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The impact of mechanical neck pain on peak expiratory flow in smartphone addicted population.

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ABSTRACT

Background: Mechanical neck pain seen in smartphone addicted population causes respiratory hazards and decrease in peak expiratory flow. Aim: To detect the effect of mechanical neck pain on peak expiratory flow in smartphone addicted population. Methods: 100 volunteers of smartphone addicts with mechanical neck pain were recruited from delta university for science and technology. Their age ranged from 18-25 years. Both sexes were included (47 males, 53 females). Their peak expiratory flow (PEF) was measured using spirometer and the results were compared to the normal predicted values based on age, sex, race, weight and height. Results: there was a significant decrease ($P<0.05$) in PEF in smartphone addicts with mechanical neck pain compared to normal predicted values. Conclusion: Mechanical neck pain causes decrease in PEF in smartphone addicted population.

Keywords: Smartphone, Mechanical neck pain, Spirometry, Peak expiratory flow

1.Introduction

People were urged to work from home when educational institutions and businesses were shut down. Students were given access to online learning activities Following the World Health Organization's (WHO) declaration of COVID-19 as a pandemic, nations imposed limitations on social mobility and travel. (Sohrabi et al., 2020)
During the epidemic, there was a significant surge in internet usage (Sun et al., 2020). According to studies, the average smartphone user spends approximately 20 hours each week on their device. It was also shown that the average smartphone user spends 6 hours and 42 minutes each day on internet-related activities, equating to approximately 100 days per year (Varga et al,.2020). Young adults aged 18 to 29 years old make up the majority of smartphone users. About 52.9% are found to be smartphones over users (Zhuang et al., 2020).
There are four essential components to smartphone addiction: withdrawal: feelings of distress without the phone, compulsive phone use: actions such as repeated checking for updates or messages, compulsive phone use: practices such as repeated checking for notifications or messages, obsessive phone use: acts such as repeated checking for updates or messages Functional impairment: interference with other daily activities and social interactions, tolerance: extended periods of usage(Lin et al.,2015).
Long-term usage of a smartphone may alter cervical spine alignment and proprioception (Kim et al., 2013). Excessive smartphone use may place a great deal of stress on the cervical spine., causing the curve to change (Park et al., 2015). When using a smartphone, most people maintain a head flexion of (33°-45°) from vertical (Lee et al. 2015).

The percentage of smartphone users who suffer from musculoskeletal symptoms ranges from 1% to 67.8%. With a frequency of 17.3 percent to 67.8% (Xie et al., 2018), neck discomfort is the most frequent musculoskeletal complaint among smartphone users. Neck pain was shown to be more common in people who used their phones frequently (Alsalameh et al., 2019).

Mechanical neck pain (MNP) is a general term for a vague discomfort that intensifies with neck movement (Daniels and Kary., 2011). Neck pain was classified as "non-specific" or mechanical when it was induced or aggravated by neck motions or chronic neck postures, and no specific underlying condition could be found (Ferrari et al.,2003).
Functional deficits in patients with chronic neck pain include weakness of deep bending neck muscles owing to excitation of neck surface muscles, increasing in the deformity of forward head posture, proprioception impairment, and poor balance. Furthermore, restricted cervical spine mobility limits the spine's range of motion and impairs respiratory function as forced vital capacity, forced expiratory volume and peak expiratory flow. (Dimitriadis et al.,2013)
So this study aimed to investigate the effect of mechanical neck pain on peak expiratory flow (PEF) in smartphone addicted population.

2. Material and methods

2.1.*Subjects*

One hundred volunteers of smartphone addicts with mechanical neck pain were enrolled in this study; they were recruited from students of Delta university. Their age ranged from (18 to 25). Both sexes were included (47 males, 53 females). Patients were included in the study if they are smartphone addicts with mechanical neck pain (men and women), they did not participate in any kind of ventilatory rehabilitation program, their BMI ranged from 18.5-24.9 kg/m². (Normal BMI range) (WHO., 2000), their smartphone addiction scale-short version score $\geqslant 31$ and $\geqslant 33$ for male and female participants respectively, and their neck disability index score in both male & female participants ranged from 10% to 48%.
Patients were excluded from this study if had chest disease, cardiovascular disease, uncontrolled hypertension, metabolic disorder, peripheral or central nervous system diseases, cervical disc prolapse or previous spinal surgery.

