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Immediate effects of mobilisation with movement on postural sway among subjects of low back pain

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Abstract

Background: Postural sway is affected in the subjects of LBP. Center of pressure (COP) measure is used to study postural control. An important spinal technique within Mulligan MWM concept is sustained natural apophyseal glide (SNAG). The immediate clinical effects of SNAGs are decrease in pain and increase in range of motion. Maitland techniques aim to restore motions of spin, glide and roll between joint surfaces and are graded according to their amplitude. Application of Maitland techniques to the vertebrae is along an anterior-posterior axis or transverse irrespective of the angle of the joint. We assume that Central Postero-anterior glide /Lateral Postero-anterior glide at spinal level will be sensitive enough for improving pain and range of lumbar spine among low back pain population. This study intends to explore the effects of SNAG and central poster anterior mobilizations on postural sway parameters of low back pain population.

Purpose of the study: To know the effectiveness of MWM on postural sway among low back pain patients.

Result: Data was collected from the subjects of LBP and the following variables and its values of pre and post intervention were described using tables and graphs:-

Gender, Age, Weight, Height and Stability Scores of Normal standing task, Loaded reach task, Forward bend task, Forward reach task, Knee level reach task and Catch a weight task.

Wilcoxn test was used to analyse within group data and Mann Whitney test was used to analyse between group data. Confidence interval was kept as 95% for the tests. Study was done on 30 patients with mean age of 37. MWM group 35.13 ± 5.64. Maitland group 38.9 ± 6.7.

Conclusion: There is significant reduction in postural sway among subjects with low back pain during functional tasks after movement with mobilisation and Maitland technique.

Keywords: BP, Postural sway, SNAG, Maitland mobilisation, force platform.

Introduction

Low back pain is a common problem that has reached epidemic levels. It has been reported that the average of 60 to 80% of all people suffer from low back pain in their

lives at some point. It is defined as pain and discomfort below the costal margins and above the inferior gluteal folds with or without leg pain. Maximum patients with isolated LBP cannot be given a specific pathoanatomical diagnosis. Mechanical LBP is defined as tension, soreness and stiffness in lower back region with no specific cause of the pain. Possible risk factors includes lifting and forceful movements, psychological factors, gender, heavy physical work, static work postures, back pain history, obesity and job dissatisfaction. Chronic low back pain is defined as pain and disability restricting patient's life activity for three months. Sub acute low back pain is defined as pain persisting for more than six weeks and less than three months duration. Acute low back pain is defined as duration of an episode of low back pain persisting for less than six weeks.

Balance is proved to be affected in LBP population. It can be tested by measuring the movement of body's centre of mass (COM) relative to the base of support in standing still and relaxed. The movement that occurs in such cases is known as postural sway, can be approximated to as the movement of a single inverted pendulum rotated around the ankle joints. Centre of pressure (COP) under the feet is strongly related to the movement of the body's COM. Since the COP trajectory is easy to measure using force platform, COP data are commonly used to study postural control. Increased postural sway is well documented in patients with non specific low back pain and a variety of theories exist regarding the effect of nonspecific low back pain and body sway. Postural control mechanisms are believed to be affected by damage to sensory tissues in the lumbar spine and trunk. This deterioration of propioceptive information reduced the accuracy of the sensory integration processes resulting in an imprecise estimation of the center of mass position, thereby inhibiting compensatory center of pressure (COP) shifts.

An important spinal technique within Mulligan MWM concept is sustained natural apophyseal glide (SNAG). In this technique the therapist applies central glide in the plane of facet joint with the patient simultaneously performs active movement. The immediate clinical effects of SNAGs are decrease in pain and increase in range of motion. We assume that compared to range of motion as an outcome, force plate parameters will be sensitive enough to SNAGS at spinal level for nociceptive stimulus and improving spinal ROM.

Maitland techniques aim to restore motions of spin, glide and roll between joint surfaces and are graded according to their amplitude. Application of Maitland techniques to the vertebrae is along an anterior-posterior axis or transverse irrespective of the angle of the joint. We assume that Central Postero-anterior glide /Lateral Postero-anterior glide at spinal level will be sensitive enough for improving pain and range of lumbar spine among low back pain population

Materials and Methods

Inclusion Criteria

The patients of above 18 and less than 55 years , with primary complain of low back pain(nonspecific in nature) and had minimum one episode of LBP , due to which physical activities were hampered or for which medical care/ intervention was sought were included. All the patients who were in their acute /subacute or chronic stage and those with reduced flexion ROM (less than 40 to 50 degrees in modified Schober's test) were included.

