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CORRELATION BETWEEN CORE MUSCLE STRENGTH AND HAND-EYE COORDINATION IN NON ATHLETES

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ABSTRACT

Background: The trunk plays a vital role in limb excursion and manipulation. Hence core muscle strength invariably affects the performance of the upper extremity skills. Thus this study tried to determine the correlation between core muscle strength and hand-eye coordination in non-athletes with low back pain.

Methods: 20 nonathletic subjects with low back pain were selected based on the selection criteria. Day 1 core muscle strength was assessed using Plank Test and Sorensen Test. Day 2 hand-eye coordination was assessed using Alternate Wall Toss Test and Simultaneous Ball Throw Test. A rest period of 2 hours was given between both the tests.

Results: Pearson's Correlation analysis was doe to find the relationship between the scales. The correlation analysis of plank test and AWT reveled r = 0.8 with significant difference (p <0.003). The analysis of plank test and SBT revealed r=0.7 with significant difference (p <0.011). The correlation analysis of Sorensen test and AWT revealed r= 0.8 with significant difference (p <0.008). The analysis of Sorensen Test and SBT revealed r=0.7 with significant difference (p< 0.005).

Conclusion: This study concludes that there is a strong positive correlation between the Core Muscle Strength and Hand-Eye Coordination in nonathletes with Low Back Pain.

Keywords: Low back pain, Non-athletes, Core muscle strength, Hand-eye coordination, Alternate Wall Toss Test, Plank Test, Simultaneous Ball Throw Test, Sorensen Test.

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INTRODUCTION

About 80% of the population are reported at least once to have reported of low back pain in their lives which is alarming higher than any other painful conditions [1]. The cardinal signs of a low backache are pain and stiffness particularly in the costal margins above inferior glutei folds which is a symptom that cannot be validated by an external scales [2]. It is not mandatory for every low back pain to present with sciatica, which when last for more than 12 weeks called chronic. The core muscles which are layers of muscle that perform a similar function, which is to provide stability and helps the limbs to function freely over a stable base of support [3,4,5]. According to Friedli et al., 1984, the core muscle contracts on an involuntary basis as a part of motor programming [6]. These muscles get recruited in response to the sensory-motor mechanism activated by the mechanoreceptors. Inadequacy in this mechanism results in an imbalance in the load distribution [7,8] which leads to poor stability The Central Nervous System controls the core muscles through feedback and feedforward control mechanisms [9]. Studies conducted by Chari et al. (1986) showed that the lower limb contributes to control the trunk in sitting when a person reaches forwards, and there was a considerable contribution [10]. According to Dean CM, during reaching movements beyond the upper limb length in a sitting position, lower limb helped to break the forward motion of the body and helps in maintaining posture [11]. These studies demonstrate that each part of the body has its influence on the other and human movement is a complex one.

Poor core strength and sensorimotor coordination are the major risk factors for a low backache, for which strength of the core muscle must be sufficient to tackle the external loads and thereby maintaining spinal alignment [12,13]. The ability of an individual to execute rhythmic, accurate and controlled movement is called coordination. There are several types of coordination such as interlimb, intralimb, and visual-motor coordination. A subcategory of visual-motor coordination is hand-eye coordination, and hand-eye and head coordination [14,15]. Hand-eye coordination allows the eyes to indirectly coordinate with the movements of the hands. Hand-eye coordination plays a vital role in subjects who always work in forward-stooped posture for a longer period and are vulnerable to core muscle weakness which is the main cause of low back pain. Though there are studies Johansson et al., (2001) and Bowman et al., (2009) correlating hand-eye coordination with hand dominance, visual reflex, movement time and reaction time, there are no documented study so far to our knowledge explaining the relationship between the had eye coordination and core muscle strength [16,17]. We perceived that the core muscle performance might influence the hand-eye coordination because both tend to influence gross motor and fine motor function. Thus in this study, a correlation is drawn between the core muscle strength on hand-eye coordination which is the need of the hour.

