The Effect of Mckenzie Approach and Mulligan's Mobilisation (SNAGS) in Lumbar Disc Prolapse with Unilateral Radiculopathy

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Abstract: ***Introduction**: Disc related disorders of spine are estimated to compromise high percentage of low back pain Indian population with incidence of 23.09% with lifetime prevalence of 60-85%.The significant cost in management often require surgical intervention so study was carried out to find out cost effective physical therapy interventions along with manual therapy. **Objective:** To study & compare the effect of McKenzie approach and Mulligan's mobilisation (SNAGS) in lumbar disc prolapse with unilateral radiculopathy. **Method:** 30 participants between 25 to 45 years classified according to Qubec Task Force (QTF) classification & divided into group A & B. Baseline treatment of shortwave diathermy, intermittent lumbar traction & interferential therapy for both groups along with McKenzie approach for Group A & Mulligan's (SNAGS) for Group B. Outcome measures visual analogue scale (VAS), Modified Oswestry Disability Index (MOLBPDI) & lumbar range of motion (ROM) were assessed pre & post treatment. **Result:** Result showed improvement in VAS, MOLBPDI & ROM except rotation ROM in both groups. But there was better improvement in Group B. **Conclusion**: McKenzie approach and Mulligan's mobilisation (SNAGS) are effective in improving pain, functional ability & ROM in prolapse intervertebral disc with unilateral radiculopathy, later is more effective.*

Keywords: McKenzie, Mulligan mobilisation (SNAGS), lumbar disc prolapse, SWD, IFT.

1. Introduction

In India incidence of low back pain(LBP) has been reported to be 23.09% and has a lifetime prevalence of 60- 85%.[1, 2] Causes of LBP with or without radiating pain are idiopathic, degenerative, traumatic, inflammatory, congenital, neoplastic, metabolic, postural and gynaecological, renal or rectal systemic. Prolapsed intervertebral disc (PIVD) is the most common cause of lumbar radiculopathy.[3]

PIVD is collective term, describing a process in which the rupture of annular fibers allow for a displacement of nucleus pulposus within the intervertebral space, most commonly in posterior or postero-lateral direction.[4] The sequences of changes occurring in PIVD are stage of nucleus degeneration, stage of nuclear displacement (Stage of protrusion, extrusion, sequestration) & stage of fibrosis [5]

The periphery of the disc is nociceptively innervated, the degenerative &/or traumatic process of disc herniation may produce Discogenic pain by the excessive mechanical strain on the outer annular fibers. PIVD can also cause radicular pain. The clinical manifestations following nerve root compression depends on the involvement of nerve root.[6] There are various Physiotherapy intervention for treatment of prolapsed intervertebral disc are available such as intermittent lumbar traction, interferential therapy, short wave diathermy, transcutaneous electrical nerve stimulation and manual therapy interventions.

2. Literature Survey

Robin McKenzie proposed methods of spinal therapy in management of subjects with spinal disorders. McKenzie exercises are passive and active exercises in beginning, middle and end range of trunk in flexion, extension and combination of side bending called slide gliding. There are three mechanical syndromes described by McKenzie which are postural, dysfunctional and derangement syndrome. Centralisation occurs during the reduction of a derangement. When derangement is fully reduced, pain is abolished and full range, pain free movement regained.[7, 8]

Brian Mulligan has developed a most ingenious compilation of manual techniques. His principle techniques are natural apophyseal glides (NAGS), sustained natural apophyseal glides (SNAGS) and mobilization with movement (MWMs). SNAGS were the first example of group of techniques known as mobilisation with movement which Mulligan developed to restore pain free unrestricted movement for most joints in body.[9] Mulligan stated that movement with mobilization correct minor bony positional faults, non palpable or visible on X ray[10] SNAGS causes repositioning of articular facets allowing normal pain free function and as such are thought primarily mobilise zygapophyseal joints, and influencing the entire spinal functional unit, including the intervertebral disc.[11]

It has been proved that McKenzie approach is effective in derangement syndrome.[7] Mulligan mobilisation SNAGS are proved to be effective in disorders of cervical spine & improving ROM in lumbar disorders.[12] But there are very less studies which prove comparative effect of both the above techniques. Therefore the present study to know the effect of McKenzie approach and Mulligan's mobilisation (SNAGS) in lumbar disc prolapse with unilateral radiculopathy.

3. Material and Methods

Clinically diagnosed cases of PIVD with radiculopathy by orthopaedician of Krishna Hospital, Karad were primarily selected for this study. Further they were screened clinically using various tests and confirmed on radiological investigation as posterolateral disc prolapsed (disc protrusion). Considering the inclusion criteria that is male & female of age 25-45 years, clinically and radiologically diagnosed with lumbar PIVD (disc protrusion) with posterolateral derangement with McKenzie derangement symptom pattern 3 i.e. unilateral (asymmetrical) with pain below knee & classified according to Quebec Task Force as sub acute sub classification (7 days- 7 weeks) with mild neurological deficit and QTF 3 & 6 were included. Subjects with anterior derangement, multiple level PIVD, presence of bilateral Radiculopathy & history of previous spinal surgery were excluded. A brief demographic data as per data collection sheet were recorded. By using convenience sampling method (chit method) the participants were randomly allocated into two groups; Group A and Group B. Pre-treatment outcome scores of pain on VAS, functional disability using MOLBPDI and ROM using an inch tape were recorded.

