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ORIGINAL ARTICLE

EFFECT OF DIFFERENT BODY POSTURE ON RESPIRATORY FUNCTION AMONG SMARTPHONE USERS

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Abstract

Background of the study: Smart phone have become essential device in our daily lives. The prevalence of smart phone users in worldwide increased from 1.57billion to 2.53billion on 2018. The frequent use of smart phone can lead to development of musculoskeletal disorder and may also affect their respiratory function. Now a day's Students adapt poor postures when using smart phone during online games and online classes. Objective of the study is to find out effect of different body postures on respiratory function among smart phone users. **Methodology:** This is a descriptive observational study done in Faculty of Physiotherapy, Dr. M.G.R. Educational Research Institute. This study was for duration of 3 months. Total of 40 students was participated in this study. Studentwithagegroupbetween17-25years, both male and female students are included in the study. FEV1/FVC Ratio and Peak Expiratory flow Rate were used as the outcome measure. The student was requested to sign the informed consent form. The entire student was asking to perform forced expiratory maneuver in 4 different body postures to investigate the influence of respiratory function. I measure FEV1/FVC ratio and Peak Expiratory Flow Rate. These variables measure in 4 different body postures. **Result:** Result of study revealed that standing position shows ($P < 0.001$) significant difference on FEV1/FVC ratio and peak expiratory flow rate among Smartphone users. **Conclusion:** The result of the study shows that standing position which gives better FEV1/FVC ratio and peak expiratory flow rate among Smartphone users.

Keywords: Smartphone, Respiratory Function, Different Body Posture, FEV1/FVC Ratio, PEFR al scale

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INTRODUCTION

A Smartphone is a handheld electronic device that provides a connection to a cellular network & the world's first Smartphone was created by IBM in 1994. Nick named "Simon," the Smartphone included revolutionary features including a touch screen, email, and built-in apps including a calculator and a sketch pad. Smartphones allow people to make phone calls, send text messages, and access the Internet. It is an unavoidable nature and far-reaching influence. It was the first to completely do away with fixed keyboard and use a touch screen allowing multiple gesture control on a touch screen and included a camera¹⁻⁵.

The prevalence of smart phone users worldwide has increased from 1.57 billion to 2.53 billion in 2018. The frequent use of smart phone can lead to development of musculoskeletal disorder and may also affect their respiratory function. Now a day's students adopt poor postures when using smart phone during online games and online classes.

The respiratory system provides oxygen to the body's cells while removing carbon dioxide, a waste product that can be lethal if allowed to accumulate. There are 3 major parts of the respiratory system: the airway, the lungs, and the muscles of respiration. The airway, which includes the nose, mouth, pharynx, larynx, trachea, bronchi, and bronchioles, carries air between the lungs and the body's exterior. The lungs act as the functional units of the respiratory system by passing oxygen into the body and carbon dioxide out of the body. Finally, the muscles of respiration, including the diaphragm and intercostal muscles, work together to act as a pump, pushing air into and

out of the lungs during breathing. The body positions determine the different lung volumes when individuals are in standing, high sitting, forward leaning, and supine lying. The length and activity of respiratory muscles change in different positions. The changes of respiratory muscles affect the ventilation and perfusion, in particular the maximum air exchange that occurs in response to gravity. The different body positions have influenced the lung volume and muscle length-tension relationship⁶⁻⁷.

Prolonged smart phone usage causes faulty posture such as forward neck posture, slouched posture, or rounded shoulders. Sustained forward neck posture can cause injury to the structure of the cervical and lumbar spine, as well as ligaments. These structural problems caused by faulty posture can also lead to respiratory dysfunction⁸.

The adverse effects of prolonged sitting and a sedentary lifestyle on our health are well known, and similarly, we should understand the effect of prolonged Smartphone usage on our posture and respiratory function. Therefore, our study focused on the change in the students' different body posture and respiratory function among Smartphone users for prolonged durations⁹⁻¹³.

FEV1/FVC Ratio: is a measurement of the amount of air you can forcefully exhale from your lungs. FEV1, or forced expiratory volume in one second, is the volume of breath exhaled with effort in that time frame. FVC, forced vital capacity, is the full amount of air that can be exhaled with effort in a complete breath^{14,15}.

