Case Report

Physiotherapy and Occupational Therapy Journal
Volume 17 Number 2, April - June 2024
DOI: http://dx.doi.org/10.21088/potj.0974.5777.17224.7

Lumbar Segmental Exercises for Reducing Pain and Improving Functional Activiy in a Post Operative Spinal Fusion Patient: A Case Study

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How to cite this article:

Anusmitha K Vijayan, Priya S, Sanaya Baliga. Lumbar Segmental Exercises for Reducing Pain and Improving Functional Activiy in a Post Operative Spinal Fusion Patient: A Case Study. Physio. and Occ. Therapy Jr. 2024;17(2):117-121.

Abstract

Background: Degenerative disc and facet joint disease of the lumbar spine is common in the ageing population. Lumbar segmental instability is a prominent disorder after a posterior lumbar interbody fusion surgery. Segmental stabilization exercises enhance muscle activation and help patients regain functional capacity lost due to pain hence could be a beneficial intervention.

Case Description: A 67-year-old female with gradual low back pain underwent PLIF at L4-L5 and L5-S1, using Depuy Moss-Miami pedicle screws and a Concorde carbon fiber interbody cage. Post surgery she received physiotherapy. She was scheduled for daily 60-minute physiotherapy sessions for four weeks, focusing on pain reduction, functional improvement, range of motion, and ADLs. Progress was assessed using the Lower Extremity Functional Scale (LEFS) and Oswestry Disability Index.

Literature Review: A comparative study was conducted by Fabio Franca et.al (2010) used the same treatment intervention to contrast the efficiency of two exercise programs, segmental stabilization and muscular strengthening in chronic low back pain. The study concluded that both techniques lessened pain and reduced disability, however, segmental stabilization proved superior as it had significant gains for all variables including transverses abdominis activation.[3]

A randomized controlled trial conducted by Stefan Kostadinovic et al (2020) used the same treatment intervention as this study, to compare the lumbar stabilization exercise program in a closed and open kinetic chain (LSCO) and lumbar stabilization exercises and thoracic mobilization program in a closed kinetic chain (LSTMC), and evaluated the clinical effectiveness of each program, in a batch of 4 weeks and 8 weeks programmes. It concluded that patients who performed the lumbar stabilization and thoracic mobilization exercise program in a closed kinetic chain had the most effective reduction of pain intensity and functional disability.[5]

Keywords: Segmental Stabilization Exercises; Post-op Spinal fusion.

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Recieved on 24.07.2024

Accepted on 29.08.2024

INTRODUCTION

Degenerative disc and facet joint disease of the lumbar spine is common in the ageing population, and is one of the most frequent causes of disability. Lumbar spondylosis may result in mechanical back pain, radicular and claudicant symptoms, reduced mobility and poor quality of life. Surgical interbody fusion of degenerative levels is an effective treatment option to stabilize the painful motion

segment, and may provide indirect decompression of the neural elements, restore lordosis and correct deformity.[1]

The surgical option for interbody fusion of the lumbar spine used was posterior lumbar interbody fusion (PLIF), involves accessing your spine through your abdomen, rib cage or through your back. During the operation, the intervertebral disc was removed and replaced by an implant known as a cage. The unstable level of the spine was then fixed together with the application of metalwork. In this case, Implant: depuy: moss-miami pedicle screws, concorde - carbon fiber interbody cage was used. Lumbar segmental instability is a prominent disorder that results from loosening of the motion segment due to injury and muscle dysfunction, leading to biomechanical vulnerability. Diagnosis involves evaluating pain, movement dysfunction, and excessive intervertebral motion, with four clinical patterns identified based on injury direction and symptoms.

Lumbar segmental stabilization focuses on precise, controlled exercises to minimize pain and reflex inhibition. Important muscles involved include the multifidus, transverse abdominis, and pelvic floor, with weakness in these areas being a risk factor for low back pain.. This study aims to investigate the effectiveness of segmental exercises in increasing functional capability and reducing pain in postoperative spinal fusion patients, offering a promising new treatment option.

