# RELATIONSHIP BETWEEN CHRONIC MECHNICAL LOW BACK PAIN AND HIP ROTATION

M. D.Mohamed, Gh. M. Koura, Al. A.Balbaa , Sh. A.Khaled

**Abstract**—Chronic mechanical low back pain (CMLBP) is the most common complaint of the working-age population. The purpose of this study was to investigate if there a relationship between chronic mechanical low back pain( CMLBP) and hip medial and lateral rotation (peak torque and Range of motion(ROM) in patients with CMLBP.SUBJECTS AND METHODS , sixty patients with CMLBP Visual Analogue Scale (VAS) was used to assess pain . Fluid Filled Inclinometer was used to measure Hip rotation ROM (medial and lateral). Isokinetic Dynamometer was used to measure peak torque of hip rotators muscles (medial and lateral), concentric peak torque with low Isokinetic speed (60°/sec ) was selected to measure peak torque .RESULTS, The results of this study demonstrated that there is poor relationship between pain and hip external rotation ROM, also there is poor relation between pain and hip internal rotation ROM. There is poor relation between pain and hip internal rotators peak torque and hip external rotators peak torque .CONCLUSIONS: SO, depending on the current study it is not recommended to give an importance to hip rotation in treating Chronic Mechanical Low Back Pain .

*Keywords—Hip rotation ROM, Hip rotators strength, Low Back Pain.*

## I. INTRODUCTION

Mechanical Low Back Pain (MLBP) is a major cause of illness and disability, especially in people of working age. By definition, it excludes pain resulting from neoplasia, fracture or inflammatory arthropathy, or that is referred from anatomical sites outside the spine, and in most cases there is no clearly demonstrable underlying pathology [11].

However, when defined by symptoms alone mechanical LBP may not be etiologically homogeneous. Although the pathogenesis is generally unclear, structural abnormalities of the spine do account for the symptom in some cases. It could be, for example, that for LBP associated with identifiable underlying spinal pathology, physical risk factors are relatively more important, while psychological risk factors have less impact [1].

This type of pain is often due to stress or strain to the back muscles; tendons, and ligaments and is usually attributed to strenuous daily activities, heavy lifting, or prolonged standing or sitting. Mechanical low back pain is often a chronic, dull, aching pain of varying intensity that affects the lower spine and might spread to the buttocks. The pain often progressively worsens during the day because of daily physical activities such as bending, twisting, and lifting. Prolonged sitting and standing often aggravate the pain. There are no associated neurological symptoms or signs [9].

The hip joint serves as a central pivot point for the body as a whole. This large ball-and socket joint allows simultaneous, triplanar movements of the femur relative to the pelvis, as well as the trunk and pelvis relative to the femur. Lifting the foot off the ground, reaching towards the floor, or rapidly rotating the trunk and pelvis while supporting the body over one limb typically demands strong and specific activation of the hips' surrounding musculature [10]. Pathology that affects the strength, control, or extensibility of the hip muscles can significantly disrupt the fluidity, comfort, and metabolic efficiency of many routine movements involving both functional and recreational activities [10].

Physical therapy diagnosis related to the hip and adjacent regions often requires a solid understanding of the actions of the surrounding muscles. This knowledge is instrumental in identifying when a specific muscle or muscle group is weak, painful, dominant, or tight (ie, lacks the extensibility to permit normal range of motion). Depending on the particular muscle, any one of these conditions can significantly affect the alignment across the lumbar spine, pelvis, and femur, ultimately affecting the alignment throughout the entire lower limb [10].

Because of the anatomic proximity and interconnections of the hip joint and lumbopelvic region, , a number of investigators have focused on the relationship between hip mobility and low back pain (LBP) [4,8,15].The interest in the hip-LBP relationship is based on the proposal that limited hip motion will be compensated by motion in the lumbopelvic region. The proposed result is (1) an increase in the frequency of lumbopelvic motion with hip motion, (2) low magnitude loading in the lumbar region, (3) accumulation of tissue stress, and eventually (4) LBP symptoms [16,17].

There have been a growing number of studies that suggest that asymmetryin hip rotation, where external rotation (ER) exceeds internal rotation (IR) or where IR exceeds ER are related to a number of different lower extremity musculoskeletal problems that clinicians often see [4].