Exclusion Criteria

The patients with the history of cauda equina, abdominal surgery in past 12 months, any spinal surgery / limb surgery done recently, neurological disorders. Pregnant ladies were also excluded. Those who had any orthopaedic impairments/ recent fractures/ peripheral vascular disease

and the subjects with CNS , respiratory or CVS impairement were excluded.

Procedure

Low back pain patients were recruited from the Out patient department of Srinivas college of physiotherapy clinic , Mangalore and Srinivas hospital , Mukka by using purposive sampling and the study design was Randomized clinical trial. BERTEC Force platform was used to measure the postural sway of the subjects.

.Permission was taken from Srinivas hospital to recruit the patients. LBP patients who had directly come to the Physiotherapy Department and those referred by orthopaedicians from various hospitals. Patients were assessed and diagnosed by physical examination by the clinicians at OPD.

Subjects who met the inclusion criteria were selected and written consent was obtained. Subjects were explained about the entire procedure. All subjects were interviewed and examined by the clinical supervisor (musculoskeletal physiotherapist with 5 years experience) for subgroup classification, and by a clinical expert for General clinical orthopaedic assessment.

Initially body weight, height, BMI was obtained from force platform during a static upright standing trial.

Subjects who met the inclusion criteria were selected and written consent was obtained. Subjects were explained about the entire procedure. All subjects were interviewed and examined by the clinical supervisor (musculoskeletal physiotherapist with 5 years experience) for subgroup classification, and by a clinical expert for General clinical orthopaedic assessment.

Intervention

The subjects were assigned in two groups:

1) MWM (mobilisation with movement) group

2) Maitland group

Demonstration was done by the therapist on the force platform inorder to avoid the patient's fear and make them understand the correct procedure. Patients with low back pain were taken and they were made to stand on the force platform. Subjects were instructed to stand still on force plate, look straight and hand besides the body till the trial gets over.

Following tasks were done

Static Task: Subjects stood on force plate with eyes open.

Dynamic Tasks

1) Loaded reach test: Subjects was asked to stand still on the force platform and then be asked to reach forward with the weight at shoulder. He will be instructed to reach as far as possible and without lifting the heels. The weight should not exceed five percent of body weight or 4.5 kg.

2) Forward trunk bending task (finger tip to floor task): Subjects were asked to stand upright on force plate and bend down as much as possible. On forward flexion the lumbar spine should move from its normal lordotic curve to atleast a straight or slightly flexed curve. They were instructed not to bend their knees while performing this task.

3) Knee level lift task: Patient had to stand erect on force plate and asked to bend down and lift the weight kept at knee level.

4) Forward leg reaching task: This is a modification of a Y reach test, however the participants were asked to take the dominant leg forward as far as they can reach while standing on the force-plate.

5) Catch a weight task: Patient had to stand upright on force platform in their normal stance, with arms outstretched. Weight was released by the therapist from the eye level distance over the palm. Patient was be instructed to catch and bear the weight without losing balance.

During all the above tasks, Stability S cores will be analysed.

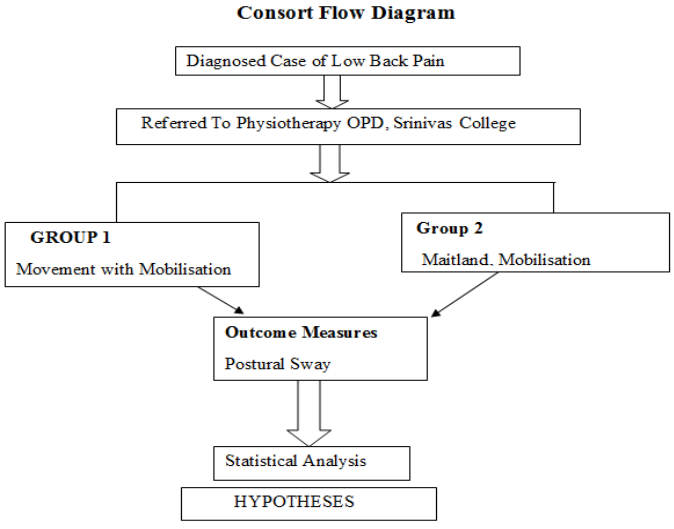
On the first day readings of all the subjects were taken on force plate. Balance check software was used to find out the static and dynamic measures of balance which portrays the postural sway.