MATERIALS AND METHODS

The study was conducted at Saveetha hospital, Chennai, after attaining consent from the institutional ethical committee of Saveetha University, Chennai. (Ref no: 007/04/2016/IEC/SU) 20 nonathletic subjects with low back pain of maximum three months duration, willing to participate in this cross-sectional study were screened based on the inclusion and exclusion criteria. Consecutive sampling was adopted. Nonathletic subjects (subjects who have not participated in sports of minimal zonal level) of age group 20 to 30 years were selected for the study both male (12) and female (8) were selected. The subjects who had neurological, orthopedic problems that resulted in impaired coordination or sensory modalities were excluded from the study. Subjects who had reported of a low backache earlier were excluded from the study. They were explained about the procedure, and informed consent was obtained. This cross-sectional study was done on two different days with one day gap in between. Every subject was assessed on day 1 for core muscle strength and day 2 for hand-eye coordination with a rest period of 2 hours between each test. Core muscle strength was assessed by plank test and Sorensen test [18]. In the plank test, the subjects were instructed to hold the plank, with their arms well separated with their back and legs straight at all times. The duration for which the position maintained was noted, and the test ends if their back lowers or raises out of the position. Sorensen test was performed with the subject's lower trunk completely secured to a table while the upper trunk was held against gravity purely by muscle activity. On the second day, hand-eye coordination was assessed using alternate wall toss test (AWT) [19] and simultaneous ball throw test (SBT) [20]. During alternate wall toss test the subjects stood 2 Meters away from the wall and tossed a tennis ball against the wall using the right hand and caught it using the left hand in return and vice versa 30 seconds. In simultaneous ball throw test, two balls were simultaneously thrown at the subjects for him to catch. The number of attempts completed was calculated. A blinded evaluator who was a physiotherapist with five years of clinical experience was used to perform the outcome measures for all the subjects to avoid interrater variations.

STATISTICAL ANALYSIS

The quantitative data were collected and statistically analyzed using 95% confidence interval. Pearson's Correlation analysis was done to find the relationship between the scales. The analysis was drawn between each scale measuring the core muscle strength (Plank test and Sorenson test) with hand-eye coordination scale namely the AWT and SBT individually to know whether they are correlated and if the existed strength of correlation was analyzed.

RESULTS

The mean value plank test was 42.8 (7.16), Sorenson was 57.65 (8.62), SBT was 16.1 (4.3) and AWT was 11.8 (3.37), The correlation analysis of plank test and AWT reveled r = 0.883 with significant difference ($p < 0.003$), the analy-

sis of plank test and SBT revealed r=0.789 with significant difference (p <0.011), the correlation analysis of Sorensen test and AWT revealed r= 0.840 with significant difference (p <0.008), the analysis of Sorensen Test and SBT revealed r=0.784 with significant difference (p< 0.005) which is presented in Table 1. The values of four outcome measure are displayed in table 2.

Table 1: Pearson's correlation analysis

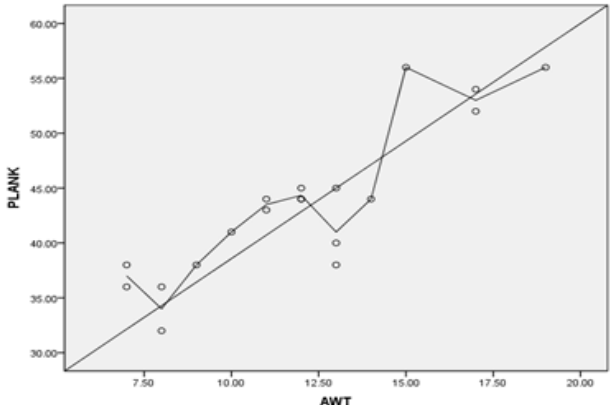
	Correlation							
	PLANK		SORRENSON		AWT		SBT	
PLANK	p- value NA	r- value 1.000	p-value NA	r- value 0.886*	p-value 0.003	r- value 0.883*	p-value 0.011	r -value 0.789*
SOR-RENSON	NA	0.886*	NA	1.000	0.008	0.840*	0.005	0.784*
AWT	0.003	0.883*	0.008	0.840*	NA	1.000	NA	0.881*
SBT	0.011	0.789*	0.005	0.784*	NA	0.881*	NA	1.000

*. Correlation is significant at the 0.01 level (2-tailed).

NA - Not Analysed

Table 2: values of four outcome measure

PLANK TEST	SORENSEN	AWT	SBT
44	55	11	13
45	58	13	13
36	45	7	13
38	48	7	13
44	58	12	13
45	62	12	13
41	59	10	13
32	48	8	13
44	59	12	13
38	53	9	13
30	49	8	13
56	76	15	13
52	69	17	13
43	52	11	13
40	50	13	13
36	49	8	13
56	66	19	13
54	72	17	13
44	68	14	13
38	57	13	13



