives

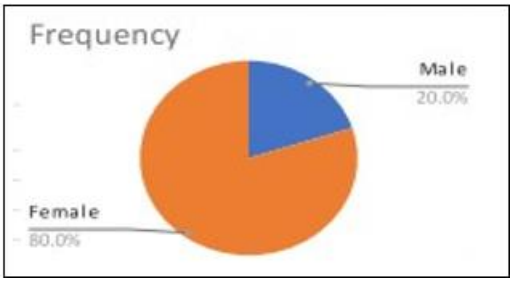
Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
age	320	15	18	33	21.44	.131	2.348	5.514
gender	320	1	1	2	1.80	.022	.401	.161
How many hours you use mobile phone in a day?	320	2	3	5	4.07	.056	.999	.998
In which position you use smart phone the most ?	320	8	1	9	6.91	.159	2.838	8.054
Valid N (listwise)	320							

Frequency Table

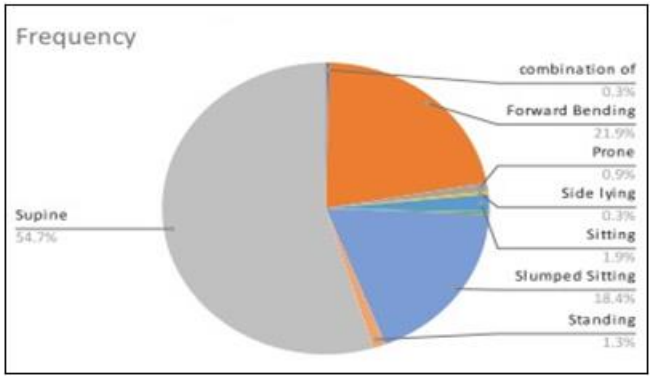
gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	64	20.0	20.0	20.0
	Female	256	80.0	80.0	100.0
	Total	320	100.0	100.0	



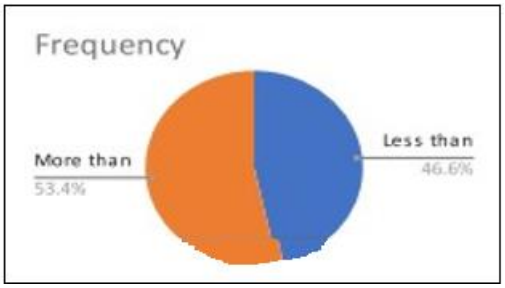
In which position you use smart phone the most ?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	combination of different positions	1	.3	.3	.3
	Forward Bending of head	70	21.9	21.9	22.2
	Prone	3	.9	.9	23.1
	Side lying	1	.3	.3	23.4
	Sitting	6	1.9	1.9	25.3
	Sleeping	1	.3	.3	25.6
	Slumped Sitting	59	18.4	18.4	44.1
	Standing	4	1.3	1.3	45.3
	Supine	175	54.7	54.7	100.0
	Total	320	100.0	100.0	



How many hours you use mobile phone in a day?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 4 hours	149	46.6	46.6	46.6
	More than 4 hours	171	53.4	53.4	100.0
	Total	320	100.0	100.0	