Treatment Protocol

A randomized control trial with concealed allocation will be conducted. Participants will be randomly allocated to any one of interventions i.e., movement with mobilization (MWM) OR Maitland mobilization (MLM). Both groups will receive ergonomic advice on first day of intervention.

Experimental group of patients will receive movement with mobilization MWM for three sittings i.e., for three days. SNAG will be given on affected lumbar segment with the patient performing the offending movement. Three sets of MWM will be given and each set will consist of 6 repetitions. Postural sway was recorded after three sittings of MWM i.e., three days.

Control group of patients control group of patients will receive Maitland mobilization (MLM) intervention; will involve central postero anterior mobilization on the affected lumbar segment for three sittings i.e., three days. Postural sway was recorded after three sittings of central poster anterior mobilization.



Outcome measure

Postural Balance: The Force plate will be used to monitor the Postural Sway during dynamic tasks.

Statistical Analysis

Non parametric tests were used because of non normal distribution. Wilcoxn signed rank test was used for within group analysis to measure postural sway after the protocol of three days. Mann Whitney test was used for inter group analysis to measure postural sway.

Results

Data was collected from the subjects of LBP and the following variables and its values of pre and post intervention were described using tables and graphs :-

Genger, Age, Weight, Height, BMI and Stability Scores (postural sway) of Normal standing task, Loaded reach task, Forward bend task, Forward reach task, Knee level reach task and Catch a weight task.

The data was entered and coded into the software SPSS (statistical Package For Social Sciences) 20 for windows. Descriptive analysis was done finding mean and standard deviation of all grouped variables as mentioned in results. The data was then subjected to test of normality. Inferential analysis was carried out by non parametric tests as sample size was small. Wilcoxn test was used to analyse within group data and Mann Whitney test was used to analyse between group data.

Confidence interval was kept as 95% for the tests. Study was done on 30 patients with mean age of 37. MWM group 35.13 ± 5.64. Maitland group 38.9 ± 6.7.

Patient Characteristics

Baseline status (patient characteristics and outcome measures) in both the groups were highly similar in demography.

Table 1: Baseline characteristics of MWM group

	N	Minimum	Maximum	Mean	Std Deviation
Age	15	25.00	48.00	35.1333	5.64253
Weight	15	1.53	1.73	1.6340	.06577
Height	15	44.70	78.10	61.3667	8.59125
BMI	15	18.0	32.1	22.860	3.1384
NSS1	15	52.5	94.0	79.207	12.6208
LRT_SS_1	15	12.0	55.0	28.987	14.7190
KT_SS_1	15	15.0	67.0	31.227	14.9874
FBEND_SS_1	15	25.0	64.8	44.893	13.7359
FRCH_SS_1	15	20.0	71.0	37.973	15.3813
CWTSS_1	15	22.3	76.7	60.167	13.1178

Analysis on Vas

VAS of pre and post intervention for MWM group and Maitland group was compared. Both the groups showed statistically highly significant change ($P < 0.001$) which means that both the groups reported decrease in pain.

However VAS when analysed between the experimental and control group, it showed that there was no statistically significant change ($P>0.05$) proving that decrease in pain were similar hence no one group was superior to other.

Table 2: Statistical Values for Vas For Both The Groups

		VAS (Mean and SD)	Vas change within the groups	P value(within group difference)	P value(difference between groups)
MWM GROUP	PRE	6.8±5.6	2.7±4.9	0.001	0.935
	POST	3.8±0.7			
MAITLAND GROUP	PRE	7.2±6.7	2±5.7	0.001	
	POST	5.2±1.0			

Analysis on Flexion Rom

Flexion range of motion of pre and post intervention for MWM group and Maitland group was compared. Both the groups showed statistically highly significant change ($P < 0.001$) which means that both the groups reported decrease in pain.

However range of motion when analysed between the MWM and Maitland group, it showed that there was no statistically significant change ($P>0.05$) proving that decrease in pain, postural sway and disability were similar hence no one group was superior to other.

Table 3: Statistical Values Of Flexion Rom For Both The Groups(Mean And S.D.)

