

Immediate Effects of Movement with Mobilization on Postural Sway among Patients with Low Back Pain

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Abstract

Objective: To find out the effect of MWM on postural sway among low back pain population.

Materials and Methods: The study was done to show the effect of Movement with Mobilization and Maitland Mobilization on postural sway in low back pain population and to find the postural control responses among low back pain population. 30 low back pain patients with age group of 18-55 years who fulfilled the inclusion criteria were selected for the study. Both the groups had 15 subjects each. Subjects of both the groups were made to stand on the force platform and all of them were made to do static and dynamic tasks on the first day, followed by three days intervention.

Discussion: MWM was given to subjects in group one (MWM group) and Maitland Mobilization was given to subjects in group two (Maitland group). On the third day postural sway was measured again and all the subjects were made to do static and dynamic tasks. Visual Analogue scale(VAS), Rolland Morris Disability Questionnaire(RMDQ), Fear Avoidance Belief's Questionnaire(FABQ) were used to measure pain, disability, fear and stress level respectively. It was found that there was reduction in postural sway during static and dynamic activities after the intervention in both the groups. Hence we conclude that Mobilization is effective in improving the pain, disability and postural control among subjects with low back pain.

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 Mobilization. Maitland Mobilization 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.

Keywords: Pilates exercises; Low back pain; Modified Oswestry Questionnaire; NPRS

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Introduction

Low back pain (LBP) is a common problem that has reached epidemic levels. Contrary to previous reports of a favorable prognosis, it has been reported that an average of 60% to 80% of all people suffer from low back pain at some time in their life. The economic burden of LBP on individuals and the community is high and increasing. It is defined as pain and discomfort located below costal margins and above inferior gluteal folds with and

without leg pain. Possible risk factors include lifting and forceful movements, psychological factors, gender, heavy physical work, static work postures, back pain history, obesity and job dissatisfaction. Probable risk factors of low back pain include smoking, age and genetic factors. 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 [1].

Balance is proved to be affected in low back pain population as compared to healthy controls. 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.

"Postural control requires a complex interaction of various components of musculoskeletal and neural systems apart from environment and task involved in it". It is a complex function and vulnerable to disruption by a wide variety of disorders. In addition to the neurological and vestibular disease, postural control also plays significant role in several musculoskeletal impairments including back and joint disorders.

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 proprioceptive 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.

In low back pain, postural adjustments of the trunk muscles are altered such that the deep trunk muscles are consistently delayed and the superficial trunk muscles are sometimes augmented. This alteration of postural adjustments may reflect disruption of normal postural control readily imparted by reduced central nervous system resources available during pain, so-called "pain interference", or reflect adoption of an alternate postural adjustment strategy. These abnormal strategies by which the CNS controls feed forward and backward adjustment of the trunk muscles during limb movement is also altered in acute and recurrent low back pain people, even when they are pain free [2].

The cause of sway is attributed to many factors such as inherent noise within the human neuromotor system as reflective of an active anticipatory search process or as an output of a control process to maintain postural control. Body sway can be assessed by measuring the deviation in the location of the centre of pressure on the supporting surface by means of force platform. COP refers to the point at which the pressure of the body over the soles of the feet would be if it were concentrated in one spot. It is, however not a true record of body sway but rather a measure of the activity of the motor system in moving the COP.

Conventionally core stability exercises were prescribed in rehabilitation of chronic low back pain to enhance dynamic control and stability of spine. In acute low back pain passive modalities (traction, laser, and ultrasound) increase the risk of illness behavior and chronicity and therefore it should be avoided and patient should return to ADL as early as possible.

Hence manual therapy is increasingly used in acute back pain population.

The Mulligan concept is now an integral component of many manual physiotherapists clinical practice. Brian Mulligan pioneered the techniques of this concept in 1970s in New Zealand. The concept has its foundation built on Kaltenborn's principles of restoring the accessory component of physiological joint movement. Unique to this concept is mobilization of the spine whilst the spine is in a weight bearing position and directing the Mobilization parallel to the spinal facet planes. 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.