Graph 1: Correlation between Plank test and AWT

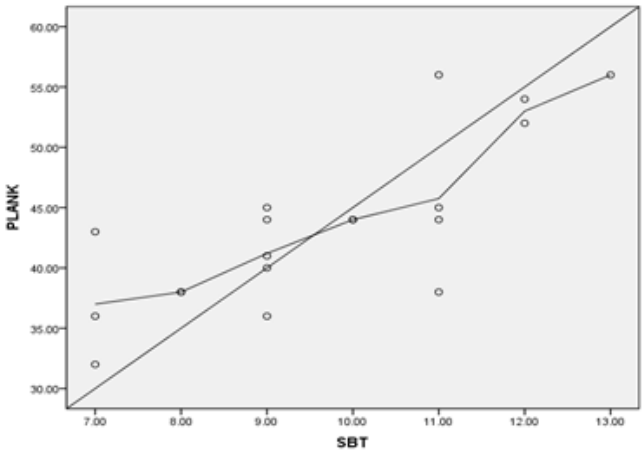


Figure 2: Correlation between Plank test and SBT

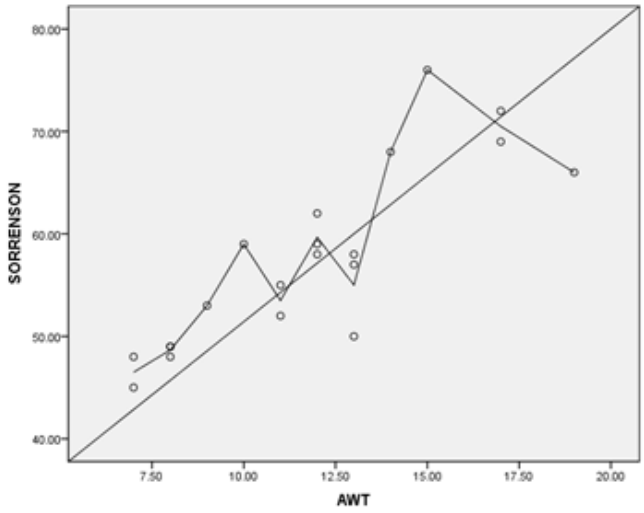


Figure 3: Correlation between Sorenson and AWT

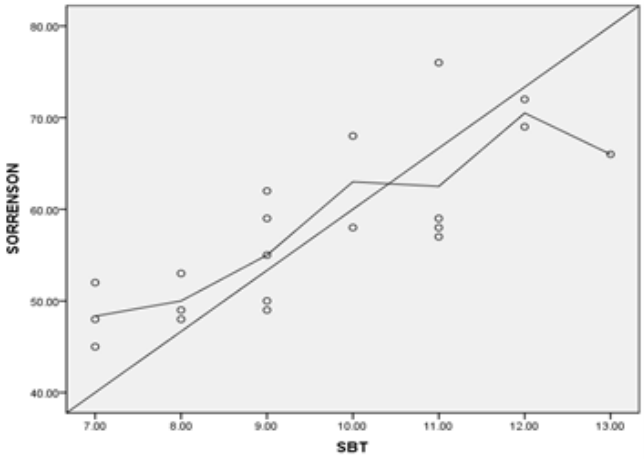


Figure 4: Correlation between Sorenson and SBT

DISCUSSION

The results of the study revealed that there was a significantly strong positive correlation between the Core Muscle Strength and Hand-Eye Coordination in non-athletes with LBP. The analysis of plant tests relation with AWT revealed that there was a perfect positive correlation (r=0.8) with a maximum strength which indicates that more the core muscle endurance more was the hand-eye coordination. The analysis of plank test and SBT showed that there was less strength of correlation compared to AWT but still had a good positive correlation. (r=0.7) The analysis of Sorenson test and AWT showed that there was a strong positive correlation compared to the other three correlations with r

= 0.8. The analyses of Sorenson test and SBT shoed a good positive correlation with r=0.7. The analysis of Sorenson test indicates the strength of the relationship between hand-eye coordination and specific low back pain. This positive correlation reflects the fact that the core forms the strong base on which the trunk moved. This also proves that the upper limb excursion was steadied and made smooth by core strength. The average age of the sample was 19.7 (1.7) years. We selected young adults as our target population because it is already established that 84 percent of subjects with specific low back pain were young adults [21,22]. The plank test was performed without time constraint in this study as its proved to be very feasible, valid and reliable tool to assess the muscle endurance of torso [23]. As the study was dealing with specific low back pain, Biering–Sorensen test was preferred as it's a very reliable scale to differentiate between specific and non-specific low back pain [24]. The average score of Alternate Hand Wall Toss Test was 11.8 (3.5) in this study which is rated as poor for the scale standards [25]. There are very few valid tests for testing the hand-eye coordination, and the literature reflects the same {26]. Thus, two reliable and valid sales were selected to assess the two variables of the study so that the comparison will be meaningful. The major clinical implication we try to explain through this cross-sectional analysis is that there is a need for training hand-eye coordination exercises to subjects with low back pain in non-athletic population. It will be of immense help to people who work for a high precision job like painting, graphics and musician and so on. We also emphasize the use of core muscle strengthening and endurance training as a tool in improving hand-eye coordination in non-athletic subjects.

CONCLUSION

This study concludes that there is a strong positive correlation between the Core Muscle Strength and Hand-Eye Coordination in nonathletes with Low Back Pain. This study sends a clear message that core muscle strength is a vital component of skill output of upper extremity though not directly related

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