		Flexion ROM (Mean And S.D.)	ROM change within the groups	P value (difference within group)	P value(difference between groups)
MWM GROUP	PRE	4.26±0.8	2.94	0.001	0.539
	POST	7.2±0.5			
MAITLAND GROUP	PRE	3.86±1.3	3.14	0.001	
	POST	7.0±0.6			

Analysis on RMDQ

Rolland morris disability questionnaire's scores of pre and post intervention for MWM group and Maitland group were compared. Both the groups showed statistically highly significant change ($P < 0.001$) which means that both the groups reported decrease in pain.

However RMDQ scores when analysed between the MWM and Maitland group, it showed that there was no statistically significant change ($P>0.05$) proving that decrease in disability was similar hence no one group was superior to other.

Table 4: Statistical Values for RMDQ scores

		RMDQ (Mean And SD)	Score change within groups	P value(difference within groups)	P value(difference between groups)
MWM GROUP	PRE	17.53±1.55	3.63	0.001	0.624
	POST	13.9±1.7			
MAITLAND GROUP	PRE	17.00±1.46	3.7	0.001	
	POST	13.3±1.2			

Analysis on FABQ Scores

Fear avoidance belief's questionnaire was compared pre and post intervention for MWM group and Maitland group. FABQ for both the groups showed statistically highly significant change ($P < 0.001$) which means that both the groups reported decrease in pain.

However FABQ scores when analysed between the MWM and Maitland group, it showed that there was no statistically significant change ($P>0.05$) proving that decrease in fear was similar hence no one group was superior to other.

Table 5: statistical Values for FABQ Scores

		FABQ	Score change within groups	P value(difference within group)	P value(difference between two groups)
MWM GROUP	PRE	48.3±15.02	8.7	0.001	0.285
	POST	39.6±12.9			
MAITLAND GROUP	PRE	48.53±11.8	9.3	0.001	
	POST	39.2±11.3			

Analysis on Normal Standing

Stability scores of normal standing task on forceplate was compared pre and post intervention for MWM group and Maitland group. Stability scores for both the groups showed statistically highly significant change (P < 0.001) which means that both the groups reported decrease in pain.

However stability scores when analysed between the MWM and Maitland group, it showed that there was no statistically significant change (P>0.05) proving that decrease in postural sway was similar, hence no one group was superior to other.

Table 6: Statistical Values of Stability Score in Normal Standing Task

		Normal Standing (Stability Score) (Mean And SD)	Score change within groups	P value (difference within group)	P value (difference between two groups)
MWM GROUP	PRE	79.207±12.6	9.95	0.001	0.285
	POST	89.15±7.87			
MAITLANDGROUP	PRE	81.03±5.18	7.3	0.001	
	POST	88.33±4.9			

Analysis on Loaded Reach Task

Stability scores of loaded reach task task on forceplate was compared pre and post intervention for MWM group and Maitland group. Stability scores for both the groups showed statistically highly significant change (P < 0.001) which means that both the groups reported decrease in pain.

However stability scores when analysed between the MWM and Maitland group, it showed that there was no statistically significant change (P>0.05) proving that decrease in postural sway was similar, hence no one group was superior to other.

Table 7: Statistical Values Of Stability Scores In Loaded Reach Task

		LRT (Stability Score Mean And SD)	Score change within groups	P value)difference within group)	P value (difference between two groups)
MWM GROUP	PRE	28.98±14.71	6.75	0.001	0.345
	POST	35.73±17.8			
MAITLAND GROUP	PRE	31.96±11.17	11.4	0.002	
	POST	43.4±14.23			

Analysis on Knee Level Lift Task

Stability scores of knee level lift task on forceplate was compared pre and post intervention for MWM group and Maitland group. Stability scores for both the groups showed statistically highly significant change (P < 0.001) which means that both the groups reported decrease in pain.

However stability scores when analysed between the MWM and Maitland group, it showed that there was no statistically significant change (P>0.05) proving that decrease in postural sway was similar, hence no one group was superior to other.

Table 8: Statistical Values of Stability Score Of Knee Level Lift Task

		LRT(Stability Score)(Mean And SD)	Score change within groups	P value(difference within group)	Pvalue (difference between both the groups)
MWM GROUP	PRE	28.98±14.98	6.75	0.01	0.967
	POST	35.73±14.74			

Analysis of Forward Bend Task

Stability scores of forward bend task on forceplate was compared pre and post intervention for MWM group and Maitland group. Stability scores for both the groups showed statistically highly significant change (P < 0.001) which means that both the groups reported decrease in pain.