METHODOLOGY

This case represents a 67 year old female patient with a history of gradual onset of low back pain since a year which was greater on the right-side than the left. The pain aggravated to an extent where she could no longer stand or walk. Following which she decided to consult a family doctor. On 28/08/22 patient got an MRI scan of lumbo-sacral spine done under his recommendation. The MRI results showed the presence of posterior disc bulge at L4-L5 and L5-S1 levels causing indentation on thecal sac with moderate narrowing of bilateral neural foramina, posterior disc bulge at l3-l4 level causing indentation on thecal sac with narrowing of bilateral lateral recesses. Similar cases were noticed in the patient's brother as well as her sister. Subsequently on 03/1/23 she visited a local hospital, where she was given epidural injections twice. She felt a relief for 2-3 weeks, but the pain re-appeared. Then on 15/1/23 she got admitted to the same local hospital and on 16/1/23 underwent Posterior Lumbar Interbody Fusion (PLIF) L_3-L_4 and L_4-L_5. Implant: Depuy: Moss-Miami Pedicle Screws, Concorde - Carbon Fiber Interbody Cage was used. Patient was discharged on 20/1/23. On observation patient showed waddling gait pattern with no other deformities. On examination, AROM and PROM of Upper Limb was within normal range whereas for Lower Limb and Lumbar region showed significantly reduced range. (ref Table 1)- Except Ankle Joint and lumbar rotations all the other joints have a reduced range of motion. Manual Muscle Testing (MMT) For Upper Limb was normal 5/5 whereas Lower Limb and Lumbar Region showed significant reduction with the highest value attained being 3; and hip extensors, abductors, knee extensors and spine flexion and extension scoring 2 (ref Table 2). Limb length showed no discrepancy. All superficial and deep reflexes were normal (2+) accept abdominal which was diminished (1+). Neurological examination showed no abnormalities. Special Tests like SLRT – Straight and Crossed was Positive (30^0), Slump Test and Stoop Test was also positive. Schober's Test showed Flexion-5cm and Extension-1cm.

The patient was informed about the study and written consent was obtained.

Outcome Measures like Lower Extremity Functional Scale (LEFS) and Oswestry Disability Index were used pre and post treatment.

INTERVENTION

The patient was scheduled for physiotherapy daily for 60 minutes sessions everyday during his rehabilitation. The patient attended the session daily for 4 weeks. The short-term goals were to reduce pain and increase strength, improve range of motion. The long term goals were to improve strength, improve gait and improve quality of life. The intervention plan and care focused primarily on reducing pain and improving functional capability, range and ADL. The subject's progression was assessed using Lower Extremity Functional Scale (LEFS) and Oswestry Disability Index. Interventions, outcome measures and changes in the impairment were documented in a treatment period of four weeks.

Fig. 1: AH in sitting

Fig. 2: Diagonal curl-up with AH

Fig. 3: Supine cycling with AH

Fig. 4: Knee-to-Chest with AH- Double leg

Outcome Measures

- Lower Extremity Functional Scale (LEFS)
- Oswestry Disability Index (ODI)

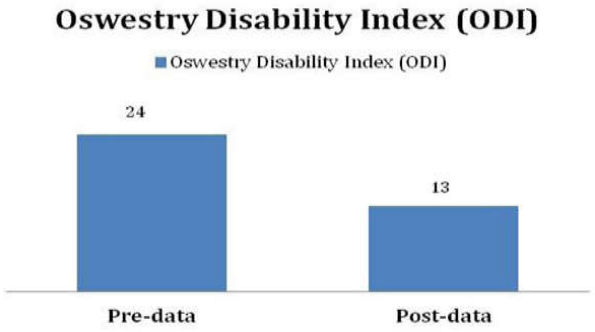
RESULTS

The patient still experiences mild pain and difficulty with sitting, lifting and standing but it has deteriorated. Personal care and sleeping are no more grossly affected. After the treatment, patient showed significant reduction in pain and improvement in ROM and functional ability. The patient can now walk for more than a mile, sit for in her favorite chair for as long as she likes (more than an hour), can step out of her apartment complex and socialize, perform most of her homemaking duties except stressful ones that lead to pain, (e.g. lifting heavy weights), she does experience slight, occasional pain and none compromising activity, She can now walk two/three blocks as opposed to indoors only and walk without support. Travel and social life is affected but not completely disregarded anymore.

DISCUSSION

This case represents a 67 year old female patient with a history of gradual onset of low back pain. PLIF was done on L4-L5 and L5-S1 levels.