Descriptives

			Statistic	Std. Error
Smart Phone Addiction Scale Score	Mean		30.21	.455
	95% Confidence Interval for Mean	Lower Bound	29.32	
		Upper Bound	31.11	
	5% Trimmed Mean		30.03	
	Median		30.00	
	Variance		66.287	
	Std. Deviation		8.142	
	Minimum		10	
	Maximum		52	
	Range		42	
	Interquartile Range		12	
	Skewness		.322	.136
	Kurtosis		-.300	.272
ROM Flexion	Mean		78.45	.292
	95% Confidence Interval for Mean	Lower Bound	77.88	
		Upper Bound	79.03	
	5% Trimmed Mean		78.68	
	Median		80.00	
	Variance		27.302	
	Std. Deviation		5.225	
	Minimum		60	
	Maximum		85	
	Range		25	
	Interquartile Range		5	
	Skewness		-.564	.136
	Kurtosis		-.245	.272
ROM Extension	Mean		70.22	.231
	95% Confidence Interval for Mean	Lower Bound	69.76	
		Upper Bound	70.67	
	5% Trimmed Mean		70.17	
	Median		70.00	
	Variance		17.037	
	Std. Deviation		4.128	
	Minimum		40	
	Maximum		85	
	Range		45	
	Interquartile Range		0	
	Skewness		-.889	.136
	Kurtosis		9.210	.272
ROM SF L	Mean		41.93	.253
	95% Confidence Interval for Mean	Lower Bound	41.44	
		Upper Bound	42.43	
	5% Trimmed Mean		42.48	
	Median		45.00	
	Variance		20.450	
	Std. Deviation		4.522	
	Minimum		4	
	Maximum		45	
	Range		41	
	Interquartile Range		5	
	Skewness		-4.015	.136
	Kurtosis		28.460	.272
ROM SF R	Mean		42.19	.222
	95% Confidence Interval for Mean	Lower Bound	41.75	
		Upper Bound	42.62	
	5% Trimmed Mean		42.41	
	Median		45.00	
	Variance		15.733	
	Std. Deviation		3.966	
	Minimum		30	
	Maximum		75	
	Range		45	
	Interquartile Range		5	
	Skewness		.984	.136
	Kurtosis		14.387	.272
ROM SR L	Mean		78.73	.297
	95% Confidence Interval for Mean	Lower Bound	78.15	
		Upper Bound	79.32	
	5% Trimmed Mean		78.96	
	Median		80.00	
	Variance		28.252	
	Std. Deviation		5.315	
	Minimum		60	
	Maximum		90	
	Range		30	
	Interquartile Range		5	
	Skewness		-.662	.136
	Kurtosis		-.092	.272
ROM SR R	Mean		78.84	.320
	95% Confidence Interval for Mean	Lower Bound	78.21	
		Upper Bound	79.47	
	5% Trimmed Mean		79.17	
	Median		80.00	
	Variance		32.828	
	Std. Deviation		5.730	
	Minimum		45	
	Maximum		90	
	Range		45	
	Interquartile Range		10	
	Skewness		-1.072	.136
	Kurtosis		3.010	.272
NPRS	Mean		1.48	.102
	95% Confidence Interval for Mean	Lower Bound	1.28	
		Upper Bound	1.69	
	5% Trimmed Mean		1.30	
	Median		1.00	
	Variance		3.348	
	Std. Deviation		1.830	
	Minimum		0	
	Maximum		8	
	Range		8	
	Interquartile Range		3	
	Skewness		1.116	.136
	Kurtosis		.538	.272

The analysis was conducted on a sample of 320 participants, which provides sufficient power for the correlation test, even though the relationship between the two variables is weak and not statistically significant.

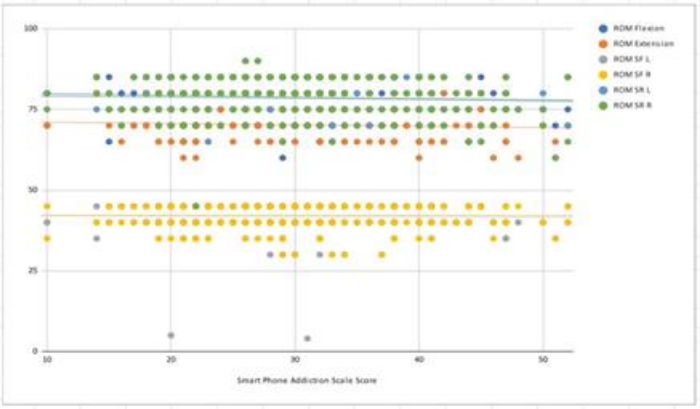
Conclusion: There is a very weak positive correlation between the Smart Phone Addiction Scale Score and NPRS, but this relationship is not statistically significant, implying that in this sample, smartphone addiction is not strongly associated with pain levels as measured by NPRS.