However stability scores when analysed between the MWM and Maitland group, it showed that there was no statistically significant change (P>0.05) proving that decrease in postural sway was similar, hence no one group was superior to other.

Table 9: Statistical Values of Stability Score For Forward Bend Task

		Forward Bend Task (Stability Score)	Score change within groups	P value (difference within group)	P value (difference between two groups)
MWM GROUP	PRE	44.89±13.73	9.98	0.001	0.436
	POST	54.87±14.54			
MAITLAND GROUP	PRE	47.75±9.63	13.98	0.001	
	POST	61.73±10.49			

Analysis of Forward Reach Task

Stability scores of forward reach task on forceplate was compared pre and post intervention for MWM group and Maitland group. Stability scores for both the groups showed statistically highly significant change (P < 0.001) which means that both the groups reported decrease in pain.

However stability scores when analysed between the MWM and Maitland group, it showed that there was no statistically significant change (P>0.05) proving that decrease in postural sway was similar, hence no one group was superior to other.

Table 10: Statistical Values of Stability Score For Forward Reach Task

		FWD RCH TASK (STABILITY SCORE)(MEAN AND S.D.)	Score change within groups	P value (difference within group)	P value (difference between two groups)
MWM GROUP	PRE	37.93±15.38	7.84	0.007	0.870
	POST	45.77±14.87			
MAITLAND GROUP	PRE	38.43±12.18	4.1	0.001	
	POST	42.53±12.36			

Analysis on Catch Weight Task

Stability scores of catch weight task on force plate was compared pre and post intervention for MWM group and Maitland group. Stability scores for both the groups showed statistically highly significant change ($P < 0.001$) which means that both the groups reported decrease in pain.

However stability scores when analysed between the MWM and Maitland group, it showed that there was no statistically significant change ($P>0.05$) proving that decrease in postural sway was similar, hence no one group was superior to other.

Table 11: Statistical Values of Scability Scores for Catch Weight Task

		CWT (STABILITY SCORE)(MEAN AND S.D.)	Score change within groups	P value (difference within group)	P value (difference between two groups)
MWM GROUP	PRE	60.17±13.11	13.68	0.001	0.624
	POST	73.85±6.98			
MAITLAND GROUP	PRE	68.25±7.14	9.88	0.001	
	POST	78.13±7.08			

Discussion

Low back pain is one of the most common musculoskeletal ailment worldwide. It affects up to 80% of the adult population at some point during their lives.[45] It has direct or indirect costs to the person, work place and society. Although most episodes of LBP appear self limiting, recurrence with a variance course is common.[46] Therefore adequate treatment of low back pain is an important issue for patients , clinicians and health care policy makers.[27]

The human postural system operates on the basis of the integrated information from three independent sensory sources: Somatosensory, Vestibular and Visual inputs. This information, which allows to assess the position and motion of the body in space, is constantly reweighted so as to generate the appropriate forces to control and maintain balance in a wide range of situations.[47] It is thus conceivable that a derangement to any of the three sensory systems will influence the overall output of the postural system.

The maintenance and control of balance, whether under static or dynamic conditions, is an essential requirement for physical and daily activities. In humans, the balance-controlling is operated by spinal and brainstem reflex networks. Postural control, a foundation for most activities of daily living is affected in people with LBP. Patients with chronic low back pain demonstrated poor postural control of lumbar spine and longer trunk muscles response times. These differences may be due to changes in the planning of the motor response or due to delayed transmission of the descending motor command in the nervous system.[20] Sensory tissues of lumbar spine and trunk are damaged in low back pain population. Hence because of this deterioration in the propioceptive mechanism, there is reduction in the accuracy of sensory integration. Therefore it results in an imprecise estimation of COM position, inhibiting compensatory COP shifts.[31] Ruhe et al (2011), proved that COP sway velocity increases linearly with increasing perceived pain intensity greater than 4 on Numerical pain rating scale (NPRS).

Conventionally many treatment options such as lumbar stabilization exercises, pilates training, neural mobilisation, core muscle strengthening, motor control exercises, lumbar traction and electrotherapy modalities. But there is no evidence for the most effective treatment which has least chance of recurrence. MWM is a technique which works on the principle of correcting the positional fault. The main aim of Mulligan concept is to provide immediate pain relief and improvement in range of motion. Clinicians follow MWM concept for treating the patients of LBP, but there is lack of evidence about the importance and effects of Lumbar SNAG in LBP.

