

Effect of L4 Mobilization and Posterior Pelvic Tilting Exercise on Sciatica in Patients with Spondylolisthesis

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Abstract

Background: Sciatica due to lumbar spondylolisthesis is an important medical and socioeconomic problem that affects the quality of life. The most important symptom is radiating leg pain.

Aim of Study: The current study was conducted to determine the effect of L4 mobilization and posterior pelvic tilting exercise on sciatica in spondylolisthesis.

Material and Methods: This study was conducted on sixty female patients with unilateral sciatica. Their ages ranged from 45 to 65 years. They were randomly assigned into four equal groups: Group (A): Received a designed physical therapy program (ultrasound and transcutaneous electrical stimulation). Group (B): Received designed physical therapy as (group A) in addition to doing posterior pelvic tilting exercises. Group (C): Received designed physical therapy as (group A) in addition to receiving lumbar mobilizations on L4 vertebra. Group (D): Received designed physical therapy as (group A) in addition to combination between lumbar spine mobilizations on L4 and posterior pelvic tilting exercises. Each patient in the four groups was evaluated by visual analogue scale to assess pain, lumbosacral X-ray to assess spondylolisthesis and Roland Morris Disability Questionnaire to evaluate the patient's functional disability before and after four weeks of treatment.

Results: Group (A) showed a significant decrease in sciatic scale by 6.29% and RDQ by 9.09%. Group (B) showed a significant decrease in sciatic scale by 27.77% and RDQ by 38.94%. Group (C) showed a significant decrease in sciatic scale by 11.81% and RDQ by 20.65%. Group (D) showed a significant decrease in sciatic scale by 46.31% and RDQ by 54.88%.

Conclusion: L4 mobilization and posterior pelvic tilting exercise has a significant effect in improving back function and sciatica.

Key Words: Sciatica – Spondylolisthesis – L4 mobilization – Posterior pelvic tilting exercise.

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Introduction

SPONDYLOLISTHESIS is a clinical ortho-neurological disorder involving slippage of one vertebral body over another, usually resulting in low back pain (LBP). Forward slippage of a vertebra is termed anterolisthesis while backward slippage is referred to as retrolisthesis. This occurs in the lumbar column as a result of a defect in bone architecture, trauma, and degenerative process. Spondylolisthesis are more common in elderly patients. Break out of such injury in aged individuals is more than that in other age groups. Wilts classified spondylolisthesis to six types based on etiology: (Dysplastic, isthmic, degenerative, traumatic, pathologic, and iatrogenic). Also classified by Meyerding according to the degree of slippage: (Grade 1: 0-25%, Grade 2: 26-50%, Grade 3: 51-75%, Grade 4: 76-100%, Grade 5: over 100%) [1,2,3].

Patients with spondylolisthesis suffer from pain, bowel and bladder dysfunction can occur with significant progression of the vertebral slippage, tightness of the hamstring is present in 80% of symptomatic patients. Pain in the buttock radiating into the posterior thighs is common during walking or standing it terms as sciatica. Sciatica describes the symptoms of sciatic nerve pain radiating and paresthesia from lower back down to the posterior leg [4,5].

Over the past decade, pelvis morphology has been shown to significantly influence spino-pelvic balance of the human trunk in normal and pathological conditions. The restoration of spino-pelvic balance is an important factor in treatment of spondylolisthesis. The treatment for spondylolisthe-

sis usually is focused on pain relief, muscle strengthening, and restoration of the range of lumbar mobility. Achieving these objects allows the patient to return to normal activity without any type of restrictions [6,7].

Studies have found that lumbar mobilization using Maitland technique, relieves pain and normalizes function. Posterior-to-anterior (PA) is rhythmical oscillatory low-velocity movements applied by the therapist's hands to a spinal segment within or at the limit of joint range. Posterior tilting of the pelvis has been recommended as an exercise for relief of LBP [8,9,10].

