Review Article

Evidence based Physiotherapy Intervention of Lumbar Spondylolisthesis: A Narrative Review

Mohammad Ainur Nishad Rhajib[1*], MD Waliul Islam[2], Mohammad Anwar Hossain[3], Md Obaidul Haque[4], Abdullah Ibne Abul Fazal[5]

[1]Clinical Physiotherapist, Musculoskeletal Unit, Department of Physiotherapy, Centre for the Rehabilitation of the Paralysed (CRP), Dhaka, Bangladesh

[2]Senior Clinical physiotherapist, Department of Physiotherapy, Dhaka, Bangladesh

[3]Senior Consultant and Head, Department of physiotherapy, Centre for the Rehabilitation of the Paralysed (CRP), Dhaka, Bangladesh

[4]Vice-Principle, Bangladesh Health Professions Institute (BHPI), Dhaka, Bangladesh

[5]Clinical physiotherapist, Department of Physiotherapy, Dhaka, Bangladesh

[*]Corresponding Author: Mohammad Ainur Nishad Rhajib, Clinical Physiotherapist, Musculoskeletal Unit, Department of physiotherapy, Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka, Bangladesh

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Abstract

Background: Spondylolisthesis refers to the anterior migration or slippage of one vertebrae in relation to the adjacent lower vertebrae.

Objectives: To assist physiotherapists in decision making during intervention for the patients with spondylolisthesis grade I and II.

Methodology: A narrative review. RCT study was used in this study to review the intervention.

Results: Four RCT study was found on spondylolisthesis. There is very hardly RCT study is found during searching. This study explored that lumbar flexion exercise as well as stretching of hip flexors, hamstring, piriformis and thoracic mobilization is effective for the spondylolisthesis.

Conclusion: This review favors the lumbar flexion exercise and stretching is effective. Further and better study is necessary for improve evidence-based practice.

Keywords: Spondylolisthesis; Evidence-based Physiotherapy

Abbreviations: BHPI: Bangladesh Health Professions Institute; CRP: Centre for the Rehabili-tation of the Paralysed; CG: Control Group; LM: Lumber Multifidus; ODI: Oswestry Disability Index; SEG: Specific Exercise Group; VAS: Visual Analogue Scale

1. Introduction

Spondylolisthesis refers to the anterior migration or slippage of one vertebra in relation to the adjacent lower vertebrae. It most commonly occurs between L5 & S1 vertebrae and followed by a slip between L4 & L5 is common [1]. According to the Wiltse-Newman classification, there are five types of spondylolisthesis, which are follows- dysplastic, isthmic, degenerative, traumatic and pathological. Dysplastic is the congenital defect between L5 and S1. Isthmic type, defines spondylolisthesis that results from defects of the pars interarticularis. Degenerative spondylolisthesis due to long standing intersegment instability and is considered a typical example of spinal instability resulting from progressive degeneration of the facet joints and the intervertebral discs with aging [2]. Another system is used, in which the degree of slippage is calculated. Thus, it can be considered: grade I – 25% or less, grade II – between 25% and 50%, grade III – between 50% and 75%, and grade IV – greater than 75% [3].

The most common symptom of spondylolisthesis is low back pain and neurogenic leg symptom [4]. Pain is commonly localized to the paraspinal region, gluteals and posterior aspect of the thighs. Other sign and symptom include restricted lumbar range of motion, paraspinal muscle spasm. In progress hamstring tightness, also find posterior tilting of the pelvis, and a flexed hip and knee posture. The individual may walk with short-stride gait and a characteristic pelvic 'waddle' (pelvic rotation with stepping) may be observed. On examination, pain is reproduced with the one legged standing lumbar extension test, and a step deformity in the lumbar spine may be observed or palpated. In moderate to severe cases, marked limitation of trunk flexion range of motion is often seen and a limited straight leg raise found [5].

