ORIGINAL ARTICLE

Effects of Thoracic Spine Mobilization on Vitals and Blood Oxygen Level in Healthy Individuals

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ABSTRACT

Objective: The objective of this study was to determine the effect of thoracic spine mobilization on heart rate, respiratory rate, blood pressure and blood oxygen saturation.

Study Design: It was a quasi experiment study.

Place and Duration of Study: The study was conducted in the department of Physical Therapy and Rehabilitation Center, Pakistan Railway Hospital Rawalpindi. The duration of study was 04 months from July 01 to October 30, 2015.

Materials and Methods: Ninety six healthy adult individuals were selected for the study by convenient sampling technique. The inclusive criteria of healthy individuals aged 20-60 years with normal vitals; Blood Pressure: 90/60 mmHg Diastolic, 140/100 mmHg Systolic, Breathing: 12-25 breaths per minute, Pulse: 60 - 120 beats per minute and Temperature: 98.6 degrees Fahrenheit. Subjects with spinal injury or deformity were not included in the study. Pre and post values of heart rate, respiratory rate, blood pressure and blood oxygen saturation after thoracic spine mobilization were obtained. The data were statistically analyzed by SPSS version 21.

Results: Mean age of the study population was 27.9+4.7, male to female ratio was 1:1. Majority of the study participants (45%) had normal BMI. Thoracic spine mobilization caused significant change in oxygen saturation. The Heart Rate (HR), Respiratory Rate (RR), both systolic and diastolic blood pressure (BP) had no significant association with the age, gender or the BMI of study participants. However blood oxygen saturation showed a statistically significant association with above mentioned variables.

Conclusion: It is concluded that mobilization on thoracic spine (T1-T4) causes a sudden elevation in heart rate, respiratory rate, blood pressure and no major change in blood oxygen saturation.

Key Words: *Blood Pressure, Heart Rate, Manual Therapy, Respiratory Rate, Thoracic Spine Mobilization.*

Introduction

The mobilization of the spine specially thoracic spine not only activates the mechanoreceptor inside the capsule of face joint which regulate the intrinsic muscle control of the spine but also have some influence to activate the sympathetic nervous system(SNS). As we know the sympathetic part of the autonomic nervous system (ANS) regulate heart rate, blood pressure, rate of respiration, body temperature, sweating, gastrointestinal motility and secretion, as well as other visceral activities that maintain homeostasis. The sympathetic system prepares the body for energy expenditure, emergency or stressful situations, i.e., fight or flight. Sympathetic preganglionic neurons are shorter than sympathetic postganglionic neurons.[1] Most organs receive innervations from SNS and Peripheral nervous system (PNS), which usually have opposing actions. However some organs do not have a response to parasympathetic stimulation.[2] Control of lung primary ventilation involve specific groups of receptors.[3] Resistive load on breathing in a healthy subject can stimulate aortic baroreceptors and susequently causes an impact on the ANS.[4]

In a study carried on patients with chronic neck pain, respiratory functions of the subjects in terms of forced vital capacity (FVC), forced expiratory volume at one second (FEV1), and peak expiratory flow (PEF) were measured via Cardio Touch equipment after thoracic mobilization and self-stretching exercises.