This study was designed to determine the effect of L4 mobilization and posterior pelvic tilting exercise on sciatica in spondylolisthesis.

Material and Methods

A randomized controlled trial (RCT) included sixty female patients with L5/S1 spondylolisthesis and unilateral sciatica. Patients were selected from the Police Hospital Nasr City Neurological Department outpatient clinic during the period from October 2018 to December 2019. The patients were diagnosed as having L5/S1 spondylolisthesis grade 1 based on careful clinical assessment by a neurologist and radiological investigations including X-ray of the lumbar spine. The Ethical Committee of Faculty of Physical Therapy of Cairo University approved the study.

We included patients were diagnosed as having L5/S1 spondylolisthesis grade 1 based on radiological investigations including X-ray of the lumbar spine with unilateral sciatica, Patients' age ranged from 45-65 years, Patients were ambulant with or without aids and their body mass index (BMI) was ranged from 25-30. Pregnant females, patients with tumors (spinal tumors), spinal fracture, previous spinal surgery, epileptic patients, patients with severe or life threatening psychiatric illness and patients with any contraindication to exercise (uncontrolled hypertension, myocardial infarction) were been excluded.

All patients have done assessment before and post treatment by Lumbo-sacral X-ray, Roland Morris Disability Questionnaire and Modified Morris Disability Scale for sciatica.

- *Lumbo-sacral X-ray*: Used to determine the slippage of vertebra over lowered one in spondylolisthesis and to determine level and degree of spondylolisthesis. Patients did lateral view plain

X-ray of lumbar spine. Position of patient lying on left or right side with knees and hips flexed for comfort, the elbows are flexed and the arms are at right angle [11].

- *Roland Morris Disability Questionnaire and Modified Morris Disability Scale for sciatica*: provides a tool for measuring the level of disability and lumbar radiculopathy experienced by a person suffering from low back pain. It's a list containing 24 sentences that people have used to describe themselves when they have back and leg pain. Patients were sitting in a comfortable position. The scale was positioned in front of them. Patients were asked to read the list and to put a tick against what describes their pain or to leave the space blank and to go on to the next one if it does not describe it. The score of the (RDQ) is the total number of items checked from a minimum of 0 to a maximum of 24 [12,13,14].

Treatment protocol:

Patients were randomly assigned into four equal groups:

Group (A): Received a physical therapy program in the form of: Pulsed US (3MHz, 1W/cm²) on the paraspinal area of the lumbar region from a prone lying position with a pillow below his abdomen. Transmission gel was applied on the head of the US device before the application. TENS Stimulators: The active electrode was placed securely at the center of the painful area of the back, and the second electrode was placed on the posterior side of the affected leg. The frequency of the output was set at 4 to 8Hz, and the current intensity was raised up to the patient's tolerance [15].

Group (B): Received the same designed physical therapy program as group (A) in addition to performing individual strengthening exercises for the posterior pelvic tilt muscles (rectus abdominis, gluteus maximus, hamstring) from crock lying position with guidance from us.

Group (C): Received the same designed physical therapy program as group (A) in addition to Lumbar mobilization on L4 (upper level of lesion). Patient prone lying position and a pillow under her belly at the level of L5, the patient's arms and head were positioned for the most comfortable position. Posteroanterior mobilization grade 4 was applied by the ulnar edge of the therapist's hand between pisiform and hamate, staying on the spinous process of the vertebra to be mobilized.

Group (D): Received the same designed physical therapy as (group A) and received a combina-

tion between lumbar spine mobilizations on L4 and posterior pelvic exercises. The treatment was conducted three sessions per week (day after day) for four weeks. The duration of each session was 30 minutes.

Methods of statistical analysis:

Descriptive statistics and MANOVA-test were conducted for comparison of the mean age, weight, height and BMI between the four groups. MANOVA-test for comparison of pre and post treatment mean values of VAS, Sciatic scale and RDQ between groups. Paired *t*-test for comparison between pre and post treatment mean values of VAS, Sciatic scale and RDQ in each group. 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 studies (SPSS) version 25 for windows.

