IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

CORRELATION BETWEEN CORE MUSCLE STRENGTH, BALANCE AND HAND EYE CO-ORDINATION IN NON SPECIFIC CHRONIC LOW BACK PAIN INDIVIDUAL

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Abstract

Aim: To find out correlation between Core Muscle Strength Balance And Hand Eye Coordination in Non -Specific Low Back Pain Individual.

Background: The trunk plays a vital role in limb excursion and manipulation. As a result, core muscle strength has a direct impact on upper extremity and balance performance . Thus this study tried to determine the correlation between core muscle , balance and hand-eye coordination in non-athletes with low back pain.

Method: 18 Individual with Non-specific Chronic Low Back Pain were selected based on Inclusion criteria and Exclusion criteria. Their core muscle strength was assessed using Plank Test Balance was assessed by Star Excursion Balance Test and Hand - Eye coordination Was assessed by Alternative Hand Wall Toss The Person's product moment coordination Statics was applied for the data analysis. All the Statistical Analysis was performed using SPSS 28.0.0 Software.

Result: It was found that there exists a positive correlation between the Core Muscle Strength, Balance And Hand Eye coordination in Non -Specific low back pain Individual (r=79.66) & (p=<0.0001).

Conclusion: The study concluded that there is significant relationship between the Core Muscle Strength, Balance And - Eye coordination In Non -Specific Low Back Pain Individual between age group 25- 40 r value (79.66) & p value (<0.0001).

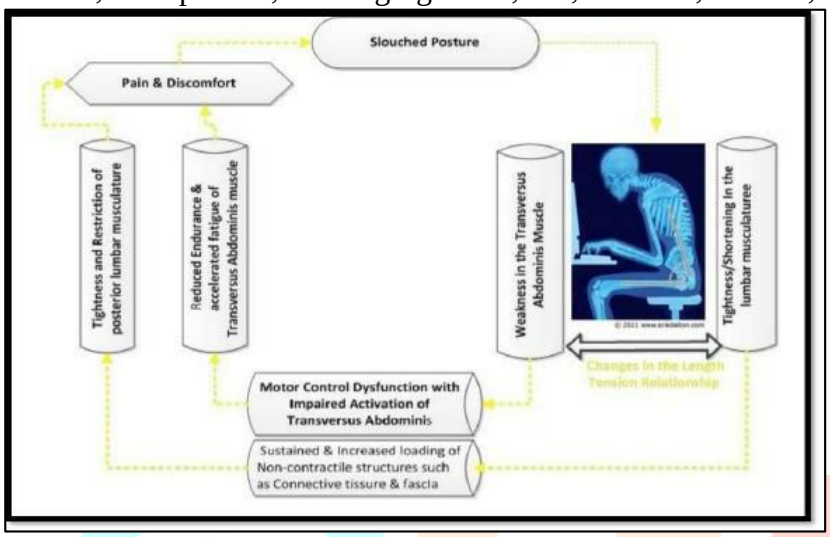
Keywords: Core Muscle strength, Balance And Hand – Eye coordination, Plank Test, Star -Excursion Balance Test And Hand Wall Toss Test**.**

INTRODUCTION

Low back pain is common musculoskeletal impairement affecting 80% of people at some point in their life. It is an important clinical social economic and public health issue affecting population in discriminaly.[(1)]

Nonspecific low back pain is defined as low back pain not attributable to a recognizable, known specific pathology, such as infection, tumor, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome, or cauda equina syndrome. Some subjects have pain in motion, but no pain when standing, and some have pain after standing for long time, but no pain in motion. O'Sullivan proposed a mechanism-based classification system dividing nonspecific low back pain into three subtypes based on pain provocative spinal postures and movement patterns.This classification system uses three subtypes: flexion pattern, active-extension pattern, and multidirectional pattern. In adolescents with nonspecific low back pain, sitting is a common aggravating factor and accounts for significant disability.

