

## Assessment of Movement Control Impairment in Mechanical Low Back Pain Post Menopause

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### Abstract

**Background:** Chronic low back pain (CLBP) is the most disabling musculoskeletal disorder with altered functioning of the lumbar core muscles. Control impairment is the loss of the ability of the core muscles to prevent excessive movement that happens at the lumbar spine. Movement impairment and control impairment syndromes are present in CLBP.

**Aim of Study:** To determine the presence of movement control impairment (MVCI) in CLBP in post-menopausal period.

**Material and Methods:** The study conducted on thirty post-menopausal women with CLBP and control group thirty subjects without low back pain using inclinometer to measure the uncontrolled movement during active lumbar flexion and extension.

**Results:** Revealed statistically significant decrease in the movement control in both flexion and extension of the study group compared with that of the control group.

**Conclusion:** Increase in MVCI of both flexion and extension in post-menopausal women with CLBP compared with post-menopausal women without CLBP.

**Key Words:** *Movement control impairment – Low back pain – Post-menopausal period.*

### Introduction

LOW back pain (LBP) is a well-known medical conditional over the world. It is the primary reason for activity restrictions [1].

Non-specific LBP has become a major public health problem worldwide. The lifetime prevalence of LBP was reported to be as high as 84%, and the prevalence of CLBP is about 23%, with 11-12% of the population being disabled by LBP [2]. Patients

with recurrent and non-specific chronic low back pain (CLBP) present with several types of motor control impairments including: Altered muscle timing [3], changes in muscle quality, altered proprioception of trunk movements, and altered trunk stiffness [4]. The health care systems seek to diminish LBP prevalence by many ways including surgeries like osteotomies, internal fixations and discectomy, as well as physiotherapy rehabilitation like McKenzie approach [5], therapeutic modalities and the motor control approach [6].

However, in some cases, interventions that were successful in improving pain and function did not affect these motor control variables [7]. The success of these interventions in the absence of improvements in the above physiologic variables may be associated with the heterogeneous nature of LBP in which the treatment does not match the primary neuromuscular impairment or the specific facet of impaired motor control [8]. Motor control is fundamentally based on the idea that the stability and control of the spine are altered in people with LBP [9]. Physiological studies have demonstrated that patients with LBP may exhibit a delayed onset of activity of the deep trunk muscles when the stability of the spine challenged in dynamic tasks [10]. Moreover, it was found that patients with LBP tend to increase the spinal stiffness to compensate for the lack of stability from the deep muscles by increasing the activity of the superficial muscles [11].

Researches stated that muscle dysfunction in patients with LBP has led to impairments in deep muscles of the trunk and back. These muscles have a functional role in enhancing spinal segmental support and control. The muscle impairments are

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not those of strength but rather problems in motor [control](#) as a result clinical trials point to the effectiveness of the movement control approach in patients with both CLBP in terms of reducing the neuromuscular impairment and in control of pain [12].

The movement control involves performance of movement with optimal interaction between neuromuscular control (sensory feedback, central nervous system processing and motor coordination) and physiological stresses [13]. The action should be performed with appropriate intensity and timing, where the movement system requires coordination between different body systems including neural, myofascial, articular and connective tissue systems in addition to central nervous system, psychosocial and physiological factors. Any problem in one or more of those systems results in pain, dysfunction and compromised life activities [14]. Reduction of functional lumbar mobility and returning to daily living activities occur as a result of chronic LBP [15].

So, we assess whether movement is dissociated or coordinated between the lumbar spine and its adjacent regions [16].

### Material and Methods

#### Patients:

This study was conducted at out-patient clinic of Dar El Shefa Hospital, and patients were referred from outpatient clinic from orthopaedist with mechanical LBP.

The procedure of the test was described data collected at one shot, started on March 2021 ended on May 2021.

#### Patients:

- Group A (test group): Thirty post-menopausal patients diagnosed and referred to physical therapy as mechanical LBP included after signing a consent form.
- Group B (control group): Thirty post-menopausal subjects without LBP.

#### Inclusion criteria:

Patients having the following criteria were included in this study.