2.2.*Materials*

Before the initiation of assessment program, a consent form was obtained from each patient as an agreement to be included in the study. Each patient received detailed explanation of procedures of the assessment and measurement devices. And the purpose of the assessment was explained for each patient.

The neck disability index (NDI): The NDI form (score out of 50) was used to measure the patient's perceived disability resulting from their neck pain. There are ten sections in this questionnaire and each section is scored 0-5 points. (Vernon, 2008)

An Arabic version of NDI was translated and validated by (Shaheen, et al.,2013)

Some benchmarks can be found in literature (Macdermid et al.,2009)

- 0-4points (0-8%) no disability,
- 5-14points (10 – 28%) mild disability,
- 15-24points (30-48%) moderate disability,
- 25-34points (50- 64%) severe disability,
- 35-50points (70-100%) complete disability

The smartphone addiction scale-short version (SAS-SV) (Arabic version): It is a ten-item questionnaire developed in South Korea to determine degrees of smartphone addiction. Participants are asked to assess how much each statement applies to them on a dimensional scale (1 "strongly disagree" to 6 "strongly agree"). Smartphone addiction cut-off values of $\geqslant 31$ and $\geqslant 33$ for male and female participants respectively were applied (Kwon et al., 2013). An Arabic version of SAS-SV was used in this study, translated and validated by (Sfendla et al. 2018)

Ventilatory function test device: Spirometry Medisoft ergocart professional, power 230V AC 50Hz, Serial number: 161121-05-0018, Belgium.

2.3. Procedures

Testing method according to Giuliodori and DiCarlo, (2004).

1. Patient preparation should consist of explanation the purpose of the test and how it was done. with keeping the explanation brief and in simple terms.
2. The patient was seated in comfortable sitting position with loosening any tight clothes like neckties or belts.
3. The device was calibrated and sterilized before the test.
4. The patient was showed the proper chin neck position, chin should be slightly elevated and neck slightly extended, this position should be maintained throughout the forced expiratory procedures, the patient was not allowed to bend the chin to the chest.
5. A clean mouth piece was placed on the valve at the end of spirometer tubing for each patient.
6. The patient was taught how to relax and regularly breathe through the mouth piece before the test was started.
7. A nose clip was placed on the patient's nose.
8. The device was switched on, the personal patient's data including age, sex, race, weight and height were entered.
9. Mouthpiece was into patient's mouth, the patient was told not to bite down on mouthpiece, lips should be sealed tightly and the tongue should not stick out into mouthpiece.
10. The patient was asked to breath 3 tidal breaths then fully expire, then take a deep inspiration to expire forcefully and rapidly as much as possible through the mouthpiece, the procedure was repeated 3 times and the best record was taken.
11. Assessment of ventilatory function is based on comparing a subject test result against the reference or predicted value in order to do this correctly, the patient's height (without shoes) age (on day of test), sex and sometimes, weight are needed.

2.4.*Statistical analysis*

The statistical analysis was conducted by using statistical SPSS Package program version 20 for Windows (SPSS, Inc., Chicago, IL). The following statistical procedures were conducted:

- Descriptive statistics including the mean and standard deviation for PEF variables.
- Unpaired (Independent) t-test to compare between predicted values and study group for PEF variables.
- Statistical level all statistical analyses were significant at level of probability less than an equal 0.05 ($P \leq 0.05$).

3.Results

Table (1) and Figure (1) represent the comparative mean values of PEF between predicted normal values and study group. The mean values of PEF in predicted and study group were 8.45 ±1.59 and 5.33 ±1.39, respectively. The statistical analysis by independent t-test revealed that there was significantly ($P=0.0001$; $P<0.05$) decreased in mean value of PEF within study group compared to the predicted normal values with change 3.12 between predicted and study group.

