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Correlation Between Neck Pain and Visual Disturbances in Smartphone Users

Mohamed H. Elgendy [a*], Yasmin S. Atallah[b], Heba M. Elfeky [a]

**** Professor of Physical Therapy, Head of the Department of Basic Sciences, Faculty of Physical Therapy, Cairo University, Egypt. Official email: prof.mgendy@hotmail.com***

[a] Basic science department, Faculty of Physical Therapy, Cairo University, Cairo, Egypt.

[b] Basic science department, Faculty of Physical Therapy, October 6 University, Cairo, Egypt.

A B S T R A C T

Background: Neck pain is a major concern among today's most common health conditions. It ranks fourth globally in terms of disability, which may affect quality of life. Many people with neck pain complain of visual disturbances, which also affect their lives and reduce visual performance. Objective: The current study was carried out to Investigate and examine the relationship between neck pain and visual disturbances in smartphone users. Methods: 141 phone users aged 18 to 50 were chosen for a cross-sectional study based on inclusion and exclusion criteria. The participants filled out the neck disability index and visual functional questionnaire at one time to investigate neck discomfort and visual disturbances accompanied by neck pain via online forms and papers. Results: when the whole set of data was considered to correlate with each other, The study revealed that there is a strong correlation among neck pain and visual disturbances with significant value (r = -0.916, p = 0.001). The correlations between items of NDI and items of VFQ-25 were moderate to strong negative significant correlation (r = -0.605 to -0.93, p = 0.001. Conclusion: it is conducted that there is a strong negative correlation between neck pain and visual disturbances

Keywords: Neck Pain, Visual Disturbances, Smartphone, Neck Posture, Eye Reflexes

Introduction

Smartphone usage is greater worldwide than that of any other portable electronic device. Three and a half billion people worldwide use smartphones [1]. Students, workers, and older people are all represented among smartphone users [2], [3], [4].

Using a smartphone too much could lead to abnormal postures. Among smartphone users with documented musculoskeletal issues, a prior study indicated that 82.74 percent kept their necks flexed when on the device [5]. Individuals were susceptible to musculoskeletal problems [6,7]. Among these is musculoskeletal pain, the prevalence of which has been linked to smartphone use in studies ranging from 8.2% to 90% across various body regions [2].

Incorrect head-to-trunk alignment may cause specific neck and scapular muscles to be used asymmetrically, which is a sign of postural imbalance. The visual, vestibular, and somatosensory systems collaborate to maintain postural balance, and any misalignment between these systems can cause poor postural control [8].

Neck discomfort is common in various nations, with 52% of people reporting it in India, 57% in New Zealand, 48% in the USA, and 83.8% in China [9]. 56.1% in Egypt [10]

There is no simple neurophysiological explanation for neck pain and visual dysfunctions, two of the most pressing medical problems of our day. The development of pain is influenced by a multitude of elements, such as physical, psychological, and individual-specific aspects of this complex disease [11].

In people with neck pain, visual complaints might be related to identified deficits in oculomotor control and disturbances in gaze stability and head-eye coordination. [12], [13]. Other visual complaints, such as blurred vision, words jumping on the page, and difficulty concentrating on focusing and reading, are more notably reported in those with neck pain disorders than others (i.e., double vision).[14]. It's reported that the incidence of visual dysfunction caused by cervical spondylosis ranges from 3% to 22.4% of other atypical symptoms [15].

This study was done to discover if there was any correlation between neck pain and visual disturbances among smartphone users.

According to this research, there aren't many studies that take into account the effect of neck pain and visual problems. To overcome these restrictions, I chose people who spend at least 4 hours per day on smartphones, especially watching and texting, for this study.

Methods

Study Design:

This study was a cross-sectional observational analytical study design conducted on smartphone users

Participants:

141 Participants who are smartphone users were selected randomly from universities and the local community of Egypt to complete both the neck disability index and visual functional questionnaire 25 version 2000.

The mean ± SD age, weight, and height of subjects, in addition to BMI, were 28.47 ± 7.21 years, 69.79 ± 12.65 kg, 168.24 ± 8.77 cm, and 24.68 ± 4.29 kg/m².

Inclusion Criteria:

To be included in the study, subjects who were smartphone users (4 hours per day) and aged between 18 to 50 years both genders were included, and all patients were able to read and write Arabic language. Participants without systemic illnesses or physical deformities were also included [12], [16].