The frequency of low back pain increases as age advances, and its prevalence in the elderly population of age 40 and older is as high as 20 to 40%. On the other hand, the prevalence of low back pain is about 10 to 25% in the age group from the late teens to age 40, defined here as young and middle-aged people, and in this age group the incidence of low back pain itself is relatively low. People in this age group are highly active in daily life and are exposed to various stresses. Unlike in the elderly, however, the aging-related changes are minimal in this age group. Due to these circumstances, therefore, low back pain in this age group is characterized by high incidence of "so-called low back pain", or nonspecific low back pain without any clear-cut diagnosis.
Low back pain is defined as pain between costal margin and inferior gluteal fold and usually accomapined by limitation of movement. Low back pain may be attributed to many pathological conditions like infection , tumour, osteoporosis, hastring tightness, RA, fracture ,sciatica , herniated disc, etc[(2)]



The core muscular network also refered to as the lumbo-pelvic-hip complex is a three dimensional space with muscular boundaries:

1) Diaphragm(superior or roof)
2) Abdominal and oblique muscles (anterior- lateral or front and side)
3) Paraspinal and gluteal muscles(posterior or back)
4) Pelvic floor including hip girdle (inferior or bottom)[(3)]

The core muscles which are layers of muscles that perform a similar function, which is to provide stability and helps the limbs to function freely over a stable base of support.[(4)]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 which leads to poor stability.[4]
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 .[5]
The core is the centre of the functional kinetic chain providing the proximal stability for distal mobility and function of limbs. It has been reported that core muscle fatigue decreasces dynamic stability of trunk ,thereby , leading to loss of balance control[6]
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.

METHODOLOGY

Sample size: **18**
Study design: Correlational study
Study setting: Dr. Ulhas Patil College Of Physiotherapy, Jalgaon.
Target population: Individuals with non specific chronic LBP
Sampling method: Convenient sampling
Study duration: 6 months

SELECTION CRITERIA

Inclusion criteria:

- Individuals with non specific chronic low back pain.
- Age between 25-40
- Both males and females
- Subject with informed consent

Exclusion criteria:

- Subjects with neurological condition that affect core strength, balance, and coordination.
- Subjects with orthopedic problems like stiffness of hand , forearm and lower extremity orthopedic condition osteoporosis.
- Abnormal gait deviation.
- Subjects using cane or any assistive devices.
- Limb length discrepancy
- Subject with visual impairment

Materials required

- Pen
- Paper
- Inform consent form
- Yoga mat
- Stopwatch
- Marker pen
- Ball
- Couch
- Measuring tape

PROCEDURE

To conduct the following study permission was taken from the Principal of Dr. Ulhas patil college of physiotherapy, Jalgaon. Subjects was taken as per the inclusion and exclusion criteria and the procedure was explained and a written consent was obtained from the subjects. Initially the demographic data that is Name , age , gender was assessed.

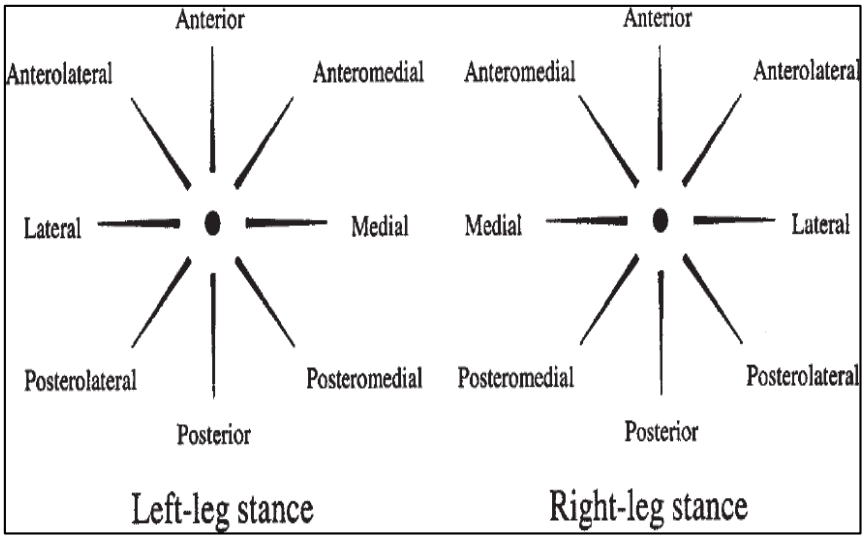
This cross-sectional study was done on three different days with one day gap in between. Every subject was assessed on day 1 for core muscle strength and day 2 for balance and day 3 for hand-eye coordination . Core muscle strength was assessed by plank test and Sorensen test with a rest period of two hours between each . Balance was assessed by star excursion test and hand eye coordination was assessed by ball throw test.