Nonparametric Correlations

Correlations

			Smart Phone Addiction Scale Score	ROM Flexion	ROM Extension	ROM SF L	ROM SF R	ROM SR L	ROM SR R
Spearman's rho	Smart Phone Addiction Scale Score	Correlation Coefficient	1.000	-.042	-.071	-.038	.033	-.040	-.010
		Sig. (2-tailed)		.459	.203	.504	.557	.472	.863
		N	320	320	320	320	320	320	320
	ROM Flexion	Correlation Coefficient	-.042	1.000	.387**	.316**	.327**	.383**	.368**
		Sig. (2-tailed)	.459		.000	.000	.000	.000	.000
		N	320	320	320	320	320	320	320
	ROM Extension	Correlation Coefficient	-.071	.387**	1.000	.318**	.342**	.442**	.394**
		Sig. (2-tailed)	.203	.000		.000	.000	.000	.000
		N	320	320	320	320	320	320	320
	ROM SF L	Correlation Coefficient	-.038	.316**	.318**	1.000	.707**	.284**	.298**
		Sig. (2-tailed)	.504	.000	.000		.000	.000	.000
		N	320	320	320	320	320	320	320
	ROM SF R	Correlation Coefficient	.033	.327**	.342**	.707**	1.000	.216**	.333**
		Sig. (2-tailed)	.557	.000	.000	.000		.000	.000
		N	320	320	320	320	320	320	320
	ROM SR L	Correlation Coefficient	-.040	.383**	.442**	.284**	.216**	1.000	.822**
		Sig. (2-tailed)	.472	.000	.000	.000	.000		.000
		N	320	320	320	320	320	320	320
	ROM SR R	Correlation Coefficient	-.010	.368**	.394**	.298**	.333**	.822**	1.000
		Sig. (2-tailed)	.863	.000	.000	.000	.000	.000	
		N	320	320	320	320	320	320	320

**. Correlation is significant at the 0.01 level (2-tailed).



Tests of Normality

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Smart Phone Addiction Scale Score	.076	320	.000	.984	320	.001
ROM Flexion	.245	320	.000	.881	320	.000
ROM Extension	.312	320	.000	.785	320	.000
ROM SF L	.270	320	.000	.586	320	.000
ROM SF R	.289	320	.000	.700	320	.000
ROM SR L	.278	320	.000	.872	320	.000
ROM SR R	.217	320	.000	.866	320	.000
NPRS	.285	320	.000	.796	320	.000

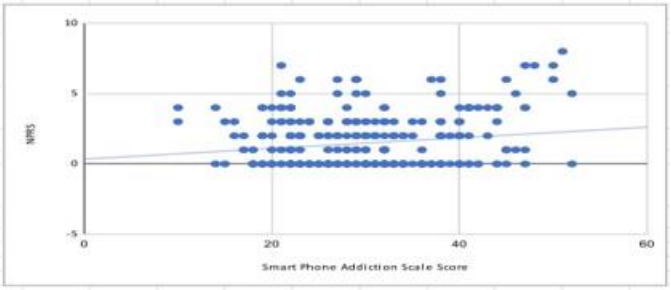
a. Lilliefors Significance Correction

The results from the Kolmogorov-Smirnov and Shapiro-Wilk tests indicate that the data for all measured variables do not follow a normal distribution. Specifically, for the Smart Phone Addiction Scale Score, ROM Flexion, ROM Extension, ROM SF (Side Flexion) Left and Right, ROM SR (Side Rotation) Left and Right, and NPRS (Numeric Pain Rating Scale), both tests show significant results ($p < 0.05$). This suggests a strong deviation from normality across all these variables, as confirmed by the low p-values. Therefore, non-parametric statistical methods may be more appropriate for analyzing this data.

