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RESEARCH ARTICLE

EFFICACY OF LUMBAR STABILIZATION EXERCISES USING PRESSURE BIOFEEDBACK AND WITHOUT PRESSURE BIOFEEDBACK ON TRUNK ANGLE IN MIDDLE GRADE SCHOOL STUDENTS WITH NO LOW BACK PAIN

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ABSTRACT

Background: To find out the efficacy of lumbar stabilization exercises by using pressure biofeedback and without pressure biofeedback on trunk angle in middle grade school students with no mechanical low back pain.
Method: A total of 90 subjects participated in the study, 45 subjects assigned to each group with a 8 weeks' intervention protocol. The first group was given lumbar stabilization exercises with pressure biofeedback and other group was given stabilization exercises without pressure biofeedback
Results: After intervention in both groups showed improvement in trunk angle (sway back posture) but pressure biofeedback group showed more significant result.
Conclusion: Lumbar Stabilization exercises using Pressure biofeedback is an effective way for improving trunk angle in middle grade school students

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INTRODUCTION

The position of different parts of the body related to each other is called posture (1). Posture of middle school children is an important area of concern because postural control which is required for maintaining the posture reaches adult maturity by 7–10 years (Maureen, 2005). Postural changes of the spine and back pain in children are considered multifactorial. Some of the most emphasized factors in scientific reports are habits related to school activities (São Carlos, 2008). It is found in many researches that there are many predisposing factors which may have an adverse effect on posture such as carrying heavy backpacks (Deepali Nivrutti Hande *et al*., 2012), computer (Sjan Mari van Niekerk *et al*., 2008) long periods of time in the seated position, the load carried in school backpacks, and the backpack model and mode of transport have been studied[3]. Childhood and adolescence back pain is a consequence of bad posture. Its prevalence rate is 10% to 70 %) (Mohammad Hoseinifar *et al*., 2007).

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In recent years, there has been an increasing concern over the association between computer use and reports of discomfort, aches and pains in students (Jacobs *et al*., 2009). Sway back abnormality is very prevalent (Josep Vidal *et al*., 2013). In sway back posture trunk angle is increased. Exact measurement of this trunk angle is not available. Trunk angle can be calculated by qualitative or quantitative method (Elizabeth Alves *et al*., 2010). Qualitative method is an objective method with low sensitivity as well as low intra and inter rater reliability. Main cause for faulty posture is poor core strength of these students as due to heavy load of work these students are not having enough time to concentrate on strengthening. Insufficient muscle strength or endurance or poor muscle control, and instability are unusually a combination of all three components. Exercises to correct the impaired posture is one of the cheapest method to prevent future aches and pain and deformity as well can be relatively inexpensive, easily administered treatment method, which proves to be the most effective solution for the patients whose pain appears to be resistant to other treatment options. There are many researches which suggest that physical therapy proves to be an effective tool in managing various postural problems.

There are many ways of strengthening core muscles. Research has developed specific exercise for core muscle with the help of pressure biofeedback unit and has been used in many researches for therapy purpose (Pennella *et al*., 2013; Katharina von Garnier *et al*., 2009; Fábio Renovato França *et al*., 2010). In this study aim was to find theefficacy of lumbar stabilization exercises using pressure biofeedback and without pressure biofeedback on trunk angle (sway back posture) in middle grade school students with no low back pain.

MATERIALS AND METHODS

This study is a pretest posttest design. Study included 90 Students of 6^{th}- 8^{th} standard with mean age between 10 to 11 with same BMI (Basal metabolic rate) years after taking consent from their parents participated in the study of which 4 were drop out. The study included both male and female students. Study excluded students with any physical disability as per school list, any diagnosed history of recent musculoskeletal trauma, back pain history, non-cooperative student's parents, congenital anomalies, any known diagnosed history of neurological disorders, any other medical condition. Each group had 45 subjects in it. Students were randomly divided in two groups. Group 1 included subject to be given core strengthening with Pressure biofeedback (Mindy *et al*., 2000; Katharina von Garnier, 2009) and Group 2 included subjects to be given core strengthening without pressure biofeedback (Fábio Renovato França, 2010). Before starting of the therapy trunk angle was calculated and after completion of the study intervention again trunk angle was calculated and compared. For calculation of trunk angle the subjects were asked to stand comfortably in upright position over the floor marker placed on the ground facing wall, then they were instructed to look straight ahead on wall. Small red color reflective ball markers were then placed by adhesive double tape over right-sided lateral landmarks of the body i.e. spinouts process of C7, greater trochanter.