Core muscle strength assessment

Plank test

1. The plank is started in the plank exercise position. This is parallel to the ground with the subject trunk straight and rigid, resting the subject weight on your toes and forearms. They should not be sagging or bending.
2. Lie face down with legs extended and elbow bent and directly under shoulder. Feet should be hip width apart. The participants are asked to contract their abdominal muscles, and then tuck their toes to lift the body keeping the forearm on the ground.
3. The duration for which the position maintained was noted, and the test ends if there back lowers or rises out of the position.

Balance assessment



Star excursion balance test

The SEBT was performed with the participants standing in the middle of a grid formed by eight lines extending out at 45° from each other . The participant was asked to reach as far as possible along each of the eight lines, make a light touch on the line, and return the reaching leg back to the center, while maintaining a single-leg stance with the other leg in the center of the grid .

Participants were instructed to make a light touch on the ground with the most distal part of the reaching leg and return to a double-leg stance without allowing the contact to affect overall balance. The terminology of excursion directions is based on the direction of reach in relation to the stance leg . When reaching in the lateral and posterolateral directions, participants must reach behind the stance leg to complete the task.

Participants were allowed to practice reaching in each of the eight directions six times to minimize the learning effect . Following a 5 min period, participants performed three trials in each of the eight directions. They began with the anterior direction and progressed clockwise around the grid. All participants began with a right stance leg in the center of the grid. After completion of the three trials in the eight directions and another 5-min rest period, the test continued with a left stance leg.

The investigator recorded each reach distance with a mark on the tape as the distance from the center of the grid to point of maximum excursion by the reach leg. At the conclusion of all trials, the investigator measured the distances of each excursion with a standard tape measure. If the investigator felt the participant used the reaching leg for a substantial amount of support at any time, removed his or her foot from the center of the grid, or was unable to maintain balance on the support leg throughout the trial, would be discarded and repeated.

Hand eye cordination assessment Alternate hand wall toss test

A mark is placed a certain distance from the wall (e.g. 2 meters, 3 feet). The female player stands behind the line and facing the wall. The ball is thrown from one hand in an underarm action against the wall, and attempted to be caught with the opposite hand.

The ball is then thrown back against the wall and caught with the initial hand. The test can continue for a nominated number of attempts or for a set time period (e.g. 30 seconds). The no. of attempts completed was calculated.

Ratings	**Score (in 30 sec)**
Excellent	**>35**
Good	**30-35**
Average	**20-29**
Fair	**15-19**