Implant: Depuy: Moss-Miami pedicle screws, Concorde-carbon fiber interbody cage was used. Complications like low back pain, waddling gait, and lumbar instability and reduced muscle strength of muscles of lower limb and back were noted. Lumbar segmental stabilization focuses on precise, controlled exercises to minimize pain and reflex inhibition, which enhances muscle activation, improve proprioception, and help patients regain functional capacity lost due to pain. Segmental Stabilization Exercises have a strong theoretical basis in treatment and prevention of low back pain. However, the clinical effectiveness of segmental exercises in post-operative spinal fusion has not yet been established. This study was done to investigate the effectiveness of segmental exercises for increasing the functional capability while reducing the pain in a post operative spinal fusion patient, thereby providing a new treatment intervention. The patient was scheduled for physiotherapy for 60 minutes sessions everyday over a period of four weeks during his rehabilitation. The LEFS is reliable and valid in assessing functional mobility group and individual change, and has large responsiveness. The ODI seems to have a slight advantage in the assessment of chronic and more severely disabled clients and is more sensitive for patients showing improvement compared with unchanged clients. In terms of validity, reliability, and responsiveness Test-retest reliability is slightly higher for the ODI compared with the Roland Morris Questionnaire and Quebec. Hence, the subject's progression was assessed using Harris Hip Score and Oswestry Disability Index.



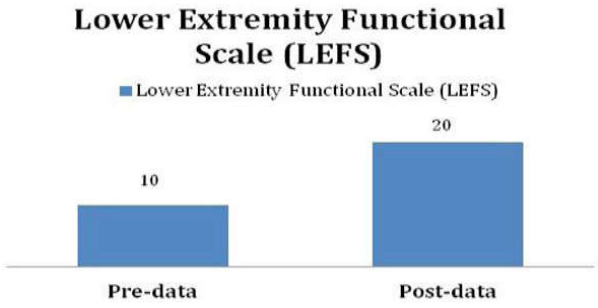


Table 1: Rom for Lower Limb (LL) and lumbar spine

Joint	Movement	Right		Left	
		Arom	Prom	Arom	Prom
Hip	Flexion	0-60^0	0-50^0	0-70^0	0-65^0
	Extension	6^0-0	6^0-0	8^0-0	8^0-0
	Abduction	0-20^0	0-20^0	0-25^0	0-20^0
	Adduction	250-0	250-0	250-0	25^0-0
Knee	Flexion	0-120^0	0-115^0	0-125^0	0-120^0
	Extension	120^0-0	115^0-0	125^0-0	120^0-0
Ankle	Plantar Flexion	0-20^0	0-20^0	0-20^0	0-20^0
	Dorsi Flexion	0-45^0	0-45^0	0-50^0	0-50^0
Spine	Flexion	30^0			
	Extension	10^0			
	Right Lateral Flexion	15^0			
	Left Lateral Flexion	15^0			
	Right Rotation	5^0			
	Left Rotation	5^0			

Table 2: MMT for lower limb and spine

Joint	Muscle Group	Right	Left
Hip	Flexors	3	2+
	Extensors	2-	2
	Abductors	2	3
	Adductors	3-	2
	Internal Rotators	2	2+
	External Rotators	2	2
Knee	Flexors	3-	3
	Extensors	2	2
Ankle	Dorsiflexors	3+	3+
	Plantarflexors	3	3
Foot	Invertors	3	3
	Evertors	3	3
Spine	Flexion	2	
	Extension	2	

Table 3: Treatment Protocol

Treatment	Sets
Abdominal Hallowing (AH)	
Hold this for about 6 seconds and do it 3 positions	10 reps
Standing	10 reps
Sitting	10 reps
Crook lying.	
Piriformis Stretching	3 reps
Hold the stretch for 30 secs	
Knee-To-Chest with AH	
A. Single leg with AH	3 reps
Hold the stretch for 30 secs	
B. Double leg with AH	
Hold the stretch for 30secs	3 reps
Calf-Stretching	3 reps
Hold for 30 secs	
Heel slides	12 reps Each side
Supine cycling with AH	12 reps
Partial curl up with AH	12 reps
Hold for 1 to 2 seconds.	
Diagonal curl-up with AH	12 reps Each side
Hold for 1 to 2 seconds.	
Bridging with AH	12 reps
Squatting with AH	12 reps

Table 4: Pre and Post Data

Scale	Pre-data	Post-data
Oswestry Disability Index (ODI)	24	13
Lower Extremity Functional Scale (LEFS)	10%	20%

CONCLUSION

This study concluded that after a 4 week treatment program Lumbar Segmental Stabilization Exercises were beneficial in reducing pain and improving functional abilities in this patient.

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