- 1- Post-menopausal women aged from 50-60 years old.
- 2- Their Body mass index between 30-35.
- 3- Patients with non-restricted (normal) range of motion 60 degree for lumbar flexion and 25 with lumbar extension.

- 4- Chronic pain (more than six months) with pain at least VAS 3 or more.
- 5- Pain primarily in the lower back symptoms increases with flexion of the back and when lifting heavy objects.

*Exclusion criteria:* Patients were excluded for any of the following reasons:

- 1- Previous trauma for one year ago, fractures or surgery of the back.
- 2- Malignancy of the back.
- 3- Rheumatoid arthritis.
- 4- Spondylolisthesis.
- 5- History of lower extremity injury within 6 months prior to the study.
- 6- Pregnancy.

All assessment procedures were instructed for each woman participating in this study to gain their cooperation.

#### Design:

The design of this study was a matched group case control design. When the patient met the inclusion and exclusion criteria, the purposes of the research were explained to the participants then some documents were taken include demographic data of the patient, weight, height, history of menopause, history of LBP.

#### 1- Weight-height scale:

It was used to measure weight and height for each woman in both groups (A&B) to measure BMI at starting of this study.



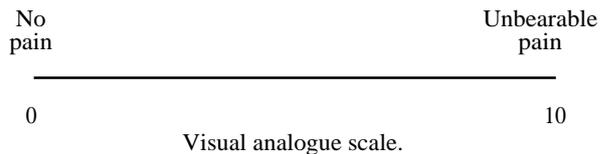
Weight and height scale.

## 2- Visual analogue scale:

The visual analogue scale (VAS) is a pain rating scale [17].

Visual analogue scale

0.10 VAS Numeric Pain Distress Scale



[18] that scores are based on self-reported measures of symptoms that are recorded with a single handwritten mark placed at one point along the length of a 10-cm line that represents a continuum between the two ends of the scale- "no pain" on the left end (0cm) of the scale and the "worst pain" on the right end of the scale (10cm) [19]. Stated that measurements from the starting point (left end) of the scale to the patients' marks are recorded in centimetres and are interpreted as their pain. The values can be used to track pain progression for a patient or to compare pain between patients with similar conditions.

## 3- Inclinometer:

The non-invasive inclinometer technique proved to be highly reliable and valid [20]. Inclinometers have dials or digital readouts that display the angle at which the inclinometer is situated relative to the line of gravity.

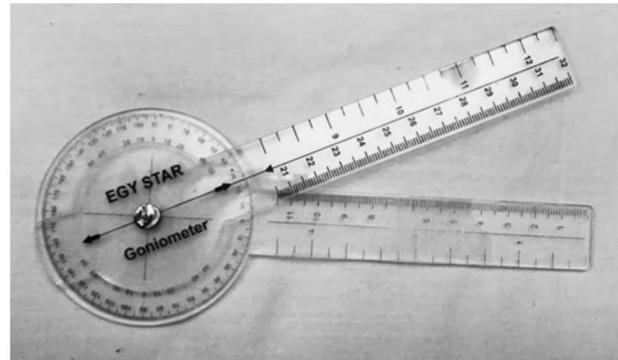


Baseline, China, 12-1056.

## 4- Goniometer:

A goniometer is a device that has two "arms" one is stationary, and one is movable that are hinged together. Each is positioned at specific points on

the body with the centre of the goniometer aligned at the joint of interest. Hash marks on the hinge allow the therapist to precisely measure ROM in degrees [21].



Goniometer.

### Procedure:

- Each subject answered the data recording sheet, their body mass index was calculated then each patient was instructed to stand erect in neutral position is the feet in a natural stance [22]. (Fig. 1 A).
- The upper edge of the sacrum and the lower edge of the T12 vertebra was palpated in patients in a standing position and labelled by a marker [23]. (Fig. 1B).
- Iliac crest was also palpated and labelled by a marker. (Fig. 1 C).
- Goniometer was fixed on an adjustable up and down stand to set normal movement angle its level adjusted according the height of each patient's iliac crest. (Fig. 1D).
- Inclinometer was placed on the level of S1-2 [23]. (Fig. 1E).
- For assessment of movement control impairment in flexion patient was asked to bend forward in a normal relaxed pattern.
- The angle at which the lumbar flex before the normal was recorded. (Fig. 1F).
- That procedure was repeated in the assessment of movement control impairment in extension in which the patient is asked to bend backward in a normal relaxed pattern then the angle at which lumbar extend before the normal 60 for flexion and 25 for extension was recorded [24]. (Fig. 1G).
- Then data was recorded where the procedure was done for women with LBP in menopause and women without LBP in menopause.