However, the exact cause of spondylolisthesis is unknown, there are some both congenital and acquired causes found. There is a birth defect in the articular process of the vertebrae or genetically weakness of pars interarticularis. Spondylolisthesis is most commonly caused by fatigue fractures or resulting from a trauma to the spine. In young athletes, repetitive motion or overuse cause fracture or elongation of the pars interarticularies. In aging, degeneration of vertebral discs and facet joint make the lumbar spine instable and allow the vertebra will slip forwardly [6]. Spondylolisthesis occurs in approximately 6% of the population. Prevalence estimates of spondylolisthesis among females range

from 6% in Taiwan to 20–25% in the United States, whereas those among males range from 3% in Taiwan and 4–8% in the United States. In Japan there is one study found, they reported that The prevalence of spondylolisthesis at any level was 15.8% in the total sample, 13.0% in males, and 17.1% in female [7].

1.1 Aim of study

To review evidence based physiotherapy intervention for the lumbar spondylolisthesis.

2. Methodology

2.1 Design

Narrative review article.

2.2 Data sources and Study selection process

An Electronic data base search strategy was conducted through BHPI library database linking with HINARI Summon, PubMed, Google scholar, Physiotherapy Evidence Database (PEDro). The articles were searched using the terminology registered in the Medical Subject Headings of U.S. National Library of Medicine (Mesh). The Key words were Spondylolisthresis, Physiotherapy, evidence-based treatment and physical exercise. Only randomize clinical trial and randomize controlled trial was included in current study, patient receiving physiotherapy or exercise programs, Published in English language.

2.2.1 Inclusion criteria:

- The cased are diagnosed as spondylolisthesis with grade I & II.
- Intervention with therapeutic physical exercise.
- The studies which were RCT and studies from 1985-2020.

2.2.2 Exclusion criteria:

- Spondylolisthesis with grade III & IV
- Spondylolisthesis with surgical management
- A pilot randomized control trial
- A study protocols
- Cross-over study
- Clinical trials that do not have a control group.

3. Result and Discussion

Lumbar spondylolisthesis causes segmental instability that results hypomobility or hypermobility of the spine segment above or below restricted segments. Researchers tried to explore the effects of mobilization of the hypomobile upper thoracic spine along with conventional flexion exercises and stretching of short hip flexors on the degree of slippage and the functions of the persons with lumbar spondylolisthesis. Around 200 patients with spondylolisthesis were randomly assigned into two groups where experimental group treated with mobilization of the thoracic spine along with the conventional physiotherapy and conventional group treated with conventional stretching, strengthening, and lumbar flexion exercise programme. The overall results of the study showed that both the groups improved in function as registered by the Modified Oswestry Disability Questionnaire from pre-treatment to post-treatment and the improvement of pain score, flexibility and strength. Experimental group treated with passive stretching of bilateral hip flexors, hamistrings, piriformis, passive Williams flexion exercise, myofascial release, posterior pelvic tilt exercise, central PA mobilisation of the thoracic spine. The conventional group was advised to do auto hip flexors, hamistrings and piriformis stretching, Williams spinal flexion and posterior pelvic tilting

exercise as a home exercise program. Both group was given moist heat.Both groups were also instructed that to avoid movement and activity that causes spinal extension and use lumbosacral brace during travelling and exertion. In addition, postural awareness was instructed to maintain normal posture. The experimental group showed a significant reduction in the percentage of vertebral slip from pre-treatment to post-treatment measurement. So, spondylolisthesis patient may be benefited by mobilisation of the thoracic spine along with stretching of short hip flexors, piriformis, lumbar flexion range of motion exercises, core strengthening exercises [5].

A study was found where researcher have tried to determine the effects of stabilization exercises on pain and function in patients with degenerative spondylolisthesis. It was a Non-randomized clinical trial, with 6 months of follow up where twenty patients over 50 years of age with degenerative spondylolisthesis underwent a 6-month, home-based training program of stabilization exercises. The home exercise programs comprising of initial phase, with the use of therapeutic heat via a hot pack for 15 minutes at the lumbosacral region, stretching exercises of the thoracolumbar fascia, hip flexors, hamstrings, triceps and initial stabilization exercises to encourage stabilizing motor patterns and determine the neutral position of the spine, with the target in control of transversus and internal oblique abdominis, multifidus, pelvic floor muscles, and diaphragmatic breathing control. Progression stages included hot packs, stretching exercises, and stabilization exercises with lateral and anterior bridges, leg raises in supine position, and arm and leg lifts in quadruped position (“bird-dog”) using a resistance-progressive program from no weight, to 0.5 kg and 1 kg in the extremities. Patients were scheduled for a monthly hour-long session with physiotherapist for clarifying everything. Pain scales (Visual Analogue Scale [VAS] and Oswestry Disability Index [ODI]) were used as measurement tool. Both pain and Oswestry Index scores were significantly decreased. Initial and final VAS for “back pain” and “sciatic pain” results decreased. Lumbar stabilization exercises could be an effective treatment option in controlling pain and improving function in patients with degenerative spondylolisthesis [8].

