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Variations in Respiratory Movements in Normal Subjects based on the Type of Chair Used

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ABSTRACT

BACKGROUND : Sitting is the main everyday 'activity' of contemporary people.In In 1997,the number of hours spent weekly on computer was 5.9 ,whereas in 2003 it reached 14.6 per week. The latest research confirms the significant impact of the sitting posture on the respiratory system. The aim of this study to compare the respiratory chest movements based on the type of chair used.

AIMS & OBJECTIVES:

1.Comparison of respiratory amplitudes in females in chair 1 and chair 2

2.Comparison of respiratory amplitudes in males in chair 1 and chair 2

3. Comparison of respiratory amplitudes(in males & females) in relation with weight.

MATERIALS & METHOD: The present study was conducted in the Research laboratory, Dept. of Physiology, RVMIMS, Laxmakkapally, Siddipet. A total of 60 subjects were selected (30 males & 30 females) between age group 17-25 years. Respiratory movements and weight were recorded. Respiratory movements were recorded using stethograph (respiratory belt) and Weight using weighing machine.The study covered respiratory chest movement assessment of the subjects in two different chairs.

RESULTS: All measured values were statistically analyzed using WindowStat software. Paired t- test analysis and ANOVA has been used to find out the significant p. Amplitudes for the first chair (298.4mV) reached a higher average level than for the second one (268.9mV).The study did not show correlation between body weight and respiratory amplitudes in first chair and second chair.The comparison clearly shows a higher respiratory amplitude for females(300.3±36.9) in first chair as compared to men(296.5±43).

CONCLUSION: The study results conclude that there is a considerable change in the chest respiratory movements depending on the orientations of joints and muscle activation. Respiratory movements in chair 1 (upright position) are higher than chair 2 (slumped position). Thus an emphasis should be made on changing the seats' physical activity and its effect on respiratory system.

Keywords: *Respiratory movements, respiratory amplitudes, chair.*

INTRODUCTION

Altered body position influences the respiratory muscle strength and function in healthy adults[1].Sitting is the main everyday activity of contemporary people. People sit when driving a car, waiting for an appointment with a physician and most frequently , working at a desk and a computer[2]. In most cases, typical sitting postures observed today are incorrect and produce several pain syndromes of the motor system[2].

Respiration means the occurrence of exhalation and inhalation in turns and the lung undertakes the role of exchange between air and blood[3].This happens through respiratory muscles and their neurophysiological

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control. The diaphragm is used as the main muscle for inhalation and rectus abdominis, internal oblique, external oblique and transverse abdominis muscles are used for exhalation[4].Respiratory functions are correlated to posture change[5-7].Changes in posture can affect the resting length of respiratory muscles according to Mori et al[8].

A well-functioning respiratory system is the basis of well-being of the whole body. Any deterioration of the respiratory function decreases oxygen saturation of human cells, affecting not only the physical , but also the mental condition. A number of research studies have confirmed the impact of body posture on the respiratory system, chest and diaphragm mobility, as well as on the number and quality of inhalations and exhalations[9,10]. The connection between posture and lung performance has proved significant[11].For example, the prone position in healthy subjects has been shown to cause compression of the anterior ribs, which limits the volume of air into the lungs and the ability to expel air out of the lungs[12].

Respiratory efficiency and change in respiratory functions reflect lung volume movement injury, asymmetry and muscle paralysis[13]. Under physiological conditions, the diaphragm falls during inhalation and rises during exhalation. An inclined position prevents proper functioning of this muscle, resulting in increased activity of the upper respiratory duct[14].

In view of this trend , it is obvious that the type of chair is a factor of major impact on people's health and work comfort. According to Donkin, a chair shapes a body posture and represents a physical support allowing for efficient performance and implementation of tasks[15]. Incorrect sitting posture impairs both the static and the dynamic balance of the pelvis and the spine[2].The most suitable chair with proper positioning should secure appropriate respiration.

The aim of the study is to confirm the variations in respiratory movements based on the type of chair used. The evaluated measure is the amplitude of respiratory movements on different types of chairs.

MATERIALS & METHOD

SUBJECTS:

A total of 60 subjects from RVM institute of Medical Sciences , Laxmakkapally, Siddipet Dist were selected.

1.30 males

2.30 females

Age group: 17-25 years

INCLUSION CRITERIA:

1.Age group including males and females between 17-25 years

2.Body weight ranging 52-87kg

EXCLUSION CRITERIA:

1.History of respiratory disorders

2. History of chest deformities

3. History of postural defects

PLACE OF STUDY:

The present study was conducted in Research laboratory, Dept. of Physiology, RVMIMS, Laxmakkapally ,Siddipet.

Respiratory movements and weight were recorded after obtaining informed consent from all the participants after approval from Ethical committee.

RESPIRATORY MOVEMENTS RECORDING:

EQUIPMENT:

Respiratory movements were recorded using stethograph (respiratory belt) and analysed using BIOCHART software version 1.0 provided by BIOSTAR INDIA.

RECORDING PROTOCOL:

The study covered respiratory chest movement assessment of the subjects in two different chairs.

The subjects were familiarized with the testing equipment and the procedure was explained.

1.First chair : Fixed chair, with no possibility to adjust. The position in the first chair is defined as sitting in a chair with the trunk extended and the hips and knees flexed as near as possible at right angle(upright position).