Fig. (1A): Patient stood in erect position with both feet in a natural stance.



Fig. (1B): T12 vertebra was palpated in patients in a standing position and labelled by a marker.



Fig. (1C): Iliac crest was labelled by a marker in a side standing position.



Fig. (1D): Goniometer was fixed on an adjustable up and down stand to set normal movement angle its level adjusted according the height of each patient's iliac crest.



Fig. (1E): Inclinometer was placed on the level of S1-2.



Fig. (1F.): The angle at which the lumbar flex before the normal was recorded.



Fig. (1G): The angle at which the lumbar extend before the normal was recorded.

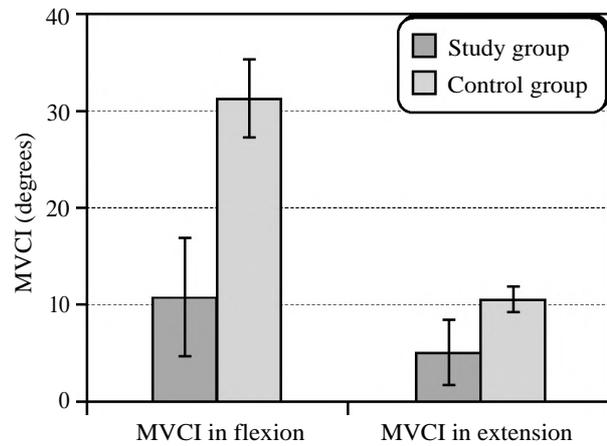


Fig. (2): Mean MVCI in flexion and extension of the study and control group.

**Statistical analysis:**

Unpaired *t*-test was conducted for comparison of age between groups. Normal distribution of data was checked using the Shapiro-Wilk test. Levene's test for homogeneity of variances was conducted to ensure the homogeneity between groups. MVCI in flexion and extension of lumbar spine were compared between groups by unpaired *t*-test. The level of significance for all statistical tests was set at  $p < 0.05$ . All statistical measures were performed through the statistical package for social sciences (SPSS) version 25 for windows.

**Results**

**Subject characteristics:**

Thirty post-menopausal women with mechanical LBP (study group) and thirty post-menopausal women without LBP (control group) participated in this study. The mean  $\pm$  SD age of the study and control groups were  $56 \pm 3.3$  and  $55.53 \pm 3.4$  years respectively. There was no significant difference between groups in the mean age values ( $p > 0.05$ ).

**Effect of LBP on MVCI in flexion and extension of lumbar spine:**

There was a significant increase in the MVCI in flexion and extension of the study group compared with that of the control group ( $p < 0.001$ ) (Table 1 & Fig. 2).

Table (1): Mean MVCI in flexion and extension of the study and control groups.

MVCI (degrees)	Study group Mean $\pm$ SD	Control group Mean $\pm$ SD	MD	<i>t</i> -value	<i>p</i> -value
MVCI in flexion	10.66 $\pm$ 6.05	31.2 $\pm$ 3.96	-20.54	-15.53	0.001
MVCI in extension	5.1 $\pm$ 3.41	10.56 $\pm$ 1.3	-5.46	-8.18	0.001

SD : Standard deviation. MD: Mean difference. *p*-value: Probability value.

**Discussion**

There is statistically significant decrease in MVC in both flexion and extension of the study group compared to the controlled group. No previous studies assessed the MVC in post-menopausal women with mechanical LBP, up to our knowledge, in order to directly compare with but there were other studies examined effect of MVC in mechanical LBP only regardless the menopausal effect on the movement components.