Data Analysis

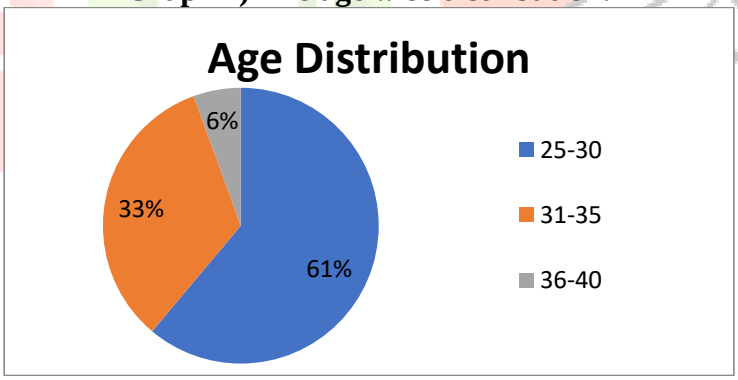
- The collected data i.e. core muscle strength , balance and hand eye co-ordination are quantitative in nature .
- Hence multiple regression product moment co-relation statistics was applied to the test to find whether the correlation between core muscle strength ,balance and hand eye co-ordination.
- All the statical analysis was performed using the statistical software SPSS 28.0.
- All the tests were performed considering 95% confidence interval and the level of significance at 0.05.

Table 1) The age wise distribution.

Age in years	No.of subjects
25-30	11
31-35	6
36-40	1

In study 11 subjects were between 25-30 years of age .6 subjects were between 31-35 years of age and 1 subjects were between 36-40 years of age.

Graph 1) The age wise distribution:



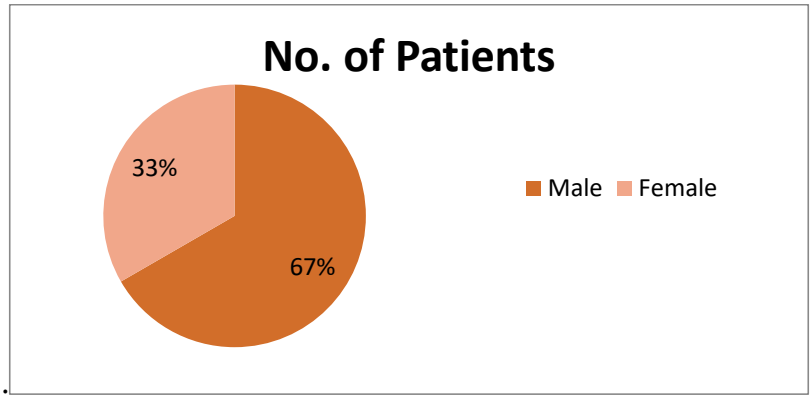
Comments- The pie diagram shows a 11 in 25-30 years of age 6 in 31-35 years of age and 1 in 36-40 years of age.

Table 2) The gender wise distribution of the subjects.

Gender	No.of Patients
Male	12
Female	6

In our study there were 12 male and 6 female .

Graph 2) The gender wise distribution of subjects.

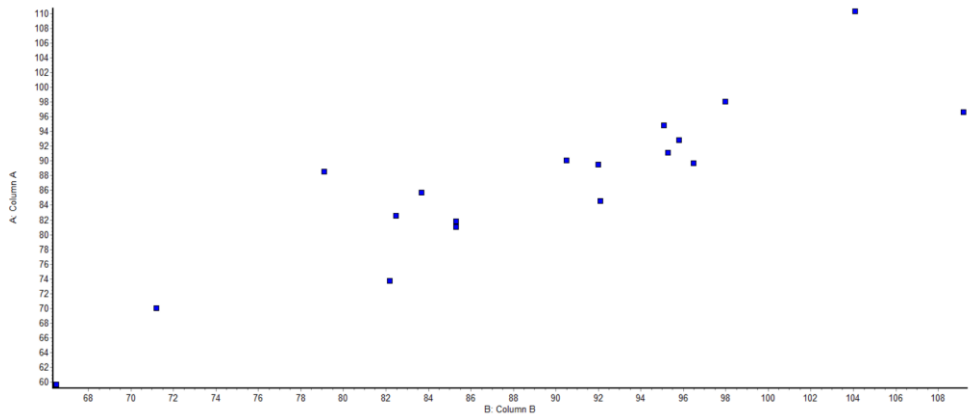


Comments-The pie diagram shows gender distribution of study there were 6 female and 12 male

Correlation between core muscle strength ,balance and hand eye coordination in non specific chronic low back pain individual

