

# Asymmetries in Functional Lifting Tests in Lumbar Degeneration Patients with Unilateral Leg Pain

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## INTRODUCTION

Lumbar degeneration (LD) is a common pathology affecting the intervertebral discs of the lumbar spine. Over time, natural wear and tear cause the discs to deteriorate, leading to chronic pain and loss of functionality. Spinal stenosis is commonly associated with LD which is a result of the spinal canal or neural foramen narrowing, and the nerves becoming impinged. Unilateral radiculopathy is caused by the stenosis of the nerves exiting the spine through the foramen on a single side. Oftentimes, this results in debilitating low back and leg pain. This is a major cause of functional impairment and occupational leave. Lifting is a common activity of daily life which demands whole-body coordination and can be greatly affected by LD. Currently, it is unclear whether symptomatic LD patients modify their lifting technique to avoid pain which may put their back at greater risk for additional injury.

## METHODS

There were 33 (16 M and 17 F) subjects with an average age of  $56.83 \pm 18.69$ yr and an average BMI of  $27.83 \pm 4.71$ yr with a

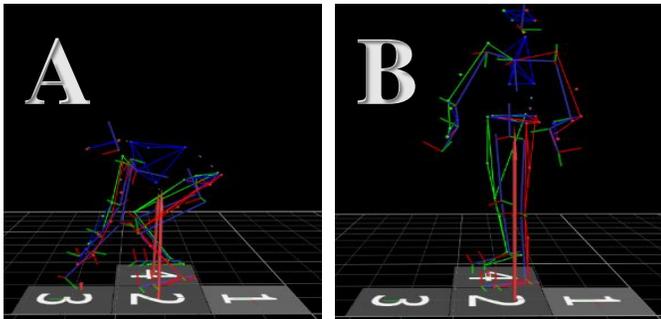


Figure 1: Example of lift (A) and set (B) time points during an asymmetric lifting task.

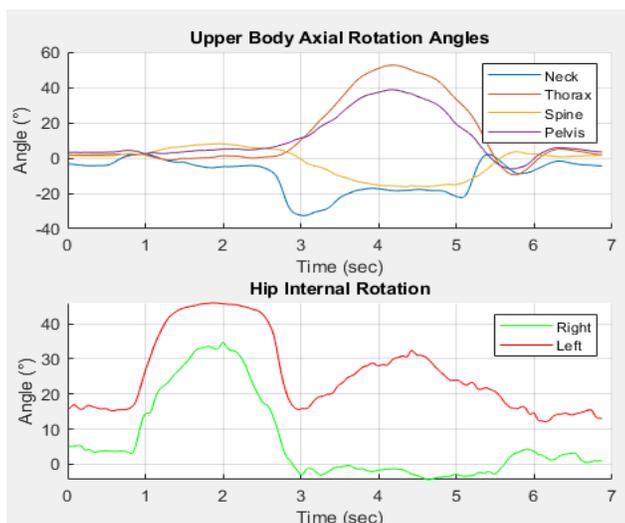


Figure 2: Neck, thorax, spine, and pelvis angles and hip internal rotation angles in degrees during asymmetric lifting task.

control group of 9 healthy individuals (H). Vicon 3-D kinematic motion capture was used to track movement as well as the thorax-hip, thorax-pelvic, and pelvic-hip angles, which were analyzed from the point of lift, point of set, and the changes from lift to set (RoM). The subjects stood on force plates which recorded the ground-reaction-force data during the test. Subjects lifted a box that was positioned directly in front of them at an elevation of 0.20m to a 1m high shelf on a single side. Three trials were completed on each side and data were grouped by lift direction on the radicular pain (RP) and non-radicular pain (NRP) side. Comparisons were made using paired and unpaired t-tests.

## RESULTS AND DISCUSSION

LD patients showed significantly slower lift-to-set time when lifting to their RP side compared to their NRP side (RP: 2.5 vs. NRP: 2.2s,  $p=0.005$ ) and to H (1.6s,  $p<0.001$ ). Hip flexion was significantly lower at lift when lifting to their RP side compared to their NRP side (RP:  $77.8^\circ$  vs. NRP:  $81.0^\circ$ ,  $p=0.054$ ). Significantly higher ground-reaction-forces were found during setting to the RP side compared to the NRP side ( $p=0.027$ ). Results also showed that LD patients alter their spinopelvic-hip relationship during asymmetric lifting and perform differently when lifting to their RP side. During the setting phase of the lift, the pelvis-hip angle ratio (NRP: 3.66 vs. RP: 2.60 vs. H: 0.41) and Thorax-hip (NRP: 5.40 vs. RP: 3.23 vs. H: 0.32) angle ratios showed an increase compared to H. There was a consistent trend for increased thorax, pelvis, and hip rotation when lifting to the RP side, resulting in a smaller pelvis-hip motion ratio (NRP: 1.62 vs. RP: 1.38 vs. H: 3.19,  $p<0.017$ ) and Thorax-hip (NRP: 2.38 vs. RP: 2.06 vs. H: 4.32,  $p<0.024$ ) RoM ratios than H. Moreover, there was a trend of greater thorax axial rotation (RP:  $31.8^\circ$  vs. NRP:  $28.2^\circ$ ). These ratios indicate that LD patients are rotating their entire torso to avoid twisting at the lumbar spine when they perform unilateral lifting activities.

## SIGNIFICANCE

The results of this study showed that LD patients are shielding themselves from pain by decreasing lumbar rotation, shifting their weight to the lifting leg, and taking more time to perform the lifting activity. Furthermore, hip flexion was decreased in LD patients, putting more strain on the back during weight loading. These aspects of lifting style serve to destabilize the LD patient during lifting tasks.

With increased destabilization and more strain on their backs, LD patients are at an increased risk for causing further damage to their spine when performing lifting activities. These damages can be debilitating, rendering LD patients unable to work, increasing the incidence of occupational leave. LD patients should be informed of these risks associated with their condition in order to protect against further injury.