Peak Expiratory Flow Rate is a person maximum speed of expiration, as measured with peak flow meter, a small hand-held device used to monitor a person's ability to breath out air

Objective of the study: To find out effect of different body postures on respiratory function among Smartphone users

Need of the study: Body position can influence in the respiratory function. Changing the body posture can alter the respiratory function. Therefore, this study focused to find out the effects of different body postures on the respiratory function while using the smart phone among student.

METHODOLOGY

It is Observational study conducted at Faculty of physiotherapy, DR.M.G. R Educational and research institute with a total 20 students as samples. Simple random sampling used to allocate the samples. Total duration of the study was 3months. Inclusion criteria were student house the smart phone for more then 2-3hoursperday, student's age group 17-25years, both genders included for the study. Material used for the study was Peak flow meter. Outcome Measure used in the study was Peak Expiratory Flow Rate FEV1/FVC Ratio

Procedure: Total 40 students were participated in this study. In those 20 students were excluded due to pandemic crisis and the remaining 20students were randomly selected. The research approval was obtained from the institutional review board of the Faculty of Physiotherapy Dr.MGR Educational and Research Institute. Based On the inclusion criteria 20 students aged between 17 to 25 years were selected forthis study. The students

were requested to sign the informed consent form. The exclusion criteria included hypertension, tobacco smoking, postural deformities such as scoliosis, chest wall deformities, spinal cord injury.

Before conducting the activities, we conducted a briefing and gave a demonstration to the students on how to perform the spirometer test (peak flow meter). The lung functions parameter (FEV1 / FVC and PEFR). A minimum of the 3 trials was obtained for each participant and the best reading of '3' trial was record for analysis.

The entire student was asking to perform forced expiratory maneuver in 4 different body postures to investigate the influence of respiratory function. I measure FEV1/FVC ratio and Peak Expiratory Flow Rate. These variables measure in 4 different body posture [i. e. supine, high sitting, forward leaning, and standing].

Different body postures:

Supine position: lay on a table with pillow supporting the head when looking up the Smartphone, arm should be in relaxed and elbow flexed to using a Smartphone with both hands. The legs are extended and relaxed position.

High sitting position: Sat on a table with their trunks extended, shoulder should be in relaxed, elbow level at the 90°flexed to both the hands holding a Smartphone, hip and knee flexed at right angle.

Forward leaning position: forward leaning eye level with elbows supported on knees. lean forward by bending through hips. Maintain an

arch in the small of your back by tightening your stomach muscles, feet flat on the floor.

Standing position: The head and neck is forward; body is an upright position elbow flexed and both the hands are holding the Smartphone close to the chest.

Peak expiratory flow meter: Ask the student Stand up straight Take a deep breath and hold the breath while placethemouthpieceinstudentmouth,bet weenstudentteethwereassessthe move the

peak flow meter marker to the bottom of the numbered scale, finally the number are noted.

Data Analysis: The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 25. Descriptive Analysis was adopted to find the statistical difference within the groups & Independent t-test (Student t-Test) was adopted to find the statistical difference between the groups.

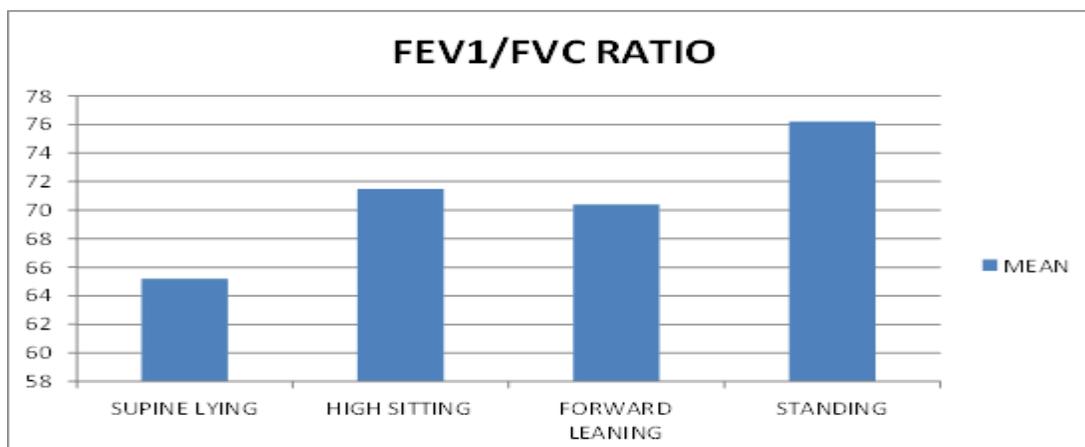
Table1: Effect of Different Body Posture on Respiratory Function among Smartphone Users within Fev1/FVC Ratio