	Variable A (Core muscle strenghth)	Variable B (SEBT Right)	Variable C (SEBT Left)	Variable D (HEC)	R^2	P Value
Mean	86.6722222222	89.1333333333	17.0555555556	46.8888888889	79.66	<0.0001
Standard deviation (SD)	11.371	10.798	5.407	29.937		Extremely significant
Median (50 Percentile)	89.000	91.250	18.500	47.500		
Normality test P Value	>o.10	>0.10	>o.10	>0.10		

So it suggest that if core muscle strength is impaired then the balance and hand eye co-ordination will be affected in non-specific chronic low back pain individual.



There is a positive significant corelation exist between core muscle strength,balance and hand eye co-ordination in non specific chronic low back pain individual.

RESULTS

- The age wise distribution in study shows group 11 subject were between 25-30 years of age,6 subject were between 31-35 years of age and 1 subject were between 36-40 years of age.
- The gender distribution in study shows 12 male and 6 female.
- There is a positive significant corelation exist between core muscle strength,balance and hand eye co-ordination in non specific chronic low back pain individual (r=79.66) and (p=<0.0001) So it suggest that if core muscle strength is impaired then the balance and hand eye co-ordination will be affected in non-specific chronic low back pain individual.

DISCUSSION

In this study,Corelation between core muscle strength,balance and hand eye co-ordination in non specific chronic low back pain individual.Multiple regression test is used for analysis on data .On correlating score with multiple regression test the r^2 value =79.66 & P value obtained was <0.0001 which implies that there is positive correlation exist between core muscle strength,balance and hand eye co-ordintion in non specific chronic 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.Possitive co-relation suggest that if core muscle strength is impaired then the balance and hand eye co-ordination will be affected in non-specific chronic low back pain individuals.

This findings are supported by research done by Anusha reddy ,Arunachalam R,Anita A (2017) conducted a study on correlation between core muscle strength and hand eye co-ordination in non athletes which done on in 20 non athletic subject with low back pain. Pearson's correlation analysis was done to find the relationshipbetween 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). 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.

The findings of study done by Shraddha Patil,Aashirwad mahajan (2020) conducted a study on effect of graded plank protocol on core stability in sedentary dentists. The mean values pre unilateral hip bridging endurance test in sec was 20.6±11.50. The mean values of post unilateral hip bridging endurance test in sec were 30.44±13.53. There was significant difference between pre and post values of unilateral hip bridging endurance test. this study concluded that 6 week graded plank protocol was effective for improving the core stability in sedentary dentists.

The findings of study by Suruliraj Karthikbabu and Geert Verheyden(2020) conducted study on relation between trunk control, core muscle strength and balance confidence in community dwelling patients with chronic stroke.the results of 177 study participants,the median (IQR)score for TIS 2.0was 10(27-61) out of 100.Trunk control was highly correlated to overall core muscle strength (r=0.66-0.70, p=<0.001).The major trunk determinants of balance confidence were TIS 2.0 total score (partial R^2=0.433) and dynamic sitting balance,i.e trunk lateral flexion (partial R^2=0.376)in chronic stroke.A significant and strong positive association exists among trunk control,core muscles strength and balance confidence in community-dwelling patients with chronic stroke ,warranting further investigation of the effect of targeted trunk rehabilitation strategieson functional balance.The findings of study by Cetin O^{ABCDE},Bagis Y.E.^{ABCDE},Suna G.$^{ABCDE.}$. conducted study on the effect of the exercises brain on boxers eye hand coordination ,dynamic balance and visual attention performance.In terms of the obtained data, it has been observed that between pre and pro tests a significant development pattern shows itself for whole study group. On the other hand, as for the investigation of the pre and post-test interactions of experiment and control group, When pre and post-test interactions of experimental and control groups were examined, there was no significant difference in visual attention and dynamic balance development, but in eyehand coordination test, improvement in experimental group was found to be higher than a control group.The findings of the study in which exercising brain applied to boxers for 8 weeks showed that there was no significant difference between dynamic balance and visual attention development values, but there was a significant difference between control and experimental group,eye hand coordination developmental values.