Exclusion Criteria:

People with head and neck injuries, eye diseases, People with diabetic retinopathy, people who had refractive correction surgery, psychiatric problems (depression), systemic illnesses or physical deformities, people who have vision impairments and disabilities, Patients who have cognitive impairment.

Scales and Instrumentation for Assessment:

1-The Neck Disability Index (NDI) Arabic version

It is a self-reporting tool used to assess impairment linked to neck pain. It asks ten questions about how neck pain may affect several daily tasks, such as pain, personal care, lifting, reading, headaches, concentration, work, driving, sleeping, and recreation.

- A score of 0 indicates "No pain" and a score of 5 indicates "Worst imaginable pain" for each component.
- A total score is the sum of all points.
- The test's results can be seen as either a percentage or a raw number, with 50 being the maximum possible score.
- A score of 0 points indicates no limitations on activity, while a score of 50 points indicates maximum limitations.
- A higher score means that the patient reported more disability.

2- Visual Function Questionnaire (VFQ-25) version 2000

The questionnaire assesses the impact of visual impairment and visual symptoms on general health domains, including social functioning and emotional well-being, as well as task-oriented domains associated with everyday visual functioning.

The VFQ-25 consists of one overall health rating question and twenty-five vision-specific questions covering eleven different constructs.

A high score indicates greater functioning on all items.

Ethical approval

Research Ethical Committee of the Faculty of Physical Therapy authorized the study protocol [No: P.T.REC/012/005137]. In addition to being registered with ClinicalTrials.gov (NCT06446700). Before taking part in this research.

Data collection:

The NDI and the VFQ were used to collect the data to examine the relationship between neck pain and visual problems among smartphone users.

Statistical methods:

Descriptive statistics on the sample were done utilizing means and standard deviations for numerical data and using frequency and percentage for categorical data. The Pearson correlation coefficient was utilized to investigate the correlation between NDI items and items of visual functioning. Multiple linear regression was performed to predict visual functioning based on NDI score, age, and sex. A p-value of less than 0.05 was used for all statistical tests. This study's statistical analysis was carried out using SPSS version 25 for Windows, developed by IBM SPSS in Chicago, IL, USA.

Results

Subject characteristics

One hundred forty-one smartphone users took part in this study. The mean ± SD age, weight, height as well as BMI of subjects were 28.47 ± 7.21 years, 69.79 ± 12.65 kg, 168.24 ± 8.77 cm and 24.68 ± 4.29 kg/m². 83 (59%) of subjects were females and 58 (41%) males were males. (Table 1**)**.

Table 1. General characteristics of the subjects.

	Mean ±SD	**Minimum**	**Maximum**
Age (years)	28.47 ± 7.21	19	49
Weight(kg)	69.79 ± 12.65	45	110
Height (cm)	168.24 ± 8.77	155	190
BMI (kg/m²)	24.68 ± 4.29	17.72	40.01
	N	**%**	
Sex distribution			
Females	83	59	
Males	58	41	

NDI of subjects

The mean ± SD total score of the NDI of subjects was 21.31 ± 15.95. The mean ± SD pain intensity was 2.40 ± 1.82. Sleeping had a higher mean of 2.43 ± 1.83, while reading had a lower score of 1.98 ± 1.61. 35 (24.8%) subjects had no disability, 24 (17%) had mild disability, 11 (7.8%) had moderate disability, 38 (27%) had severe disability, and 33 (23.4%) subjects had complete disability (table 2).

VFQ-25 of subjects

The mean ± SD total score of subjects VFQ-25 was 57.20 ± 29.86. The mean ± SD general vision, color vision, and peripheral vision were 66.28 ± 23.79, 61.17 ± 33.06, and 58.87 ± 36.12, respectively. Role Difficulties and ocular pain had lower means of 51.14 ± 31.43 and 51.58 ± 31.29, respectively (Table 2).

Table 2. Mean NDI and VFQ-25 items of subjects.