There is considerable evidence for changes in muscle activation and muscle morphology in individuals with a history of LBP, but the observations vary. Several features may account for this variation in findings. First, the trunk system is highly redundant, with many options available to achieve a similar objective, and different individuals may adopt different solutions for the same outcome [25]. Second, changes may depend on the specific muscles investigated; deeper muscles, appear more consistently inhibited [26], whereas changes in the larger, more superficial muscles are more variable, though activity is often increased [11]. Third, differences in motor control may depend on the tasks and contexts investigated.

The movement control impairment (MVCI) leads to increased loading and pain [27]. MVCI is not identified by noting hypermobile ROM or relative flexibility. Furthermore, MVCI is not identified by habitual postures or initiation of function with movement at one segment [28]. MVCI is identified by a lack of the ability to actively control or prevent movement (or lack of ability to learn how to control movement) in a particular direction at a particular joint or motion segment. The MVCI can be identified in the presence or in the absence of a symptomatic episode. It is independent of hypermobile or hypomobile range of

motion [29]. That is, some people may demonstrate MVCI even in situations of reduced functional range, while other people with hypermobile ROM may demonstrate good active control of their excessive ROM. The presence of MVCI is a powerful indicator of symptomatic function associated with recurrence and chronicity of musculoskeletal pain [30].

Patients with MVCI tend to experience pain during motor tasks that load the spine mainly in one plane of space. They performed it with unconscious compensation strategies or with the changes of postures with typical patterns. These patients are categorized according to the type of posture and the direction of provocative movement (e.g., flexion pattern and extension pattern) [31].

Oestrogens participate in a variety of biological processes through different molecular mechanisms also play an important role in the aetiology and pathophysiology of a variety of musculoskeletal degenerative diseases [32]. A number of reports suggest that women have higher prevalence of LBP than men.

Oestrogen also acts as a regulator of muscle energy metabolism and muscle cell viability. Menopause leads to the cessation of ovarian oestrogen production concurrent to the deterioration of muscle function, diminution of muscle strength [33].

It had been showed that genetics also plays a role in the development of LBP [34]. Postmenopausal women also show higher osteoporosis related spine fracture rate, particularly at the thoracolumbar junction site. That explain low back pain (LBP) is more prevalent in postmenopausal women than age-matched men and is associated with the physiological changes caused by the relatively lower level of sex hormones after menopause in women [35].

#### *Limitation of the study:*

It was observed that MVCI may be influenced by other factors that are not directly associated with LBP such as spinal, pelvis and lower extremity malalignment which were not quantified in this study. Also, previous surgery as hysterectomy or caesarean section that led to poor mechanics causing LBP.

#### *Conclusion:*

In regard to the findings of our study there is significant increase in control MVCI of both flexion and extension in post-menopausal women with LBP compared with post-menopausal women without LBP.

#### *Conflict of interest:*

The authors have no conflicts of interest to declare.

All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

#### *Acknowledgment:*

I owe a great thanks for all the patients for their participation and co-operation in this study.

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## تقييم اعتلال التحكم الحركي في حالات آلام أسفل الظهر الميكانيكية في فترة ما بعد انقطاع الطمث

تمت دراسة تأثير سن اليأس على التحكم الحركي وضعفه في حالات آلام أسفل الظهر المزمنة.

تم إجراء التقييم عن طريق مقياس الميل الأساسي الذي يقيس الحركة غير المنضبطة في كل من ثني الفقرات القطنية وتمدها في النساء بعد انقطاع الطمث المصابات بالآلام أسفل الظهر كمجموعة دراسة وكذلك النساء بعد سن اليأس دون آلام أسفل الظهر المزمنة كمجموعة تحكم.

كانت النتيجة أن هناك فرقاً كبيراً في ضعف كل من انثناء وتمديد العمود الفقري القطني لدى النساء بعد انقطاع الطمث اللاتي يعانين من آلام أسفل الظهر المزمنة مقارنة بأولئك الذين لا يعانون من آلام أسفل الظهر.

وأيضاً وجد أن الألم يؤثر على التحكم الحركي ويؤدي إلى ضعف في التحكم الحركي في كلا المجموعتين بالإضافة إلى تأثير انقطاع الطمث الذي يسبب انخفاض فسيولوجي في مستويات هرمون الاستروجين التي تؤثر بشكل غير مباشر على التحكم في المحرك وتؤدي إلى ضعفها.