Then photograph was taken by using a digital camera (Canon 14.1 Megapixel)[11] which attached to a tripod stand which will be placed at a distance of 2 m and in a direct line from the subject. The tripod stand was secured in the correct position on the floor by using floor markers, also to standardize subject placement and to ensure that the subject's right side was aligned perpendicular to the camera (Yamini Sharma *et al*., 2016). Angle is between the line drawn from greater trochanter and C7 and the straight vertical line from greater trochanter using of UTHESCA version 3 software (Yamini Sharma *et al*., 2016). To allow for visualization of the marker placed on greater trochanter, the subject will be further instructed to flex his or her elbow and then move elbow slightly forward but still touching the body and with minimal shoulder movement. In Group 1 Pressure biofeedback was place on the back and subjects were made to lie in supine lying, cuff of PBU was inflated to 40mmhg. Then subject was ask increase the pressure to 60mmhg and hold it for 10 seconds and gradually increased to 30 seconds. In Group 2 focus was on superficial muscles such as rectus abdominis, internal oblique and external oblique isometrics for 10 seconds and gradually increased up to 30 seconds.

Training session was for 30 minutes, thrice a week for about 8 weeks. Patients were instructed in both groups not hold breath while doing exercise.

Data Analysis

The data was analyzed using SPSS and STATA 11.00 software package. Descriptive analysis was also used to project the results. Dependent variables were analyzed using parametric tests like students t test. $p \leq 0.05$ level of significance was used for all conclusions.

RESULTS

Out of the total 90 subjects recruited only 86 successfully completed the study. The mean age of the sample was10-11 years (10.5 ±0.71)

Table 1. Demographic data of the two groups Disability index measurements

Gender	Group 1	Group 2
Total	45	41
Male	21	14
Female	24	27

Pre- test comparison

Analysis of pretest measurements of Trunk Angle for a mean of 65.94±2,24 for Group 1 and 66.2±2.42 for Group 2 gave a p-value of $0.30^{(NS)}$ which indicates no significant difference between the baseline measurements of the two groups.

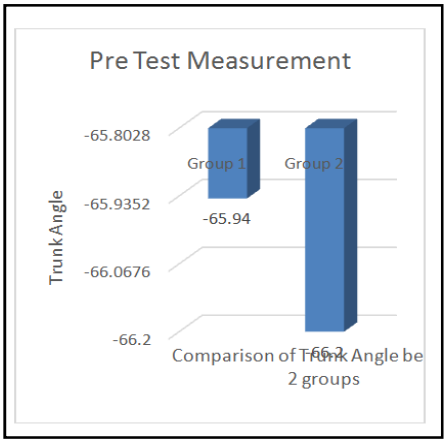
Post –test comparison

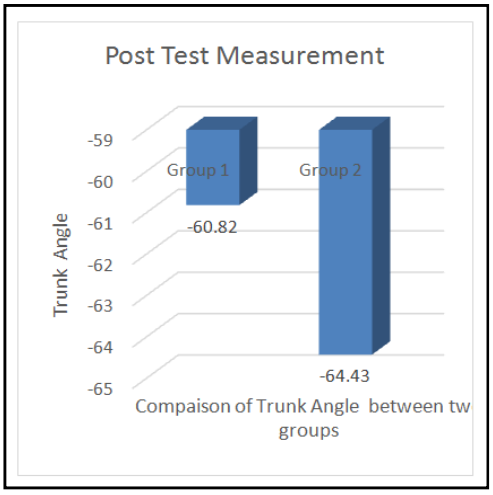
Result of analysis for post-test measurements of Disability index for a mean of 60.82±3.97 for Group 1 and 64.43±4.18 for Group 2 showed significant difference with a p-value of 0.02, indicating significant improvements in Group 1.