Hip rotation asymmetry is often found in many different musculoskeletal conditions that affect the low back, hip, and knee [5]

The results of their study lend further support to the importance of

MA. D. Mohamed is with Department of Physical Therapy For Muscloskeletal Disorders And Their Surgery, Faculty of Physical Therapy, Cairo University,(dr.mahmoud_diab@yahoo.com)
Gh. M. Koura is with Department of Physical Therapy For Muscloskeletal Disorders And Their Surgery, Faculty of Physical Therapy, Cairo University, (ghada.koura@cu.edu.eg) SH.A.Khaled is with Department of orthopedics ,Faculty of medicine, Cairo University, (sherifakhaled@yahoo.com)

assessing hip rotation asymmetry when treating patients with low back, hip, or knee Pain[4].

To our knowledge, the relationship between MLBP assessed by VAS and peak torque of hip rotators assessed by Isokinetic dynamometer up till now has not been examined in people with mechanical LBP.

*Aim of the study:*

The purpose of this study is to detect if there is a relationship between mechanical low back pain and torque of hip lateral and medial rotators and to detect if there is a relationship between mechanical low back pain and ROM of hip lateral and medial rotation.

## II. Materials and Methods:

*Subjects:*

The study was conducted on 60 patients (53male and 7 female) referred from an orthopedist with the diagnosis of mechanical low back pain, their age ranged from 20-30 years with mean of age (23.76±2.39) years, mean weight (71.8±12.7) (Kg), mean height (169.65±7.49) (Cm) and mean BMI (25.5±3.86) (Kg/m2). We measured muscle torque by isokinetic dynamometer.

Subjects were included in this study if they suffer from mechanical low back pain, their age ranged from 20 to 30 years and their pain from at least three months ago. All subjects were asked to assign a consent form approved from ethical committee of faculty of physical therapy of Cairo university. This study was conducted in the lab of isokinetic of the faculty of physical therapy, Cairo University.

Patients were excluded if they had one of the following: lumber disc prolapsed, lumber spondylosis, Spinal stenosis, sponylolisthesis, spondylolysis, ankylosing spondylitis and Spinal instability lower limb injury (surgery or leg-length discrepancy), knee or hip osteoarthritis fracture of vertebral column or history of spinal surgery kyphosis or scoliosis, Rheumatoid arthritis.and sacroiliac joint dysfunction.

Our patients were at working age, some of them were office worker, some were graduated students of physical therapy at training year and others were workers.

*Instrumentations:*

Biodex system 3 isokinetic dynamometer

(Biodex Medical Systems, Shirley, New York, USA)

The apparatus consists of a dynamometer, a chair, and a control panel .

The position of the dynamometer can be controlled; it can be rotated horizontally, tilted and its height can be adjusted according to the test or rehabilitation procedure as described by the manufacturer's guide. Similarly, the chair position and height can be adjusted. The position and the tilting of the back seat can also be controlled.

The dynamometer can be controlled through the control panel or the computer software (Biodex Advantage Software). Using the panel control, the operator should set the mode (isokinetic, passive, isotonic concentric or eccentric) and the range of motion. Using the computer program, patient's data are first entered, and then the testing or rehabilitation protocol and range of motion are set. A report can be obtained, saved and printed out if desired. The main outcomes documented are: the peak torque, the average peak torque, total work, average power, and agonist/antagonist ratio.

2. The Fluid Filled Inclinometer

3.Scale for measuring pain intensity (Appendix II).

Pain intensity was measured by means of visual analogue scale (VAS)( Fig 3). A 10 cm line marked with numbers 0 to 10 was used where 0 symbolized no pain and 10 was maximum pain. Patient asked to mark this pain on this line as per the severity.

*Evaluation procedure*

Patients had received full explanation of assessment and treatment procedures, and all procedure was performed after they signed written informed consent form.

*Hip medial and lateral rotators torque assessment:*

All patients were assessed bilateral hip external and internal rotators torque using an isokinetic dynamometer (Biodex Medical Systems 3). All strength testing were performed at 60º/sec (low speed). Calibration of the dynamometer was carried out before the measurements. Before testing, participants were provided with detailed instructions for the strength testing procedures. Five maximal repetitions for hip external and internal rotation were performed for each strength test

A protocol ( hip external and internal rotators)for testing was set and saved on the software of the isokinetic apparatus prior to the study, unilateral isokinetic mode, contraction type(concentric/concentric), 60º/sec velocity. .

The patient's weight and height were measured and recorded. Patient's personal data were entered to the "patient" section of the software and saved.

The positions of the seat and the dynamometer was adjusted for measuring hip joint for rotators. Dynamometer orientation 0º, dynamometer tilt 0°, seat orientation 90°, and seatback tilt 85º. The attachment of the hip (of the involved side) was attached to the dynamometer (Biodex system 3 pro manual).