NDI items	**Mean ±SD**	**VFQ-25**	**Mean ±SD**
Pain Intensity	2.40 ± 1.82	**General Health**	67.55 ± 20.65
Personal Care	2.16 ± 1.76	**General vision**	66.28 ± 23.79
Lifting	2.04 ± 1.74	**Ocular pain**	51.58 ± 31.29
Reading	1.98 ± 1.61	**Near activities**	57.35 ± 31.52
Headaches	2.34 ± 1.76	**Distance activities**	59.07 ± 31.17
Concentration	2.28 ± 1.67	**Social functioning**	59.90 ± 32.07
Work	2.01 ± 1.64	**Mental health**	53.77 ± 32.38
Driving	2.15 ± 1.84	**Role Difficulties**	51.14 ± 31.43
Sleeping	2.43 ± 1.83	**Dependency**	55.17 ± 32.99
Recreation	2.16 ± 1.68	**Driving**	59.16 ± 33.95
Total score	21.31 ± 15.95	**Color vision**	61.17 ± 33.06
Percentage score (%)	43.91± 32.51	**Peripheral vision**	58.87 ± 36.12
		Total score	57.20 ± 29.86

Correlations among pain intensity, NDI, and visual functioning:

The correlation among the pain intensity of NDI as well as the total score of VFQ-25 was a strong significant correlation (r = -0.916, p = 0.001). Similarly, the correlation was a strong correlation with general vision (r = -0.838, p = 0.001), color vision (r = -0.850, r = 0.001), and peripheral vision (r = -0.837, p = 0.001). Pain intensity and total score of NDI showed a strong correlation with all items of VFQ-25. (Table 3).

There was a strong significant correlation between total score of VFQ-25 with personal care (r = -0.84, p = 0.001), lifting (r = -0.898, p = 0.001), reading (r = -0.855, p = 0.001), headaches (r = -0.924, p = 0.001), concentration (r = -0.865, p = 0.001), work (r = -0.888, p = 0.001), driving (r = -0.912, p = 0.001), sleeping (r = -0.912, p = 0.001) and recreation (r = -0.882, p = 0.001). The correlations among items of NDI as well as items of VFQ-25 were moderate to strong significant correlation (r = -0.605 to -0.93, p = 0.001). (Table 3).

Table 3. Correlations between NDI and items of VFQ-25:

VFQ-25 items	NDI										
	Pain Intensity	**Personal Care**	**Lifting**	**Reading**	**Headaches**	**Concen-tration**	**Work**	**Driving**	**Sleeping**	**Recreation**	**Total score**
General Health	-0.756**	-0.615**	-0.605**	-0.744**	-0.660**	-0.696**	-0.662**	-0.758**	-0.681**	-0.663**	-0.716**
General vision	-0.838**	-0.793**	-0.795**	-0.803**	-0.856**	-0.806**	-0.815**	-0.83**	-0.850**	-0.815**	-0.868**
Ocular pain	-0.826**	-0.691**	-0.782**	-0.741**	-0.844**	-0.821**	-0.792**	-0.858**	-0.831**	-0.780**	-0.845**
Near activities	-0.910**	-0.821**	-0.890**	-0.864**	-0.916**	-0.896**	-0.889**	-0.933**	-0.913**	-0.900**	-0.944**
Distance activities	-0.901**	-0.849**	-0.900**	-0.854**	-0.892**	-0.826**	-0.876**	-0.878**	-0.876**	-0.869**	-0.918**
Social functioning	-0.867**	-0.822**	-0.878**	-0.841**	-0.860**	-0.798**	-0.848**	-0.861**	-0.852**	-0.862**	-0.897**
Mental health	-0.878**	-0.793**	-0.860**	-0.813**	-0.891**	-0.815**	-0.859**	-0.874**	-0.879**	-0.846**	-0.900**
Role Difficulties	-0.865**	-0.803**	-0.855**	-0.824**	-.0867**	-0.821**	-0.839**	-0.879**	-0.874**	-0.831**	-0.894**
Dependency	-0.866**	-0.863**	-0.855**	-0.787**	-0.909**	-0.805**	-0.853**	-0.86**	-0.860**	-0.836**	-0.896**
Driving	-0.923**	-0.759**	-0.896**	-0.834**	-0.877**	-0.893**	-0.895**	-0.92**	-0.911**	-0.854**	-0.921**
Color vision	-0.850**	-0.796**	-0.834**	-0.778**	-0.862**	-0.775**	-0.814**	-0.833**	-0.841**	-0.815**	-0.861**
Peripheral vision	-0.837**	-0.754**	-0.844**	-0.784**	-0.838**	-0.790**	-0.829**	-0.836**	-0.828**	-0.813**	-0.861**