One study showed the use of three dimensional electronic goniometer (Zebris CMS 20) before and after each SNAG technique and showed no significant difference in range of motion in asymptomatic population. This may be due to absence of positional fault in healthy subjects. Hence 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's Concepts (often also referred to as the Maitland Technique) involve the application of passive and accessory oscillatory movements to spinal and vertebral joints to treat pain and stiffness of a mechanical nature. The 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. Many studies has demonstrated hypoalgesic response to mobilizations on symptomatic population.

We assume that Maitland glides can have impact on improving the pain and posture of the low back pain patient by clearing the obstruction, which in turn can improve the body sway during functional activities.

There was no literature found to explore the effects of MWM and Maitland mobilization on postural control domains. Hence this study intends to explore the effects of SNAG and central poster anterior mobilizations on symptom reduction, disability and avoidance of fear during activity and postural sway parameters of low back pain population [3].

Materials and Methods

Inclusion criteria

- Age: 18-55 years.
- Patient should have primary complain of back pain, Nonspecific in nature. Who had minimum 1 episode of

LBP necessitating alteration in normal activities or for which medical care/intervention has been sought?

- Reduced (i.e., less than 40-50 degrees) spinal flexion range of motion due to pain at back in modified Schober's test.
- Patients with acute, sub-acute and chronic stage.

Exclusion criteria

- Evidence of cauda equina
- Abdominal surgery in past 12 months
- Any spinal surgery, limb surgery
- Neurological disorders
- Pregnancy
- Any orthopedic impairment, fractures, peripheral vascular disease
- Subjects with CNS, respiratory or CVS impairment

Procedure

Source of the data: Patients with LBP were recruited from the outpatient department of Srinivas College of Physiotherapy Clinic, Mangalore and Srinivas hospital, Mukka.

Sampling procedure: Purposive sampling.

Study design: Randomized clinical trial.

Tool/equipment used: BERTEC Force plate, Columbus, OH 43229, USA.

Materials used: Presented in **Table 1**.

Questionnaires and scales used:

- Visual Analog Scale (VAS).
- Fear Avoidance Belief Questionnaire (FABQ).
- Rolland Moris Disability Questionnaire (RMDQ).

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 during the month of August 2013 to month of December 2014 were recruited. 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 orthopedic assessment [4].

Table 1: Material used.

Materials	Use of Materials
Pen/Pencil	To note down the readings
Paper	To note down the essential readings
Inch tape/ stadiometer	To measure the height and range of motion
Weighing machine	To measure the weight of the subject

Initially body weight, height, BMI was obtained from force platform during a static upright standing trial. Specific assessment was taken using Visual Analogue Scale (VAS), Rolland Morris Disability Questionnaire (RMDQ), and Fear avoidance Belief's Questionnaire (FABQ).

Interventions

The subjects were assigned in two groups:

- MWM (Mobilization with movement) group
- Maitland group

Demonstration was done by the therapist on the force platform in order 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 [5].

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 (fingertip 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 at least 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 being instructed to catch and bear the weight without losing balance.

During all the above tasks, Stability Scores will be analyzed.

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. All the outcome measures will be 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. All outcome measures will be recorded after three sittings of central poster anterior mobilization [6] (Figure 1).

Outcome measures

- Postural balance: The Force plate will be used to monitor the Postural Sway during dynamic tasks.
- Pain of the patient will be measured by a Visual Analogue Scale.
- Fear avoidance questionnaire.
- Lumbar flexion will be measured by a using Modified Schober's method.
- Rolando Morris Disability Questionnaire.

Statistical analysis

Non parametric tests were used because of non-normal distribution.

Wilcoxon signed rank test was used for within group analysis to measure VAS score, RMDQ, FABQ, Postural sway and Flexion Range of motion after the protocol of three days.

Mann Whitney test was used for inter group analysis to measure VAS score, FABQ score, RMDQ score, Postural sway and flexion range of motion [7] (Figures 2-10).