Nonparametric Correlations

Correlations

			Smart Phone Addiction Scale Score	NPRS
Spearman's rho	Smart Phone Addiction Scale Score	Correlation Coefficient	1.000	.079
		Sig. (2-tailed)		.159
		N	320	320
	NPRS	Correlation Coefficient	.079	1.000
		Sig. (2-tailed)	.159	
		N	320	320



1. Correlation Coefficient (Spearman's rho):

The correlation coefficient between the Smart Phone Addiction Scale Score and NPRS is 0.079. This indicates a very weak positive correlation between the two variables, suggesting that as the Smart Phone Addiction Scale Score increases, the NPRS tends to increase slightly. However, the strength of this relationship is minimal.

2. Significance (Sig. 2-tailed):

The p-value associated with this correlation is 0.159. Since this p-value is greater than the commonly used significance level of 0.05, the correlation is not statistically significant. This means that there is no strong evidence to suggest a meaningful relationship between the Smart Phone Addiction Scale Score and NPRS in this sample.

3. Sample Size (N):

1. Smart Phone Addiction Scale Score and ROM Flexion:

Correlation Coefficient: -0.042
Significance (Sig. 2-tailed): 0.459
Interpretation: There is a very weak negative correlation between the Smart Phone Addiction Scale Score and ROM Flexion, but this correlation is not statistically significant ($p > 0.05$). This suggests no meaningful relationship between smartphone addiction and ROM Flexion.

2. Smart Phone Addiction Scale Score and ROM Extension:

Correlation Coefficient: -0.071
Significance (Sig. 2-tailed): 0.203
Interpretation: The correlation between the Smart Phone Addiction Scale Score and ROM Extension is also very weakly negative and not statistically significant ($p > 0.05$). This indicates that smartphone addiction has no significant association with ROM Extension.

3. Smart Phone Addiction Scale Score and ROM Side Flexion (SF) Left:

Correlation Coefficient: -0.038
Significance (Sig. 2-tailed): 0.504
Interpretation: There is a very weak negative correlation between the Smart Phone Addiction Scale Score and ROM SF Left, which is not statistically significant ($p > 0.05$). This implies no substantial relationship between smartphone addiction and ROM SF Left.

4. Smart Phone Addiction Scale Score and ROM Side Flexion (SF) Right:

Correlation Coefficient: 0.033
Significance (Sig. 2-tailed): 0.557
Interpretation: The correlation between the Smart Phone Addiction Scale Score and ROM SF Right is very weakly positive but not statistically significant ($p > 0.05$). This suggests no meaningful relationship between smartphone addiction and ROM SF Right.

5. Smart Phone Addiction Scale Score and ROM Side Rotation (SR) Left:

Correlation Coefficient: -0.040
Significance (Sig. 2-tailed): 0.472
Interpretation: The correlation between the Smart Phone Addiction Scale Score and ROM SR Left is very weakly negative and not statistically significant ($p > 0.05$). This indicates no significant association between smartphone addiction and ROM SR Left.

6. Smart Phone Addiction Scale Score and ROM Side Rotation (SR) Right:

Correlation Coefficient: -0.010
Significance (Sig. 2-tailed): 0.863
Interpretation: The correlation between the Smart Phone Addiction Scale Score and ROM SR Right is almost zero, with no statistical significance ($p > 0.05$). This suggests that smartphone addiction has no association with ROM SR Right.

Overall Interpretation:

All the correlations between the Smart Phone Addiction Scale Score and various cervical ROM measures (Flexion, Extension, SF Left and Right, SR Left and Right) are very weak and not statistically significant. This implies that smartphone addiction does not have a meaningful impact on the cervical range of motion in this sample of 320 participants.

	Code
Gender	
Male	1
Female	2
How many hours you use mobile phone in a day?	
Less than 4 hours	3
More than 4 hours	5
In which position you use smart phone the most ?	
combination of different positions	1
Forward Bending of head	2
Prone	3
Side lying	4
Sitting	5
Sleeping	6
Slumped Sitting	7
Standing	8
Supine	9
combination of different positions	1
Forward Bending of head	70
Prone	3
Side lying	1
Sitting	5
Sitting on	1
Sleeping	1
Slumped Sitting	59
Standing	4
Supine	175
	320

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