Total Score	-0.916**	-0.84**	-0.898**	-0.855**	-0.924	-0.865**	-0.888**	-0.912**	-0.912**	-0.882**	-0.940**

r value: Pearson correlation coefficient p-value: Probability value **: Significant at $p < 0.001$

Discussion

This investigation primarily focused on assessing the influence of neck pain on vision. A combination of two questionnaires, which are NDI and VFS, are used for the assessment of neck pain and disability & visual function and found a highly significant result p=0.001.

The repetitive flexion or bending of the head during smartphone use is a key contributor to neck discomfort [17]. This notion aligns with a previous study indicating that a substantial portion of the population aged 18 to 44, approximately 79%, are almost perpetually connected to their cell phones. [18]

Neck pain is a common complaint among smartphone users because their heads move forward when using the device, which puts strain on the cervical vertebral column as well as muscles in the neck. This, in turn, leads to an excessive anterior curvature in the lower cervical region and an excessive posterior curvature in the upper thoracic region to keep balance [19], [20].

Due to its central role and heightened sensitivity, the neck is an intriguing site to experience visual and neurological symptoms. A large number of its cells are proprioceptors, which are responsible for activating ocular and vestibular reflexes. This enables a high degree of control over posture, eye and head motion [21]. This study was done to explore if there is an association among neck pain due to neck-related issues like neck muscle strains, weakness, tightness, spinal curvature disturbance, trigger points, etc., and visual disturbances among smartphone users.

By the end of our study, we found that the analysis of data revealed that:

The correlation among pain intensity of NDI as well as total score of VFQ-25 was a strong negative significant correlation ($r = -0.916$, $p = 0.001$), the correlation was a strong negative correlation between NDI and general vision ($r = -0.838$, $p = 0.001$), color vision ($r = -0.850$, $r = 0.001$) and with peripheral vision ($r = -0.837$, $p = 0.001$). Also, Pain intensity and total score of NDI showed a strong negative correlation with all items of VFQ-25.

The correlations between items of NDI and items of VFQ-25 were moderate to strong negative significant correlation ($r = -0.605$ to -0.93, $p = 0.001$). Therefore, this study reported that there is a relationship between neck pain and visual problems among people who use smartphone users.

According to results from the study by Treleaven and Takasaki (2014), visual symptoms that have been linked to neck pain tend to have comparable characteristics. Among the most common symptoms, "sensitivity to light" (58.6% of cases) and "need to concentrate to read" (70%) were listed. "Dizzy reading" (38.6% prevalence) and "double vision" (28.6% prevalence) were the least common. "Need to concentrate to read," "visual fatigue," "problems judging distances," and "sensitivity to light" were the most severe symptoms, whereas "double vision," "red eyes," as well as "spots and words moving" were the least severe complaints.

This is appropriate with research conducted by Kristjansson & Treleaven,2009 At least half of those who experienced neck pain reported "visual fatigue" along with "need to concentrate to read," the two most common and troublesome symptoms. Though reported by at least half of the population, "sensitivity to light" was less problematic.

Furthermore, according to Treleaven et al. (2003) and Treleaven (2008), this study found that compared to asymptomatic individuals, subjects with neck pain reported far more visual complaints and a higher proportion of complaints overall. Additionally, it demonstrated that, in general, visual symptoms were more problematic (larger in magnitude) but not always more common in WAD patients compared to INP subjects, even when the injury had occurred before the pain began.

These findings were in line with Shabbir et al., 2022 concluded that there is a strong relationship between visual impairment (nearsightedness) and neck pain. Sánchez et al. (2019) The results of the systematic review and meta-analysis, as well as the qualitative evaluation, showed that all the studies that were considered established a connection among the visual as well as musculoskeletal systems of the neck. Finally, all studies agreed on the effect of neck pain on visual disturbances and agreed on their correlation to each other.

Limitation:

•The length of the visual functional questionnaire made participants bored

•Some participants answered only one questionnaire and left the other unanswered.

Conclusion:

It could be concluded that neck pain in smartphone users leads to visual problems, and the findings also show that there is a strong correlation between neck pain and visual disturbances..

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