Another study was found on specific stabilization exercise where researcher hypothesis that specific exercise training of the "stability" muscles of the trunk is effective in reducing pain and functional disability in patients with spondylolisthesis. Fourty four patients with radiologic diagnosed spondylolisthesis was randomly assigned in two groups named specific exercise group (SEG) and control group (CG). The SEG underwent a 10-week treatment program directed on a weekly basis by one of four manipulative physiotherapists. The intervention programed was train the specific contraction of the deep abdominal muscles, without substitution from large torque producing muscles such as rectus abdominis and external oblique, using the abdominal drawing in maneuver, and train the specific contraction of deep abdominal muscles with co-activation of LM proximal to the pars defect. The holding time for these exercises was increased gradually so that patients were able to perform 10 contractions with 10-second holds. Patients also performed these exercise at home. When patient can perform accurate activation of co-contarction pattern without synergic involvement, encourage the subject to activate these muscles regularly during daily activities especially in situation where previously aggravate their symptom. On the

other hand, CG went treatment throughout a 10 week period with general exercise such as swimming, walking, gym work as well as pain relieving method as heat, massage and UST. After intervention, they found that the specific exercise group showed a statistically significant reduction in pain intensity and functional disability levels with 30-month follow-up. On the other hand, CG did not show significant change [9].

A very previous study was found where researcher evaluate the which type of back exercise (flexion or extension) is most useful for the patients with low grade (grade-1) spondylolisthesis. Forty-eight non-operative patients with non-traumatic back pain with lumbar spondylolisthesis is included and maintained three years follow-up. Participants are randomly assigned in two group named flexion and extension group. Prescribed exercise techniques were flexion or extension. Flexion exercises was flexion of the lumbar spine. These exercises consist of abdominal strengthening (isometric or isotonic), pelvic tilt, and chest-to-thigh position. Extension exercises resulted in lumbar extension beyond the neutral position. These exercises consist of upper back extension in prone lying and hip extension prone lying. The instructions had given to the both group about posture (dynamic and static), lifting techniques, and the use of heat for relief of symptoms. This study stated that flexion exercises are more beneficial than extension exercises for symptomatic relief and also recommended heat to relief of symptoms, posture and lifting instructions to decrease faulty body mechanics and to decrease lumbar lordosis, flexion exercises to stretch rectus spinal muscles, and exercises to strengthen the abdominal muscles and lower back musculature [10].

This review is developed for the physiotherapist. Additionally, this paper address the need to decrease variability and increase transparency in clinical practice and legitimize profession in eyes of external stakeholders. It increases transparency of evidence to justify intervention. As far, we know there is still not developed physiotherapy practice guideline on spondylolisthesis. It will assist the Physiotherapist with developing direction of future clinical research. Allow professional to self-assess their current practice. Provide quick access to synthesis of evidence. This guideline will help in clinical practice to take decision for the patient with radiologically diagnosed spondylolisthesis grade I and II.

This paper made on the four randomized clinical trial about spondylolisthesis This guideline made on the five randomized clinical trial about spondylolisthesis. In our clinical practice we can go to the lumbar flexion exercise. Lumbar stabilization exercise and thoracic mobilization also found effective with lumbar flexion exercise. This study did not cover the congenital spondylolisthesis and mainly focused on acquired spondylolisthesis due to degenerative and traumatic. We can advise the patient to wear to lumbosacral brace during travelling. There is very few RCT design type study found during searching literature on the physiotherapy management of spondylolisthesis grade I & II. Most of the RCT design was the postoperative physiotherapy management of spondylolisthesis grade III & IV. There is 3 RCT study was beyond 2010 year among the four RCT study.