Results

The mean \pm SD sciatic scale of group A, B, C and D were 17 ± 3.33 , 16.06 ± 3.32 , 16.93 ± 3.17 and 16.13 ± 3.27 respectively. There was no significant difference in the sciatic scale between the four groups ($p=0.78$). While the mean \pm SD RDQ of group A, B, C and D were 17.6 ± 2.72 , 17.13 ± 3.02 , 16.8 ± 2.24 and 16.4 ± 2.77 respectively. There was no significant difference in the RDQ between the four groups ($p=0.66$). And post treatment the mean \pm SD sciatic scale of group A, B, C and D were 15.93 ± 3.4 , 11.6 ± 2.09 , 14.93 ± 2.15 and 8.66 ± 3.35 respectively. There was a significant difference in the sciatic scale between the four groups ($p=0.0001$). While the mean \pm SD RDQ of group A, B, C and D were 16 ± 3.11 , 10.46 ± 1.8 , 13.33 ± 1.91 and 7.4 ± 2.32 respectively. There was a significant difference in the RDQ between the four groups ($p=0.0001$).

Table (1): Comparison between pre and post treatment mean values of sciatic scale and RDQ of the four groups (A, B, C and D).

Scales	Sciatic scale				RDQ			
	X \pm SD				X \pm SD			
	Group A	Group B	Group C	Group D	Group A	Group B	Group C	Group D
Pre	17 \pm 3.33	16.06 \pm 3.32	16.93 \pm 3.17	7.26 \pm 1.09	17.6 \pm 2.72	17.13 \pm 3.02	16.8 \pm 2.24	16.13 \pm 3.27
Post	15.93 \pm 3.4	11.6 \pm 2.09	14.93 \pm 2.15	3.06 \pm 0.96	16 \pm 3.11	10.46 \pm 1.8	13.33 \pm 1.91	8.66 \pm 3.35
MD	1.07	4.46	2	4.2	1.6	6.67	3.47	7.47
% of change	6.29	27.77	11.81	57.85	9.09	38.94	20.65	46.31
<i>t</i> -value	5.17	10.82	3.2	16.03	5.52	12.75	5.85	10.72
<i>p</i> -value	0.0001	0.0001	0.006	0.0001	0.0001	0.0001	0.0001	0.0001
Sig	S	S	S	S	S	S	S	S

Table (2): Comparison of post treatment mean values of sciatic scale and RDQ between the four groups (A, B, C and D).

Scales	Multiple comparison (Tukey) Sciatic scale			Multiple comparison (Tukey) RDQ		
	MD	<i>p</i> -value	Sig.	MD	<i>p</i> -value	Sig.
Group A - Group B	4.33	0.001	S	5.54	0.0001	S
Group A - Group C	1	0.76	NS	2.67	0.01	S
Group A - Group D	7.27	0.0001	S	8.6	0.0001	S
Group B - Group C	-3.33	0.01	S	-2.87	0.008	S
Group B - Group D	2.94	0.03	S	3.06	0.004	S
Group C - Group D	6.27	0.0001	S	5.93	0.0001	S

X : Mean
SD: Standard deviation.

p-value: Probability value
MD: Mean difference.

S : Significant.
NS: Non significant.

Discussion

The results of the current study reviewed a statistically significant improvement in mean values of sciatica scale and RDQ in group (D), little improvement in sciatica scale and RDQ in group

(B), little improvement in RDQ only in group (C) and no improvement neither in sciatica scale nor in RDQ in group (A).

This indicate that maitland mobilizations and posterior pelvic tilting exercise increase lumbar

spine function and decreasing sciatic nerve leg radiation. Mobilization of the hypomobile vertebra upper vertebra of the affected one. Mobilization of L4 in patients with spondylolisthesis of L5-S 1 was improving the lumbar function and decreasing sciatic nerve radiation through posterior leg. And improving that by posterior pelvic tilting exercise.