Table (1): Comparison of mean values PEF between predicted normal values and study group

Items	PEF (Mean ±SD)
Predicted group	8.45 ±1.59
study group (n=100)	5.33 ±1.39
Mean difference (change)	3.12
t-value	13.201
P-value (P<0.05)	0.0001*
Significance	S

Data are expressed as mean ±standard deviation
P-value: probability value S: significant * Significant (P<0.05)

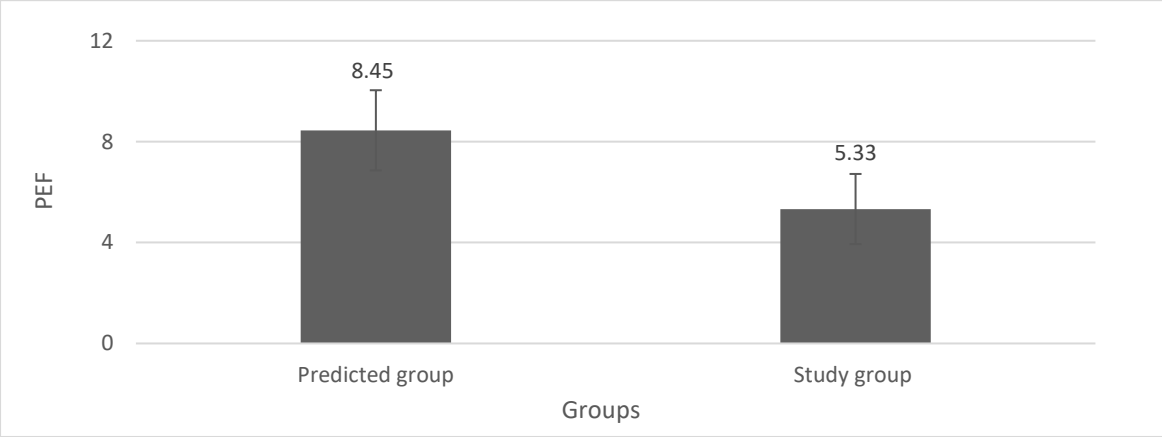

Figure (1): Mean values of PEF in predicted normal values and study group.

4.Discussion

The results of the study revealed that there was a decrease in PEF value as the statistical analysis by independent t-test revealed that there was significantly (P=0.0001; P<0.05) decreased in mean value of PEF within study group compared to predicted group with change 3.12% between predicted values and study group.

This result agrees with Yozbatiran et al (2006) who investigated Influence of physiotherapy program on peak expiratory flow rate (PEFR) and chest expansion in patients with neck and low back pain. The study found that there was a significant decrease in PEF values before applying physiotherapy program in the patients suffering from neck pain.

Also, this result agrees with Jung et al (2016) who performed a study to know the effect of smartphone usage time on posture and respiratory function. They found a significant decrease in PEF value in subjects who use smartphones for prolonged periods as these subjects tended to have poorer forward head posture and rounded

shoulders compared with the patients who spent less time on smartphones. It also shows that people who used smartphones for long durations had partly impaired respiratory function.

On the other side, this result disagrees with Wirth et al (2014) who studied the respiratory dysfunction in patients with chronic neck pain and the influence of thoracic spine and chest mobility, and reported that there was no significant decrease in PEF value in the patients with chronic neck pain than the control group in the study.

This result failed to agree with Dimitriadis et al (2014) who performed a spirometric study to investigate the pulmonary functions in the patients with chronic neck pain and reported that there was no significant decrease in PEF value in the patients with chronic neck pain than the control group in the study. And found Patients with persistent neck pain appear to have respiratory dysfunction symptoms that are very similar to those seen in respiratory patients with neuromuscular weakness, according to the study The beginnings of this weakness are thought to be connected to cervical musculature dysfunction, while discomfort and kinesiophobia may also play a role in the development of this dysfunction, either directly or indirectly.

Conclusion

Mechanical neck pain has a significant negative effect on the ventilatory functions in smartphone addicted young subjects.

Disclosure

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