FEV1/FVCRATIO	DAYS	MEAN	SD	t-test	Sign
SupineLying	1 st	65.2	2.24	129.9	0.000
HighSitting	2 nd	71.5	1.84	172.8	0.000
ForwardLeaning	3 rd	70.4	2.06	152.2	0.000
Standing	4 th	76.2	3.44	98.9	0.000

#No Significance at $p > 0.05$ & **Highly Significant at $p < 0.01$

The above table reveals the Mean, Standard Deviation (S.D), t-test and p-value of the Four Position(high sitting, forward leaning, supine lying & standing) between in FEV1/FVC Ratio (** $P \leq 0.001$).

There are statistically highly significant difference values between in FEV1/FVC Ratio (** $P \leq 0.001$).



Graph 1: Effect Of Different Body Posture On Respiratory Function Among Smartphone Users Within Fev1/FVC Ratio

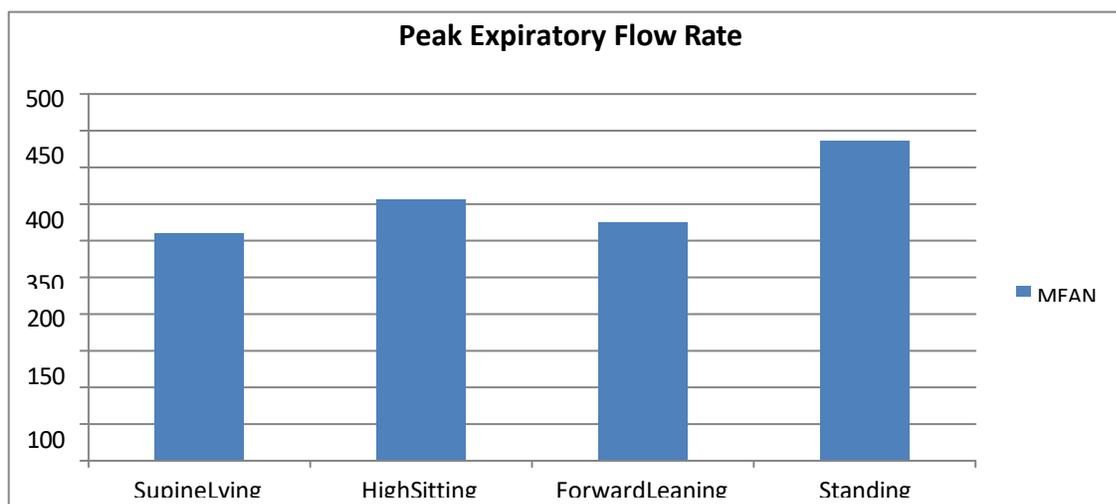
Table2: effect of different body posture on respiratory function among smart phone users within peak expiratory flow rate

PEFR	DAYS	MEAN	SD	t-test	Sign
Supine Lying	1 st	310.1	26.04	53.2	0.000
High Sitting	2 nd	356.2	18.34	86.8	0.000
Forward Leaning	3 rd	324	11.76	123.1	0.000
Standing	4 th	436	15.71	124.0	0.000

#No Significance at $p > 0.05$ & **Highly Significant at $p < 0.01$

The above table reveals the Mean, Standard Deviation (S.D), t-test and p-value of the Four Position (high sitting, forward leaning, supine lying & standing) values between peak expiratory flow rate (PEFR) (** $P \leq 0.001$).