Author	Study design	Intervention	Outcome measurement	Result
Mohanty and Pattnaik (2016)[5]	Randomized clinical trial. With sample size 200.	Experimental group treated with passive stretching of bilateral hip flexors, hamistrings, piriformis, passive Williams flexion exercise, myofascial release, posterior pelvic tilt exercise, central PA mobilisation of the thoracic spine. The conventional group was advised to do auto hip flexors, hamistrings and piriformis stretching, Williams spinal flexion and posterior pelvic tilting exercise as a home exercise program	Pain scales (Visual Analogue Scale [VAS] and Oswestry Disability Index [ODI]	experimental group showed a significant reduction in the percentage of vertebral slip from pre-treatment to post-treatment measurement
Nava-Bringas et al. (2014)[8]	Non-randomized clinical trial. With sample size 12.	The home exercise programs comprising of initial phase, with the use of therapeutic heat via a hot pack for 15 minutes at the lumbosacral region, stretching exercises of the thoracolumbar fascia, hip flexors, hamstrings, triceps and initial stabilization exercises to encourage stabilizing motor patterns and determine the neutral position of the spine, with the target in control of transversus and internal oblique abdominis, multifidus, pelvic floor muscles, and diaphragmatic breathing control. Progression stages included hot packs, stretching exercises, and stabilization exercises with lateral and anterior bridges, leg raises in supine position, and arm and leg lifts in quadruped position (“bird-dog”) using a resistance-progressive program from no weight, to 0.5 kg and 1 kg in the extremities.	Functional and pain scales (Visual Analogue Scale [VAS] and Oswestry Disability Index [ODI]), and conducted an isokinetic trunk test.	The results of VAS and ODI scores correlated significantly with improvement in the isokinetic test
O'Sullivan et al. (1997)[9]	Randomize control trial. With 44 patents.	The intervention programed was train the specific contraction of the deep abdominal muscles, without substitution from large torque producing muscles such as rectus abdominis and external oblique, using the abdominal drawing in maneuver, and train the specific contraction of deep abdominal muscles with co-activation of LM proximal to the pars defect. The holding time for these exercises was increased gradually so that patients were able to perform 10 contractions with 10-second holds. Patients also performed this exercise at home.	Short-form McGill Pain Questionnaire. The Oswestry disability Index. Lumber spine rang of motion.	A "specific exercise" treatment approach appears more effect-tive than other commonly pre-scribed conservative treatment programs in patients with chro-nically symptomatic spondylo-lysis or spondylolisthesis.
Sinaki et al.(1989) [10]	Randomize control trial. With 48 patents.	These exercises consist of abdominal strengthening (isometric or isotonic), pelvic tilt, and chest-to-thigh position. Extension exercises resulted in lumbar extension beyond the neutral position. These exercises consist of upper back extension in prone lying and hip extension prone lying.	Functional and pain scales (Visual Analogue Scale [VAS]	If a conservative treatment program is elected, back flexion or isometric back strengthening exercises should be considered.

Table 1: Article summary

Impairment	Treatment
Pain	• Lumber flexion exercise • Moist heat [5, 10]
Faulty body posture	• Educate the patient • Postural awareness • Instruct lifting technique • Use lumbosacral brace during travelling and exertion [5, 10]
Reduced ROM	• Lumbar flexion exercise • Passive stretching • Williams flexion exercises [5, 10]
Tight hip flexor, hamstring and piriformis	• Passive stretching [5].
Hypomobile of thoracic spine	• Maitland's rhythmical oscillatory central PA [5].
Lumbar instability	• Lumbar stabilization exercise: twice a day, every day, 10 repetition of each exercise [8]. • Specific stabilization exercise.
Posterior pelvic tilt	• Posterior pelvic tilting exercise [5].
Para spinal muscle spasm	• Myofascial release [5].

Table 2: Intervention summary for lumbar spondylolisthesis.

4. Conclusion

This review was conducted for the patients with spondylolisthesis grade I & II. Low back pain due to spondylolisthesis we can go to the direction of flexion exercise of lumbar spine. Lumbar stabilization exercise also should be practice in our daily clinical practice to provide lumbar stability. In addition, thoracic mobilization, stretching of hip flexors and piriformis, myofascial release for paraspinal muscle spasm also suggested. Educate the patient about postural awareness and correct lifting technique. The patient also instructed to wear lumbosacral brace only during travelling and exercise.

Conflict of Interest

No conflict of interest is relevant to the content of this case study.

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