Mobilization increase range of motion of hypomobile vertebrae and decrease sensitivity of neural elements. Oscillatory movements performed during mobilization are believed to produce mechanical effects, such as the realignment of collagen, increase in fiber glide, and the breakup of adhesions, which help to restore normal mobility. Mobilizations of the L4-L5 segment served to move the mechanical interface around the affected nerves that would serve to reduce inflammation and compression surrounding these neural structures. Central PA mobilization restoring the normal lordosis, so muscle activity is decreased and muscles are able to relax, thus decreasing pain and increasing ROM. This agreed with Sharma et al., 2015 [9], Olson 2015 [16], Khan et al., 2018 [17].

It was found a highly significant correlation in the change of pelvic inclination with that of lumbar lordosis. Posterior pelvic tilting exercise is decreasing the depth of lumbar curve so decreasing lumbar hyper-lordosis, decreasing compression on sciatic nerve and improving lumbar spine. After posterior pelvic tilting exercise, the pelvic tilt angles of the right and left sides recovered to within his normal ranges. This agreed with Yoo 2014 [18], Day et al., 1984 [19].

The study disagreed with Coulter et al., 2018 [20] who said that evidence to support mobilization interventions does not seem to be as strong as evidence to support manipulation intervention for chronic low back pain. Although there are several large studies on mobilization compared with active comparators for chronic low back pain, the majority did not show statistically significant differences in favor of mobilization interventions compared with other active comparators. The contradiction may be due to the duration and chronicity of the affection as the mobilization would be more effective in chronic patients. Also disagreed with Papastamos et al., [21] that found mobilization had no significant effect on bending stiffness or flexion and extension ROM. The contradiction may be due to using only central mobilization without exercise. And Puhl et al., [22] found that spinal mobilization is a Placebo effect.

The current study found effectiveness of posterior pelvic tilting exercise in contrast with Lindgren et al., [23] who did not find any improvement in 9 subjects with segmental dysfunction, following a treatment regimen focusing on strength of the abdominis and multifidi. The contradiction may be due to small number of patients in the study. Nourbakhsh, et al., [24] disagreed with this study by founding a large variation of pelvic morphology masks any difference in pelvic tilt between normal subjects and a group of low back pain. The contradiction may be due to different gender.

Conclusion:

On the basis of the present data, it is possible to conclude that: L4 mobilization and posterior pelvic tilting exercise has a significant effect in improving back and sciatica pain.

References

- 1- ANTONIO M.: Current concepts on the sagittal balance and classification of spondylolysis and spondylolisthesis. *Rev. Bras Ortop.*, 49 (1): 3-12, 2014.
- 2- ALAM M., BARI W. and OMAR S.: Incidence, diagnosis and management of adult cases presenting with symptomatic lumbar spondylolisthesis in a tertiary care hospital. *Int. J. Res. Med. Sci. Jan.*, 4 (1): 38-41, 2016.
- 3- LAYEGH M. and HEJAZIAN E.: Prevalence of spondylolysis and spondylolisthesis in patients afflicted with chronic back pain in Babol city, Iran, during 2012 and 2013. *Iran J. Neurosurg.*, 3 (1), 2017.
- 4- TSIRIKOS A. and GARRIDO E.: Spondylolysis and spondylolisthesis in children and adolescents. *The journal of Bone & Joint Surgery*, 92 (6), 2010.
- 5- VALAT P., GENEVAY S., MARTY M., ROZENBERG S. and KOES B.: Sciatica. *Best Pract Res. Clin. Rheumatol.*, 24 (2): 241-252, 2010.
- 6- LABELLE H., ROUSSOULY P., CHOPIN D., BERTHONNAUD E., HRESKO T. and O'BRIEN M.: Spino-pelvic alignment after surgical correction for developmental spondylolisthesis. *Eur. Spine J.*, 17: 1170-6, 2008.
- 7- GONZALEZ C., SUAREZ A., MARTÍNEZ E., De la PENA M., GONZÁLEZ R. and ATANASIO J.: Guidelines for treatment of degenerative lumbar spondylolisthesis. *Coluna/Columna*, 15 (3): 238-40, 2016.
- 8- EMMA G., SUZANNE J. and AREN A.: Learning Lumbar Spine Mobilization: The Effects of Frequency and Self-control of Feedback. *J. Orthop. Sport Phys. Ther.*, 42: 114-124, 2012.
- 9- SHARMA A., ALAHMARI K. and AHMED I.: Efficacy of manual therapy versus conventional physical therapy in chronic low back pain due to lumbar spondylosis. A Pilot Study. *Med. Sci.*, 3: 55-63, 2015.
- 10- SALVATORE J., BRENT S., KATHRYN J., ALESSANDRIA Y. and EDWARD F.: Low Back Pain Response to Pelvic Tilt Position: An Observational Study of Chiropractic Patients. *J. Chiropr. Med.*, 15 (1): 27-34, 2016.