There is statistically highly significant difference between in peak expiratory flow rate (PEFR) (** $P \leq 0.001$).



Graph 2: Effect of different body posture on respiratory function among Smartphone users within peak expiratory flow rate

RESULT

On comparing the Mean values of FEV1/FVC Ratio on Lung Volume & Lung Capacity Measurement in terms of Peak Expiratory Flow Rate Score using Peak Flow Meter, it shows

Significant Increase. The mean value in Standing Position was higher Mean value than High Sitting, Supine lying & Forward Leaning $P \leq 0.001$. On comparing FEV1/FVC ratio & peak expiratory flow rate on Lung volume &

capacity shows highly significant difference in Mean values at $P \leq 0.001$

DISCUSSION

This present study was conducted to investigate the effect of different body positioning on lung functions among prolonged Smartphone users. The participants were mostly middle-aged individuals; the average age being 17-25 ages. The average weight and height of participants were optimal for the age group under survey and they further validated the study outcomes in terms of applicability.

The study results demonstrated significant changes in lung function variables across body positions. Generally, the lung function variables decreased as the subjects became more recumbent and the highest FEV1/FVC Ratio were observed in 4 different position are (Standing, High Sitting, Forward Leaning & Supine lying) which is consistent with the data reported in literature where a significant decrease in FEV1/FVC Ratio was found when the High sitting, Forward Leaning & Supine position and the higher lung function was observed in the standing position.

The increased in airway diameter, the highest vertical gravitation and the wide antero-posterior diameter of thoracic wall in standing posture might have an effect on improvement of lung function. The lesser compression on lungs and heart while in standing might result in the positive impact on FEV1/FVC ratio. Second, changes in forced-length curves, muscles imbalances, and segmental instability of the cervical spine are also possible cases of

respiratory dysfunction. Another reason of the above findings may be due to an increase in thoracic cavity volume and the effect of gravity on the abdominal contents caudally within the abdominal cavity, thereby increasing the vertical diameter of the thorax and/or the allowance that is present in the inspiratory muscles, enabling Effect of different body positioning on lung function variables among Smart phone users.

Arch Physiotherapy Glob Res 2017; them to expand the unrestricted thorax in all directions. Moreover, our findings showed comparable FEV1/ FVC ratio in the high sitting, forward leaning, standing and supine positions.

The major factor responsible for the low arousal level is often associated with recumbent positions and effects of gravity. Incidentally, the base of the lungs is not compressed by the weight of the heart and abdominal contents in lying positions, which may account for the similarities seen. No significant differences in PEFR values were observed in the high sitting, forward leaning, standing and supine positions. This may be due to the fact that PEFR is a factor of speed while FEV1/FVC ratio, are the factors of volume and the affects mainly the volume of the lungs¹⁶⁻¹⁷.

Generally, according to our results as the subjects became more recumbent the ability to generate higher lung functions diminished, which was reported earlier. Conversely, as the subjects moved to less recumbent positions, the expiratory pressures and flow rates improved. Although the results showed similar PEFR values for all the four positions, PEFR is

also known to be assisted by elastic recoil of the lungs and chest wall, which is likely to explain the above results¹⁸⁻²¹.

Pierson et al, had evaluated spirometry test results of individuals with normal to various severity of ventilation impairment in both sitting and standing position, observed that the standing value of FVC was significant more but the magnitude of difference was small.

Moreover, the study results demonstrated that sitting led to the second highest lung function after standing. The above may be caused to the effect of the sitting position on the abdominal cavity which interferes more with the diaphragmatic motion, as compared to the standing position²²⁻²⁴.

Our study found that the posture among Smartphone users leads to reduce respiratory function. The result of the study showed that using a Smartphone for a prolonged duration could negatively affect both body posture and respiratory function.

This result may be used to promote awareness about Smartphone usage and also health considerations, need to pay attention to the duration of usage, as well as posture while using a Smartphone user. The literature data concerning this subject are sparse despite its importance for physiotherapy and guide for students 'self-management as well as education²⁵⁻²⁷.

CONCLUSION

It concluded that standing position which gives better FEV1/FVC ratio and PEFr among Smartphone users.

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