Discussion

Low back pain is one of the most common musculoskeletal ailments worldwide. It affects up to 80% of the adult population at some point during their lives. 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. Therefore adequate treatment of low back pain is an important issue for patients, clinicians and health care policy makers.

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 assessing 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

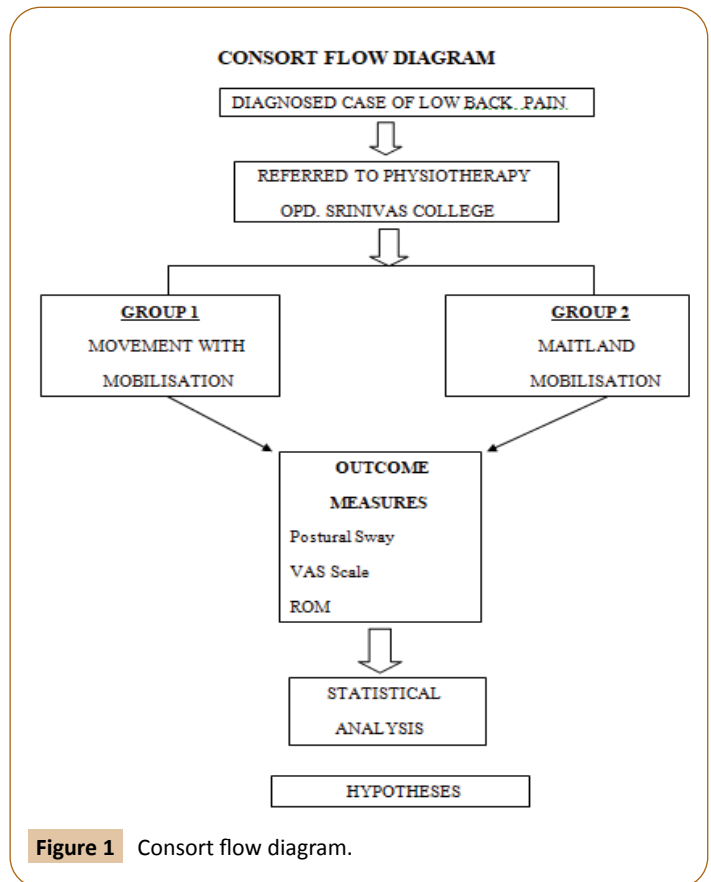


Figure 1 Consort flow diagram.



Figure 2 Subject in normal standing.



Figure 3 Subject in forward bend task.



Figure 4 Subject in loaded reach task.

situations. It is thus conceivable that a derangement to any of the three sensory systems will influence the overall output of the postural system [8].

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.

Sensory tissues of lumbar spine and trunk are damaged in low back pain population. Hence because of this deterioration in the proprioceptive mechanism, there is reduction in the accuracy of sensory integration. Therefore it results in an imprecise estimation of COM position, inhibiting compensatory COP shifts. Ruhe et al. 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 Mobilization, 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.



Figure 5 Subject in forward reach task.



Figure 6 Subject in knee level lift task.



Figure 7 Subject in front weight level lift task.



Figure 8 Central postero-anterior mobilization with subject in prone position.

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 Mobilization is a well-known technique pioneered by Brian Mulligan. Immediate effects of lumbar SNAG is reduction of pain and improvement in range of motion. Maitland technique is also widely used in treating various spinal conditions of mechanical origin. Till date there is no literature found on the effect of MWM and Maitland Mobilization 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 postero-anterior Mobilization 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.



Figure 9 Lumbar snag starting position.



Figure 10 Lumbar snag for flexion.

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 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. 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.

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Many studies have shown pain reduction and improvement in stiffness after application of Maitland technique. Central Postero-anterior Mobilization was given to LBP subjects who belonged to group two. 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 implications

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 stabilization exercises, lumbar traction are conventional treatments for LBP patients. Movement with Mobilization and Maitland Mobilization should also administer 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.
- Sub 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 Mobilization. Maitland Mobilization 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 Mobilization 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 Mobilization.

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