The patient sat on the chair of the apparatus with the hip and knee flexed to 90° (fig. 1), the axis of rotation for the dynamometer was aligned with the long axis of the femur, and the seat height and position will be adjusted for accurate alignment.

The hip attachment was adjusted to be proximal to the patient's lateral malleolus then secured by its strap. Shoulder and thigh stabilization straps were fastened (Biodex system 3 pro manual).

The dynamometer ROM was set, with 30ºexternal rotation away (Fig 1) and 30º internal toward (Fig 2). (concentric away and concentric toward), the anatomical position of the patient was calibrated, and the patient's limb weight was measured, neutral position was used as starting position. After two trial repetitions, the test was conducted.

The patient was verbally encouraged to maintain muscle contraction through the seated ROM, patients taking visual and auditory feedback from apparatus, and not stop the movement (if patient movement stops, resistance stops) using verbal command as push.

The patient performed 5 repetitions of concentric contraction (medial and lateral hip rotation).The largest number of (peak torque) readings will be documented and was used in comparison between variables. All peak torque data (Nm) was normalized to body mass index (Nm/kg/m2).

Fig.(1) Hip rotation strength test for RT hip internal rotators test


Fig .(2)Hip rotation strength test for RT hip external rotators test

2. Procedure of measurement of hip rotation ROM:

All subjects were required to wear non restrictiveclothes and, prior to the test the joint was moved through its full range of motion. Measurements were taken place with the subject in the prone position chosen rather than supine as it has been shown to be more reliable. The participant's arms were positioned at his sides and his head was turned to the side that was most comfortable (Fig7).

In order to localize the measure to the hip joint the pelvis wasstabilized with a belt at the level of the posterior inferior iliac spines. The measured hip was placed in 0 degree of abduction and knee flexed to 90(fig.3). The contra lateral hip was abducted to 30 degree (Fig 4).


Fig. (3): Starting position for RT hip rotation ROM measurement

To familiarize the participant with the procedures and to assure them that the lower extremity movements were free, the lower extremity to be tested was passively moved once into medial rotation and once into lateral rotation.

The start position for testing passive hip rotation then was achieved by positioning the tibia plateau of the tested leg parallel to the support surface. After zeroing the inclinometer to a fixed vertical reference, the Inclinometer was positioned just below lateral malleolus and the starting position was measured. The leg was then passively moved to produce medial (Fig.3) and lateral (Fig.4)rotation with the range of movement (ROM) being recorded to the nearest degree at the point of resistance.


Fig.(4) End position of RT hip external rotation ROM measurement

Final passive ROM was decided when resistance was met or compensatory movement at the pelvis became evident.ROM was obtained for both right and left. Passive range of motion was calculated as the difference between the final and initial position of the lower leg average the across the three trials. The first limb to be tested and the direction of rotation (medial, lateral)

Total medial and lateral hip rotation was defined as the sum of both left and right measurement. Three measurements were taken for each maneuver and a mean was obtained.

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## III. Results

In this study, 60 patients with mechanical low back pain were participated in this study. The data in table (1) represented their mean age (23.76±2.39) years, mean weight (71.8±12.7) kilograms (Kg), mean height (169.65±7.49) (Cm) and mean BMI (25.5±3.86) (Kg/m2).

Table (1): Physical characteristics of patients

| Items | Mean | ±SD |
|---|---|---|
| Age (yrs) | 23.76 | ±2.39 |
| Weight (Kg) | 71.8 | ±12.7 |
| Height (Cm) | 169.65 | ±7.49 |
| BMI (Kg/m2) | 25.5 | ±3.86 |

We compare between both variables ( internal and external muscle peak torque) using mean values and then we use paired t-test to assess the significance of difference between variables and we used person correlation coefficient to relate between variables.

1. Pain intensity (VAS) and total hip internal rotation ROM:

There was no significant correlation between Pain intensity (VAS) and Total hip internal rotation ROM as shown in Table (2).

Table (2): Correlation Analysis between (VAS) and ROM.

| correlation coefficient | |
|---|---|
| R-value | -0.05 |
| P-value | 0.68 |

*R-value: correlation coefficient, P-value: probability.

2. Pain intensity (VAS) and total hip external rotation ROM:

There was no significant correlation between Pain intensity (VAS) and Total hip external rotation ROM as shown in Table (3) .