Movement with mobilisation is a well known technique pioneered by Brian Mulligan. Immediate effects of lumbar SNAG is reduction of pain and improvement in range of motion.[22] Maitland technique is also widely used in treating various spinal conditions of mechanical origin.[25] Till date there is no literature found on the effect of MWM and Maitland mobilisation on postural control domains. Hence this study was done to explore the effects of MWM and Maitland technique on the postural control domains among low back pain subjects.

In this study subjects with LBP were divided into two groups – MWM or Maitland group. Three days of lumbar flexion SNAGs was given in group one. Central Posteroanterior mobilisation was given in subjects in group two.

Outcome measurement was done using Force plate to check postural sway, Modified Schober's method for measuring ROM, VAS scale to assess the severity of pain, Rolland Morris Disability questionnaire to know the functional level and Fear avoidance belief's questionnaire in order to rule out the yellow flags , respectively.

VAS scale is a tool which has high reliability and validity. Horizontal VAS scale of 10mm was used for this study. It is a self reported tool.

Force plate is a platform used to measure COP. It is available in two forms- stationary force platform and movable force platform. In this study stationary force plate was used to measure the postural sway of low back pain patients. It measured the stability score of the patient. More the sway, less is the stability score and vice a versa. Mientjes and Frank [10] tested subjects in a range of conditions, comprising standing on firm and unstable surfaces, with eyes open and closed but significant result was not obtained. Hence in this study we measured the postural sway while doing functional activities, because balance is the most important factor which has to be considered while performing functional tasks. Five tasks which were included were loaded reach task, catch a weight task, forward bend task, forward reach task and knee level lift task.

Modified Schober's method is proved to be a reliable and valid tool to check the lumbar ROM.[45] Lumbar flexion was measured using this method. In order to avoid heterogeneity only flexion range of motion was considered. Forward bending is the most common activity of daily routine and it is mostly restricted as well as painful among the subjects of LBP. Hence in this study only lumbar flexion range of motion was focused.

Rolland Morris Disability Questionnaire is a self reported questionnaire which was used in this study. It is proved to have high reliability and validity. Fear Avoidance Belief's questionnaire was also used to find out the psychological status of the patient, in order to avoid the risk of chronicity.

Mulligan and Maitland techniques are proved for immediate pain relief and improvement of range of motion. Therefore in this study intervention was given only for three days and postural sway was measured on the first day before the intervention and on third day after the intervention. Stability score was decreased in both the groups after the intervention as compared to pre intervention score. By applying lumbar SNAG parallel to plane of the facet joint with the patient performing the offending movement, the positional fault of the joint was corrected which in turn lead to restoration of normal range of motion and immediate pain reduction.

Many studies have shown pain reduction and improvement in stiffness after application of Maitland technique. Central Posteroanterior mobilisation was given to LBP subjects who belonged to group two.[10] By applying Central PA (passive accessory oscillatory movement) on the spinous process the joint position sense and pain were improved and restriction was reduced.

There is a strong correlation between pain intensity and abnormal postural sway. After MWM and Maitland there was reduction of pain and restoration of range of motion due to which the stability score was improved and in turn the body sway was reduced.

Clinical implication: Postural sway is an important objective measure which should be considered and examined before and after the treatment of LBP patients. Core stabilization exercises, lumbar stabilisation exercises, lumbar traction are conventional treatments for LBP patients. Movement with mobilisation and Maitland mobilisation should also administered along with the conventional therapy while treating the patients of low back pain.

Limitations

- Long term follow up was not there.
- Sample size was small.
- Only flexion range of motion was measured.
- Grouping of the patients was not done.

Conclusion

The result of this study showed that there is significant reduction in postural sway among subjects with low back pain during functional tasks after movement with mobilisation. Maitland mobilisation is also equally effective in improving the postural sway. It also showed that the postural sway is affected in patients having low back pain during static and dynamic activities.

On the basis of our study we can assume that three days intervention of movement with mobilisation is effective in enhancing postural control during the functional activities. The clinician can also evaluate and make a note of prognosis and can streamline the treatment protocol apart from MWM and Maitland mobilisation.

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