- 11- IGBINEDION B. and AKHIGBE A.: Correlation of Radiographic findings in patients with Low Back Pain. *Niger Med. J.*, 52 (1): 28-34, 2011.
- 12- KIM M., GUILFOYLE M., SEELEY H. and LAING R.: A modified Roland-Morris disability scale for the assessment of sciatica. *Acta. Neurochir.*, 152: 1549-1553, 2010.
- 13- SENSKE J. and HARRIS M.: Initial validation of a modified version of the Roland-Morris Disability Questionnaire (RMDQ) in a general chronic pain population. *The Journal of Pain*, 14 (4), 2013.
- 14- STEVENS M., LIN C. and MAHER G.: The Roland Morris Disability Questionnaire. *Journal of physiotherapy*, 62 (2): 116, 2016.
- 15- ALYAZEDI F., KHAN S., AL GHAMDI A., AL-TORIRI N. and SHAMSI S.: Effect of Ultrasound and Exercise together and TENS alone in the Management of Chronic back pain. *IOSR Journal of Nursing and Health Science*, 4 (5): 110-114, 2015.
- 16- OLSON K.: Examination and treatment of lumbopelvic spine disorders. Chapter 4 in *Manual Physical Therapy of the Spine*. 2nd edition. W B Saunders Co., Pp. 93-197, 2015.
- 17- KHAN S., AL TORAIRI N. and SHAMSI S.: Comparative study of SNAGS and Maitland's mobilization in chronic low back pain. *European Journal of physical education and sport science*, 4 (12): 71-84, 2018.
- 18- YOO W.: Effect of the Individual Strengthening Exercises for Posterior Pelvic Tilt Muscles on Back Pain, Pelvic Angle, and Lumbar ROM of a LBP Patient with Excessive Lordosis: A Case Study. *J. Phys. Ther. Sci.*, 26 (2): 319-320, 2014.
- 19- DAY W., SMIDT L. and LEHMANN T.: Effect of pelvic tilt on standing posture. *Phys. Ther.*, 64: 510-516, 1984.
- 20- COULTER I., CRAWFORD C., HURWITZ E., VERNON H., KHORSAN R., BOOTH M. and HERMAN P.: Manipulation and mobilization for treating chronic low back pain: A systematic review and meta-analysis. *The Spine Journal*, 18: 866-879, 2018.
- 21- PAPASTAMOS N., PETTY N. and WILLIAMS J.: Changes in bending stiffness and lumbar spine range of movement following lumbar mobilization and manipulation. *Journal of Manipulative and Physiological Therapeutics*, 34 (1): 46-53, 2011.
- 22- PUHL A., REINHART J., ROK R. and INJEYAN S.: An Examination of the Observed Placebo Effect Associated with the Treatment of Low Back Pain - A Systematic Review. *Pain Research and Management*, 16 (1): 45-52, 2011.
- 23- LINDGREN A., SIHVONEN T., LEINO E., PITKANEN M. and MANNINEN H.: Exercise therapy effects on functional radiographic findings and segmental electromyographic activity in lumbar spine instability. *Arch. Phys. Med. Rehabil.*, 74: 933-934, 1993.
- 24- NOURBAKHS R., MOUSSAVI J. and SALAVATI M.: Effects of lifestyle and work related physical activity on the degree of lumbar lordosis and chronic low back pain in a middle east population. *Journal of spinal disorders*, 14 (4): 283-292, 2001.