Table (3): Correlation Analysis between (VAS) and ROM.

| correlation coefficient | |
|---|---|
| R-value | -0.07 |
| P- value | 0.57 |

3.pain intensity (VAS) and l total hip internal rotation torque/ BMI:

There was no significant correlation between Pain intensity (VAS) and Low speed total hip internal rotation torque as shown in Table (4) .

Table (4): Correlation Analysis between (VAS) and torque/BMI.

| correlation coefficient | |
|---|---|
| R-value | -0.03 |
| P-value | 0.76 |

4.Pain intensity (VAS) total hip external rotation torque/ BMI:

There was no significant correlation between Pain intensity (VAS) and Low speed total hip external rotation torque as shown in Table (5) .

Table (5): Correlation Analysis between (VAS) and torque/BMI.

| correlation coefficient | |
|---|---|
| R-value | -0.02 |
| P-value | 0.86 |

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## IV.Discussion

Chronic mechanical low back pain (CMLBP) is the most common complaint of the working-age population. In addition to human suffering, it causes a substantial economic burden due to the wide use of medical services and absence from work. Imbalance between hip internal and external rotators muscles may be a contributing factor for low back pain.

We summed right and left rotation ROM to be the total rotation ROM and total rotation peak torque equals the sum of both RT and LT Rotation peak torque. This procedure similar to reference [5,15].

*1.Relationship between CMLBP and hip rotation ROM*

Statistical analysis revealed that there was poor inverse correlation between pain intensity and total hip internal rotation ROM and there was poor inverse correlation between pain intensity (VAS) and total hip external ROM.

Those results were in agreement with reference [14]which found that there was no relationship between low back pain and movement of the hip in horizontal plane. It could be due to twisting movement in trunk mainly achieved by movements of the hips with small amount of movement of the lumbar spine

Our finding agree with reference [8] which examined hip mobility in 476 patients with recurrent LBP and stated that there is no significant correlation between LBP and hip external oration ROM, but his results revealed significant negative relation between LBP and hip internal rotation and this results against our finding ,It may be due to Clinical characteristics of his participants were different as mean age of his participants was 44 years old which higher than our participants which was 23 years and that might be related to the severity or progression of LBP.

In reference [5] who examined patients with unspecified LBP and concluded a significant relationship between low back pain and limited hip rotation ROM .Their results could not be compared with ours since the clinical characteristics of their subjects were different from ours .As he selected the patients with canal stenosis and disc herniation and sacroiliac dysfunction with age ranged from 23 to 61 years whom we excluded in our study.

Also, reference [15] investigated the relationship between LBP and passive hip rotation motion in forty-eight subjects (35 males, 13 females) .The results is in contradiction with the result of our study and it may be due to the clinical history and characteristics of the subjects included in the study, the participants reported regular participation in a sport that placed repetitive rotational demands on the hip and the lumbopelvic region.

*2. Relatioship between CMLBP and hip rotators torque .*

Statistical analysis revealed that there was poor inverse correlation between pain intensity and low speed total hip internal rotators peak torque, and there was poor inverse correlation between pain intensity and low speed total hip external rotators peak torque.
So the results revealed no relationship between pain and hip rotators peak torque (in both speeds of assessment) as those of previous finding between pain and ROM patient with CMLBP.It could be due to limited axial rotation of the spine by natural resistance ( stretched apophyseal joint capsule and annulus fibrosis ) which provides vertical stability throughout the lower end of the vertebral column. The well-developed lumbar multifidi muscles and relatively rigid sacroiliac joints reinforce this stability [10].

And as we mentioned before the poor relationship between peak torque /BMI and CMLBP could be due to small age of the patients and the lower need for greater hip rotation and it may get worth by aging.

We assessed the relationship between LBP and hip rotation ROM and peak torque by using 60 adult male and female patients suffering from MLBP and referred from an orthopedic surgeon and those were strong points in our study, We assessed the Rotation ROM using fluid filled inclinometer and the muscle torque by Isokinetic unit which are validated and reliable tools for assessment. And the points of weakness were that: this is only one group of assessment, lack of a clear way of randomization and most of the subjects were males.

## V. Conclusion

It was concluded that there is no relationship between low back pain and hip rotators ( peak torque and ROM) in patient with CMLBP .So when the age is small and the need to hip rotation is not higher (not athlete), the patient cannot feel the problem (MLBP) even it exists. So, we recommend caution that the problem doesn't found yet, but it may be exaggerate to patients by growing older or by progress of the conditions or both.

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