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The results of the study indicated that thoracic mobilization is effective treatment strategy for improving pulmonary functions.[5] Reduction in lung function may be due to thoracic spine motion and costochondral joint restriction might affect the functions of respiratory system. When hypomobility of the joint is identified, joint mobilization techniques are applied that may influence in improving lung function. Physical therapeutic approaches for the thorax include thoracic mobilization, stretching of the respiratory muscles, and strengthening of the respiratory muscles. Such respiratory rehabilitation reduces respiratory problems in patients with respiratory dysfunction. Autonomic output to the heart may be influenced by high velocity and low amplitude manipulations of the thoracic spine.[6] Physical therapy can promote effective health outcomes by minimizing the deleterious effects of pathological conditions, including the Coronary Artery Disease, Arterial Hypertension (HTN), Diabetes Mellitus, Atherosclerosis, Osteoporosis, Alzheimer and Parkinson's disease.[7] Physiotherapists frequently apply spinal manipulative therapeutic techniques to relieve pain syndromes of musculoskeletal origin and to enhance the joint movement quality. In a study, grade III mobilization technique in posterior-anterior direction was centrally applied to the cervical spine; as a result both respiratory and cardiovascular values were affected. During the application of the technique there was a significant increase in respiratory rate, heart rate, systolic and diastolic blood pressure when it was compared with control group.[8] Manual therapy intervention to the thoracic spine was able to modify heart rate variable in women with Fibromyalgia. Considering this we can justify that there is a correlation between autonomic dysfunction and symptom severity or quality of life of the patients. Some studies have shown that spinal manipulation is able to modulate autonomic nervous activity. Yates et al[9] examined the effect of chiropractic manipulation of T1–T5 spine segments in patients with Arterial Hypertension. He observed a reduction in systolic and diastolic blood pressure and anxiety level. Brain budgell et al in 2006 used high-velocity and low-amplitude manipulation of the thoracic spine which showed a different result in output of heart as compared to sham procedure group.[6] Elderly people can improve and maintain their cardiopulmonary circulation and also increase their oxygen intake through continuous physical training. In a society where aging is becoming a longer process due to increased average life expectancy, research on interventions to improve respiratory function in the elderly should be actively conducted.[9]

The anatomical relation of thoracic spine with the sympathetic nervous system is well defined and most of the studies showed the relationship of manual therapy effects on SNS. In Pakistan no such study has been conducted to find the relationship of thoracic spine mobilization and SNS in healthy individuals or the patients having cardiac or other associated problem. From clinical perceptive it is advised that physical therapist should take special consideration of patients while applying thoracic mobilization. The result of this study will create awareness regarding the fruitful effects of thoracic mobilization on cardiovascular and pulmonary system. The purpose of this study is to determine the effect of thoracic mobilization on Heart rate, Respiratory rate, BP and blood oxygen saturation.

Materials and Methods

It was quasi experimental study done in the department of Physical Therapy and Rehabilitation Center, Pakistan Railway Hospital Rawalpindi. The duration of study was 04 months from July 01 to October 30, 2015.

Ninety Six healthy individuals having age between 20 to 60 years with normal vitals, Systolic BP 140/100 mm of Hg, Diastolic BP 90/60 mm of Hg, Breathing: 12 - 25 breaths per minute, HR 60 - 120 beats per minute and Temperature 98.6 degrees Fahrenheit were selected for this study. Those who had abnormal vitals, any previous spinal injury or surgery, spinal deformities were excluded from the study.

In order to determine the effect of thoracic mobilization on heart rate and respiratory rate, self-designed questionnaire was used and data was collected by the therapist himself. Informed consent was taken from every subject prior to participation in study. Only participants who were vitally stable were given Kaltenborn grade 3 thoracic mobilizations. Heart rate, respiratory rate and other readings were taken before thoracic mobilization. 5 set with 15 repetitions were given on thoracic spine (T1 to T4

Level) with the gap of 10 to 15 seconds. After thoracic spine mobilization again heart rate, respiratory rate and other readings were measured again. The telemetry operon OM12 apparatus was used for measuring pre and post readings. The telemetry operon OM12 complete built-in module design ensures stable and reliable performance, unique all-lead ECG on-one-screen display, which can facilitate the diagnosis and analysis of cardiac disease. The oxygen saturation was measured through digital pulse oxy meter. Questionnaire consisted of two components, the first component comprised of 10 questions to assess the physical fitness of the subjects. The second component was used to measure the pre and post variables readings. The data was analyzed using SPSS 21 software. Paired *t* test was applied to compare the pre and post mean difference and p-values.

Fig 1: Collecting initials and final readings through telemeter

Fig 2: Thoracic spine Mobilization

Results

The mean age of participant was 27.9±4.7, male to female ratio was 1:1 and majority of the subjects had normal BMI. (Fig 3)

As shown in Table I, after thoracic spine mobilization the pre and post mean values of heart rate, respiratory rate, systolic and diastolic BP, and blood oxygen saturation shows a statistically significant difference.

As shown in the Table II the HR, RR, Both systolic and Diastolic BP have no significant association with age, gender or the BMI of study participants. However blood oxygen saturation shows a statistically significant association with above mentioned variables.