2.Second chair : Movable seat and back rest. The second chair is allowing the pelvis to be positioned in the middle of the seat with the trunk reclining posteriorly

against the back rest(slumped position).

Stethograph (respiratory belt) was tied around the chest of the subject.

Weight was recorded using weighing machine.

The study was conducted after rest of 10 minutes. The subject was asked to take a seat in the consecutive chairs and regulate breathing. Throughout this time, breathing was recorded. When breathing became regular, the subjects were asked to read a text. For the purpose of analysis two-minute record of regular, calm breathing while reading was chosen.

RESULTS

All measured values were statistically analyzed using WindowStat software.

Paired t- test analysis and ANOVA has been used to find out the significant p value.

The analysis of the data comparisons show the respiratory amplitude of first chair (298.4mV) and for second chair (268.9mV).In that case , amplitudes for the first chair reached a higher average level than for the second one. The difference noted is statistically significant(p=0.00)

In the present study, there is no relevance of body weight to respiratory amplitudes in first chair and second chair.

The comparison clearly shows a higher respiratory amplitude for females(300.3±36.9) in first chair as compared to men(296.5±43).

1.RESPIRATORY AMPLITUDES OF FEMALES IN CHAIR 1 AND CHAIR 2:

2.RESPIRATORY AMPLITUDES OF MALES IN CHAIR 1 AND CHAIR 2:

3.RESPIRATORY AMPLITUDES IN RELATION WITH WEIGHT:

	AMPLITUDE(mV) Chair 1	AMPLITUDE(mV) Chair 2	X1 - X2	
Mean	300.300	267.300	33.000	
Std. Error	6.738	4.592	4.119	
Std. Deviation	36.905	25.154	22.560	
Variance	39498.410	18348.398	14760.000	
Pooled s^2			997.359	
t-Test		Prob	0.000	***

Before	Mean		Std.Dev.	After	Mean		Std.Dev.	Before-After	Paired t-test	Probability	
AMPLITUDE(mV) Chair 1	296.500	±	43.184	AMPLITUDE(mV) Chair 2	270.633	±	32.570	25.867	9.514	0.000	***

Source of Variations	df	Sum of Squares	Mean Squares	F Ratio	Probability
WEIGHT(Kg)	1	13.181	13.181	0.008	0.929
Groups	1	281.208	281.208	0.171	0.680

DISCUSSION

Sitting posture is an integral part of our life. Incorrect sitting posture maintained for a longer period of time may be a cause of many motor disturbances[16]. Latest research confirms its impact on respiratory system. The present study aimed to compare the amplitudes of respiratory chest movements based on the type of chair used. It is confirmed that our different postures are shaped by our trunk muscles' activity, which affects the changeable activity of the ribs and abdomen[17,18] . Biomechanical alteration of postural alignment affects the ranges of motion, position and coupling patterns of the articulations between the thoracic spinal vertebrae and ribcage, which influence lung compliance via changing articular movement available for breathing[19]. The diaphragm has several attachments to spinal vertebrae and ribcage and changes in the position of these bony structures altered the proper functioning of the diaphragm. Restriction of the rib cage during slouched position limits the mobility of the diaphragm[20,21].

A 'stooped' posture results in a lack of proper diaphragm working space, which stimulates the upper respiratory duct, overloading the auxiliary inhale muscles. Such a person would raise their shoulders during inhalation[14]. In young healthy subjects with a normally positioned diaphragm, the stooped sitting posture results in increased intra-abdominal pressure by approximating the ribs to the pelvis, making it difficult for the diaphragm to descend caudally during inspiration[22].Duru et al reported that sitting caused an increased compression of abdominal viscera and limitation of downward movement of the lungs[23].In addition, placing the head and neck in proper alignment reduced airway obstruction, which helped to increase pulmonary function[24].Adapting a stooped position reduces the ability of the diaphragm to generate appropriate force for the abdominal cavity. This is supported by a number of studies which demonstrated an alteration of the ribcage and the diaphragm strength force during different positions[21,25]. This position is detrimental to both spinal alignment and respiratory function. In addition, stooped position contributes to impairment of other systems including reduced venous return, autonomic nervous system and phrenic nerve excitability. Similar to this study, previous studies have reported an increased respiratory effort and reduced respiratory capacity and control in normal individuals in a stooped position compared to normal erect sitting position. Facilitating a normal breathing pattern needs an effective diaphragm muscle contraction[22].

Present study confirms that the chair type used for our work has an impact on chest movements[20,22,26]. Our results are confirmed by papers published by Morl. The author states that an individual sitting in a chair in prone to a slump position, results in flattening of lumbar lordosis and posterior pelvic tilt[27]. The second chair decreased thoracic duct activity as compared to the first one. In addition, this chair enabled increased abdominal activity. In chair without seat adjustment, lumbar lordosis decreased despite support[28].

Russos and Koutsoukou proved that obese individuals need more energy to perform respiratory activity with decreased system efficiency[29]. Present research results did not show any relationship between the subjects' body weight and respiratory system function in relation with type of chair used. Studies have documented that women more commonly used the thoracic duct when sitting in a comfortable chair as compared to men[30].

CONCLUSION

Changes in respiratory movements in chair 1 and chair 2 showed differences in chest mobility. These differences regarded the sitting posture probably affects respiratory patterns. This can be used as an indicator for respiratory chest movements which enables people to both work and relax.

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance –taken from Institutional Ethical Committee

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