Table 2. Comparison Trunk Angle for Pre and Post test between 2 groups

Trunk Angle	Group 1	Group 2	p- value
Pre- test	65.94±2.24	66.19±2.42	0.30^{NS}
Post- test	60.82±3.97	64.43±4.18	0.02*

NS= non-significant
*= significant (p value≤0.05)





DISCUSSION

Aim of this study was find the efficacy of lumbar stabilization exercises using pressure biofeedback and without pressure biofeedback on trunk angle (sway back posture) in middle grade school students with no low back pain. In this study, 90 subjects of mean age group 10.5 ±0.71 were included with their consent and were randomly allocated in two groups (45 each). Out of 90 subjects 4 subjects dropped out from the study. The study included subjects with same BMI in order to exclude the effect of weight and height on motor control and postural control. It was found in research study that there was a significant improvement in trunk angle of subjects in Group 1.

Trunk angle is in negative value as per Cartesian coordinate system. By improving the trunk angle i.e. decreasing its numerical value we can improve the sway back posture. In sway back posture there is hyperextension of the knee and ankle goes in dorsiflexion. With sway back disorder, when the pelvis moves forward, the ankle joint will have go in dorsiflexion. This is also supported by Zahra Abdolvahabi et.al[12]. The reason for this is that compensative and changing mechanisms along the upper joints such as knees and thighs have a chain movement manner that will cause the changes to be unable to change the ankle joint orientation in a meaningful manner in sway back subjects in spite of the correlation between the pelvis inclination and ankle angle.

In sway back posture LOG passes posterior to hip joint, anterior to knee joint, and anterior to ankle joint. The study included both males and females with females and males. Results from our study indicate that there is no gender disparity. According to the researches present in the literature, both males and females either have equal propensity to develop low back pain or females are more prone to it. This study does not included patients with back pain as pain is contraindication for exercise. Fisioter *et al.* conducted a study in 2008 on Effects of educational sessions on school backpack use among elementary school students found that the educational sessions promoted changes in backpack use and it was observed a satisfactory adherence to the intervention program proposed. These results demonstrate the importance of Physical Therapy educational programs in schoolchildren's health (São Carlos, 2008).

Our work of use of pressure biofeedback is also supported by its use in many other musculoskeletal and postural problems. The result of the inter group comparison of the study reveals that there is significant improvement of trunk angle statistically in group A (with pressure biofeedback) as compared to group B (without pressure biofeedback) with p value of 0.02. Mean and standard deviation of Disability Index prior to the intervention was -65.94±2.24 in group 1 and -66.19±2.42 in group 2 with p value of 0.3 suggesting that there were no base line differences in disability score of both the groups. After 8 weeks of intervention again mean and standard deviation of Trunk Angle was measured and found to be -60.82±3.97 in group 1 and -64.43±4.18 in group 2.

Pressure biofeedback unit may be considered as a useful tool to act as an indicator of deep abdominal function (Katharina von Garnier *et al*., 2009), thus causes co- contraction of transversus abdominis, posterior fibres of internal oblique and lumbar multifidus. These muscles are segmental muscles, thus directly attach to the lumbar vertebra hence are most responsible for segmental stabilization. So, contraction of these muscles increases the intra-abdominal pressure and the tension of thoracolumbar fascia, stabilization of the spine is maintained by the intra-abdominal pressure in the abdominal cavity and the stiffness of the lumbar spine. Pressure biofeedback is also found to be useful in treating Chronic Low Back Pain by Fábio Renovato França *et al*. than just focussing on superficial muscles as PBU has ability to target on deep segmental muscles (FábioRenovatoFrança, 2010).

Conclusion

In this study pressure biofeedback group showed to be effective for treating sway back posture by targeting trunk angle.

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