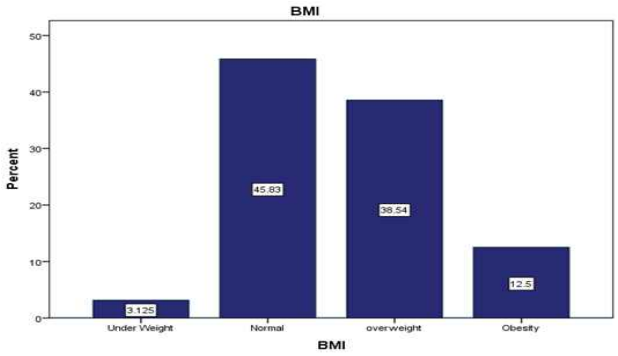

Fig 3: BMI of the Participants

Table I: Pre and post mean value of Heart rate, Respiratory rate, Systolic blood pressure

Variables	Pretreatment Mean ± SD	Post Treatment Mean ± SD	Mean Difference	% Difference	P value
Heart Rate	81.72 ± 7.017	88.36 ± 9.37	6.63542 ± 6.25	8.1	.000*
Respiratory Rate	15.67 ± 1.80	18.15 ± 2.30	2.48958 ± 2.50	15.8	.000*
Systolic Blood Pressure	122.79 ± 8.77	124.64 ± 6.19	1.85417 ± 7.12	1.50	.012*
Diastolic Blood Pressure	77.38 ± 6.44	78.91 ± 5.81	1.53125 ± 3.08	2.08	.000*
Blood O_2 Saturation	96.87 ± 1.27	97.34 ± 2.28	.46875 ± 2.19	0.47	.039*

Table II: Association of Heart rate, Respiratory Rate, Systolic and Diastolic Blood Pressure and Blood Oxygen Saturation with age, gender and BMI

Variables	Vs	Value	Asymp. Sig. (2-sided)
Heart Rate	Age	74.408[a]	.969
	Gender	40.228[a]	.181
	BMI	82.486[a]	.885
Respiratory Rate	Age	33.961[a]	.282
	Gender	14.759[a]	.141
	BMI	34.790[a]	.250
Systolic blood Pressure	Age	99.043[a]	.010*
	Gender	20.240[a]	.627
	BMI	82.151[a]	.133
Diastolic blood Pressure	Age	82.352[a]	.130
	Gender	20.904[a]	.587
	BMI	69.848[a]	.449
SPO2	Age	30.920[a]	.009*
	Gender	19.507[a]	.002*
	BMI	27.622[a]	.024*

Discussion

The results of present study showed that thoracic spine mobilization resulted in sudden elevation of HR, RR, Systoikc and diastolic BP and blood oxygen level in healthy individuals. The blood oxygen saturation showed significant relation with age, gender and BMI.

It provides objective evidence that application of mobilization technique elicits change in SNS. The previous studies show that spinal mobilization and manipulation causes marked effect on HR and RR. Reis MS et al saw the effect of thoracic posteroanterior thoracic mobilization on heart rate variability; they also concluded that one session of Maitland mobilization on thoracic spine decreases the HR from 81± 10 to 77 ± 9 and improves pain on NPRS from 6 ± 1 to 4 ± 1. Similarly, in this study, difference (8.1%) in heart rate was observed before and after posteroanterior mobilization i.e. an increase in heart rate was noticed after thoracic mobilization.[10]

Ward J et al (2013) observed the effect of upper thoracic spine manipulation on cardiovascular response; their study shows that cardiovascular physiologic response is not affected in the short term by anterior upper thoracic spine chiropractor mobilization/manipulative therapy in young normotensive individuals. Contrary to this, the study depicted short term effect after thoracic mobilization on cardiovascular system.[11] Yung e Et al (2014) observed the blood pressure and heart rate response to anterior to posterior directed glide to spine in young pain free individuals. This study showed that the AP glide caused the statistically significant response that results in a minor drop in HR as compared to placebo group. In both groups, there was a small but statistically significant reduction in systolic BP after thoracic mobilization.[12] MC guiness j et al (1997) observed the influence of a cervical mobilization technique on respiratory and cardiovascular function results shows significant increase in respiratory rate, heart rate, systolic and diastolic blood pressure. [13]

Conclusion

It is concluded that mobilization on thoracic spine T1-T4 will cause a sudden elevation in HR, RR, BP and blood oxygen saturation. There is a significant relation of blood oxygen saturation with age, gender and BMI.

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