تأثير تحريك الفقرات القطنية الرابعة وتمارين إمالة الحوض للخلف على عرق النسا في الانزلاق الفقري

خلفية البحث: يعد ألم العصب الوركي أو عرق النسا بسبب الانزلاق الفقري هو مشكلة طبية واجتماعية واقتصادية مهمة تؤثر على النشاط اليومي.

هدف الدراسة: أجريت الدراسة الحالية لتحديد أثر تحريك الفقرات القطنية الرابعة وتمارين إمالة الحوض على عرق النسا في الانزلاق الفقري.

الإجراءات: أجريت هذه الدراسة على ستين مريضة تعاني من عرق النسا من جانب واحد. تراوحت أعمارهم بين ٤٥ و ٦٥ سنة. تم تعيينهم بشكل عشوائي في أربع مجموعات متساوية: المجموعة (أ): برنامج العلاج الطبيعي المصمم (الموجات فوق الصوتية والتحفيز الكهربائي عبر الجلد). المجموعة (ب): تلقى العلاج الطبيعي المصمم نفسه (المجموعة أ) وقام بتمارين إمالة الحوض للخلف. المجموعة (ج) تلقت نفس العلاج الطبيعي المصمم (المجموعة أ) وتلقى تحريك للفقرات القطنية الرابعة. المجموعة (د): تلقت نفس العلاج الطبيعي المصمم مثل (المجموعة أ) وحصلت على تمارين إمالة الحوض للخلف وتحريك الفقرات القطنية الرابعة. تم تقييم كل مريض في المجموعات الأربع من خلال المقياس التماثلي البصري لتقييم الألم والأشعة السينية القطنية لتقييم الانزلاق الفقري واستبيان الإعاقة لرولان موريس لتقييم الإعاقة الوظيفية للمريض ومقياس الإعاقة لرولان موريس المعدل لتقييم عرق النسا قبل وبعد أربعة أسابيع من العلاج.

النتائج: أظهرت المجموعة (أ) انخفاضاً كبيراً في المقياس التماثلي البصري بنسبة ٧.٥١٪ ومقياس الورك بنسبة ٦.٢٩٪ واستبيان الإعاقة لرولان موريس بنسبة ٩.٠٩٪. أظهرت المجموعة (ب) انخفاضاً كبيراً في المقياس التماثلي البصري بنسبة ٣٣.٤٣٪ ومقياس الورك بنسبة ٢٧.٧٧٪ واستبيان رولان موريس للإعاقة بنسبة ٣٨.٩٤٪. أظهرت المجموعة (ج) انخفاضاً كبيراً في المقياس التماثلي البصري بنسبة ٨.٦٦٪، ومقياس الورك بنسبة ١١.٨١٪ واستبيان الإعاقة لرولان موريس بنسبة ٢٠.٦٥٪. أظهرت المجموعة (د) انخفاضاً ملحوظاً في المقياس التماثلي البصري بنسبة ٥٧.٨٥٪ ومقياس الورك بنسبة ٤٦.٣١٪ واستبيان الإعاقة لرولان موريس بنسبة ٥٤.٨٨٪.

الخلاصة: إن عملية تحريك الفقرات القطنية الرابعة وتمارين إمالة الحوض للخلف لها تأثير كبير في تحسين آلام الظهر وآلام عرق النسا.