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SPINAL MANIPULATION: ORIGINAL NEURODYNAMIC STUDY

# The immediate and 24-hour follow-up effect of unilateral lumbar Z-joint mobilisation on posterior chain neurodynamics

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**Summary** Few studies have reported the effects of lumbar spine mobilization on neurodynamics. In a recent study, Szlezak et al. (2011) reported immediate improvement of posterior chain neurodynamics [range of passive straight leg raise (SLR)] following ipsilateral lumbar spine zygopophyseal (Z) joint mobilization. We re-duplicated the study with a 24 h follow-up measurement. Sixty healthy college students were assigned to two groups, mobilization and control. The mobilization group received ipsilateral grade 3 Maitland mobilizations to Z joint at a frequency of 2 MHz for 3 min and the control group received no treatment. The SLR was measured before and after the intervention for both the groups on the day of testing and 24-h later. Repeated measures ANOVA showed statistically significant pre to post improvement in SLR range after mobilization. The improvement was retained at 24-h. The results of the study are consistent with Szlezak et al. (2011).


## Introduction

Neurodynamics refers to the mechanical and physiological components of the nervous system and the interconnections between them (Shacklock, 1995). The mechanical components of the nervous system must be resilient enough to endure tension and compression, while allowing sliding of the nerves (Shacklock, 2005). The neural tension tests are used to move the neural tissues to gain an impression of their mobility and sensitivity to mechanical stresses. Structures that are affected with these tests include the neuraxis, meninges, nerve roots (Breig, 1960, 1978; Louis, 1981) and peripheral nerves (Goddard and Reid, 1965; McLellan and Swash, 1976; Millesi, 1986). One of the most commonly used neural tension test is the straight leg raise (SLR) test (Breig and Troup, 1979).

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The SLR test is a common neurodynamic test used to examine the mechanosensitivity of the lower extremity nervous system (Boyd et al., 2009) in determining the ability of the nerves to move and respond to the tensile and compressive forces. The test procedures, underlying mechanisms and interpretations of the test results has been described by many different groups (Lasegue, 1864; Forst, 1881; De Beurmann, 1884; Fajersztajn, 1901; Moutard-Martin and Parturier, 1907) all cited by Woodhall and Hayes 1950. The SLR test is of great value in assessing normality of the roots of the sciatic nerve (Breig and Troup, 1979; Urban, 1981) and tightness of the hamstring muscles (Tanigawa, 1972; Medeiros et al., 1977; Erickson and Coney, 1979; Halkovich et al., 1981). Further, it has been suggested that improving SLR mobility reduces the degree of impairment in patients with low back pain (Blunt et al., 1997; Hall et al., 2001; Hanten and Chandler, 1994).

Various studies have reported greater improvement on pain following a neurodynamic mobilization technique in combination with other treatment protocols (Cleland et al., 2006; Nagrale et al., 2011). Coppieters et al., 2003 investigated the response to cervical mobilizations in participants with "cervicobrachial pain" and found that the participants who received lateral translations of the cervical spine demonstrated statistically significant improvement in elbow extension range of motion and intensity of pain during a median nerve test. In a recent study, Szlezak et al., 2011 reported that posterior chain neurodynamics can be immediately restored with lumbar spine zygopophyseal (Z) joint mobilization on the same side. The authors applied unilateral grade III oscillatory mobilizations at a frequency of 2 Hz to the T12/L1, L1/L2, L2/L3, L3/L4, L4/L5, and L5/S1 for 30 s per joint and found an improvement in the same side mean SLR score.

We wanted to demonstrate the sustainability of the Szlezak et al., 2011 results and see if any change in range would be maintained 24 h later. This formed the focus of our work and the aim of our study was to evaluate the immediate and 24-h follow-up effect of unilateral lumbar Z-joint mobilisation on posterior chain neurodynamics in normal subjects.

## Materials and methods

The study design was a prospective trial using an experimental pre, post and follow up design. Thirty healthy physiotherapy students (15 males and 15 females), with full range of motion in ankle, knee and hip were recruited for the study. The participants recruited had no history of any neurological abnormalities, previous injuries, disorders and surgeries to the spine and limbs. The mean age of the participants was 22.03 (range 20–24). Another 30 (total $n = 60$) age, sex and height matched subjects served as controls (mean age 22.06, range 20–24). Participants with diabetes mellitus were excluded as a study by Boyd et al. (2010) concluded that people with diabetes mellitus have limited responses to SLR neurodynamic testing, and may be at risk of harm from nerve overstretch. All the participants were able to tolerate prone position (no breathing difficulties). Informed consent was signed by every participant and the procedure was approved by the institutional ethics committee. The procedure was adequately explained to the participants and the consenting participants agreed that they would not engage in any other lower limb exercises for a 24 h period except their usual routines.

## Outcome variable

The straight-leg -raise (SLR) test was used to measure the extensibility of posterior chain muscles. A goniometer was used to measure the SLR range. This method was shown to be reliable for both intrasession (Medeiros et al., 1977) and intersession (Troup et al., 1968) measurements of the SLR.

Participants, wearing loose shorts, were positioned in supine with the right side of the body parallel to the edge of a firm treatment table. The tested hip was positioned in neutral abduction, knee in extension and the ankle maintained in plantigrade position by an orthosis. The other leg was maintained flat by strapping to the treatment table to avoid excessive posterior pelvic tilt. The goniometer was placed with the stationary arm parallel to the edge of the treatment table, the moving arm along the lateral midline of the thigh, and the axis over the superior half of the greater trochanter. The goniometer was strapped to the measuring limb (Fig. 1). Each participant was instructed to relax as much as possible.

Three investigators blinded to the study completed all the measurements. The investigators attended a training session prior to the study, where they discussed the measurement procedure. All the data were collected in a private room with only the investigators present. To maintain the uniformity, only the right limb was studied. The limb was passively lifted by one of the independent investigators to the initial point of limb resistance or a sensation of discomfort, stretch, pulling, tension or pain by the participant, whichever was earlier. The second investigator palpated for pelvic tilt to ensure that SLR was not accompanied by pelvic rocking movement (Fig. 2). Those participants who had pelvic tilt before the resistance was felt were excluded from the study. Care was taken to avoid transverse and coronal plane movements during passive hip flexion. The measurement was recorded by the moveable arm of goniometer by the third investigator. The limb was then returned to the treatment table. The hip flexion angles were measured in whole degrees using a goniometer. One trial movement was allowed to familiarize the participants to the testing procedure. Once the data were collected, the investigators left the room and the authors entered and applied one of the two interventions. The investigators were blinded to the interventions being undertaken, thereby eliminating potential bias. Successful blinding was ensured as no communication occurred

**Figure 1** Straight leg raise measurement — positioning.