Variable:Correlation between core muscle strength and dynamic balance-The findings of study by Heta Harish Thakkar,Senthin Kumar E.(2015) Conducted study on Static and dynamic postural stability in subjects with and without chronic low back pain.Balance, equilibrium, and postural control are synonyms concepts which are controlled by integrated system of postural mechanism - static or dynamic.The amalgamation of afferent and efferent signals provides a feedback control circuit between brain and musculoskeletal system.This is the reason why control subjects performed well in all direction where all the systems are integrated. The excursion distances have been found to be reduced in CLBP group (Table 2). CLBP patients' exhibit deficit in proprioception and tactile acuity. Moreover in CLBP, balance dysfunctions are attributed by altered feedback input from lumbar spine. In addition to it; pain proprioception inhibits the recruitment of muscular pattern from lumbar to ankle joint, CLBP also exhibits faulty kinematics aiding in poor performance of SEBT. Silfes et al. (2009) have demonstrated experimentally that lack of feedback activation of core musculature in CLBP patients leading to motor control dysfunction of posture during movement.The external cues such as visual and vestibular inputs are required to control the dynamic excursion activity -SEBT. The visual cues are more reliable than vestibular system, due to accommodation strategy of eye movements even in conflicting base of

support inputs. During posterior reach, vestibular system are more integrated than non-available visual cues leading to reduced posterior direction in both extremities. This may be attributed to the peculiar nature of SEBT, than any other factors. On the right leg reach, anteromedial and antero lateral direction didn't show any significant difference which is contradicting to previous studies.Faulty proprioception, kinetics and altered muscle length tension could have reduced the performance of SEBT. In addition to it all the participants' were of right dominancy, where uneven muscle pattern and recruitment takes place i.e. as the subject stands on the stance leg and uses the opposite limb to reach, the rectus abdominus muscles and oblique's would fire before the movement occurs to perform trunk motion, allowing the subject to maintain balance. Also, the multifundi and transverse abdominus muscles would help to maintain dynamic balance during lower extremity movement by providing support to the lumbar spine.

Variable:Correlation between core muscle strength and hand eye coordination-The findings of study by Preeti,Sheetal Kalra,Joginder Yadav,Sonia Pawaria conducted by effect of pilates on lower limb strength ,dynamic balance ,agility and coordination skills in aspiring state level badminton players. When core stability is attained, the local group of core muscles gives stability to the mobility of the distal segments and the global group of core muscles increases the moment arm for lower limb movements, generate and transfer the forces from lower limb to upper limb and vice versa.

CONCLUSION

The study concluded that there is significant relationship between the core muscle strength,balance and hand eye coordination in non specific chronic low back pain individual between the age group 25-40 r value (79.66) and p value (<0.0001).

CLINICAL IMPLICATION

- By this study we can find out the subject with poor core muscle strength ,poor dyanamic balance and poor hand eye co-ordination and further recreational activities sessions can be added in their daily lifestyle itself.
- The estabilished effect of the long term training of core muscle strength could be one of the rationale for improve the hand eye co-ordination and dynamic balance in patient with chronic low back pain individuals.

LIMITATIONS

A specific core strengthening program , hand eye coordination program and balance training was not incorporated for the subject in this particular study.

FUTURE SCOPE

- Assessment of the core muscle strength,hand eye co-ordination and balance may be followed by a proper Core strengthening program, hand eye co-ordination program and balance improvement strategies on a large sample size.
- It may include core strengthening program ,along with pre-strengthning and post-strengthning evaluation of core strength ,hand eye co-ordination and balance .
- Other more appropriate tests for assessing dynamic balance can be used.(Balance sensor,Videography).
- Beside dynamic balance ,even static balance could be evaluated.

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