Interventions: Group A received baseline treatment of shortwave diathermy (SWD), intermittent lumbar traction (ILT) and interferential therapy (IFT) along with McKenzie approach for 7 days.

Group B received a baseline treatment of SWD, ILT and IFT along with Mulligan's mobilisation (SNAGS) for 7 days.

3.1 Outcome measures

Before & after the intervention, i.e. after 7 days outcome measures used were, pain was assessed by VAS, functional disability by MOLBPDI & lumbar ROM by inch tape method.

3.2 Visual analogue scale (VAS)

A 10 cms straight line was drawn on a paper marked with number 0 to 10, with 0 resembles no pain and 10 resembles the worst tolerable pain and participants were asked to mark a point on this line as per the severity of his or her pain which indicates present pain level.

3.3 Modified Oswestry Disability Index(MOLBPDI)

Functional disability was measured by MOLBPDI, a well validated, self report, self complete questionnaire design for assessing disability in people with low back pain. The questionnaire has 10 sections selected from a series of experimental questionnaires designed to assess limitations of various activities of daily living. The subjects were asked to mark his or her ability to perform each of the 10 activities and then scoring for MOLBPDI was done.

3.4 Lumbar range of motion (ROM)

Flexion & extension ROM of lumbar spine was measured using Modified Schober's technique. The lateral flexion ROM was measured using Finger-tip to floor method. The lumbar rotation was measured using a tape measure method.[13]

4. Statistical Analysis

Stastistical analysis was done manually & by using the statistics software's INSTAT so as to verify the results derived. Probability values ≤ 0.01 were considered statistically significant & ≤ 0.0001 were considered extremely significant. The statistical analysis of non parametric data (VAS and MOLBPDI scores) was done by Wilcoxon matched pairs test and Mann-Whitney test. Wilcoxon matched pairs test was used for statistical analysis of pre and post intervention within group. Mann-Whitney test was used for between group statistical analysis of Group A and Group B (pre- pre and post-post intervention). The statistical analysis of the parametric data was done using paired't' and unpaired't' tests. Student's paired't' test was used for statistical analysis of pre and post intervention within group. Student's unpaired't' test was used for between group statistical analysis of Group A and Group B.

5. Result

30 subjects with lumbar PIVD with unilateral radiculopathy between age group 25 to 45 years were taken. Out of 30 subjects, 15 were male and 15 were female. Group A had 8 males and 7 females and Group B had 7 males and 8 females. The mean age of the participants in Group A was 39.53 ± 4.89 and in Group B was 38.93 ± 5.92. There was no statistically significant difference between the mean ages of the participants in both the groups. (p=0.7646)

Table 1: Baseline characteristics of participants

Variable	*Group A*	*Group B*
Sex	M=8 & F= 7	M=7 & F=8
Age (years)	39.53 ± 4.89	38.93 ± 5.92

In the present study pre-interventional mean of VAS score was 7.66 ± 1.23 in Group A and 7.8 ± 1.014 in Group B whereas post- interventionally mean of VAS score was 2.73 ± 0.703 in Group A and 1.6 ± 0.73 in Group B.

Intra group analysis of VAS score revealed statistically significant reduction in pain post interventionally for both the groups Group A (p<0.0001), Group B (p<0.0001).

Pre intervention analysis showed no significant difference between Group A and Group B (p=0.8673). Post intervention analysis showed significant difference between Group A and Group B (p=0.0012).

Table 2: Comparison of VAS score

Group	*Pre*	*Post*	*'p'*
	Mean± SD	*Mean± SD*	
A	7.66 ± 1.23	2.73 ± 0.70	<0.0001**
B	7.8 ± 1.01	1.6 ± 0.73	<0.0001**
P	0.8673	0.0012#	

**= extremely significant (p≤ 0.0001)
= significant difference (p < 0.001)

In the present study pre-interventional mean MOLBPDI score was 72.4 ± 8.98 in Group A and 69.867 ± 9.33 in Group B, whereas post-interventionally mean MOLBPDI score was 21.2 ± 4.70 in Group A and 12.13 ± 5.42 in Group B respectively.

Intra group analysis of the MOLBPDI scores revealed statistically reduction in functional disability scores post interventionally for both the groups Group A ($p<0.0001$), Group B ($p<0.0001$).

Pre intervention analysis showed no significant difference between Group A and Group B ($p=0.4302$). Post intervention analysis showed significant difference between Group A and Group B ($p=0.0002$).

Table 3: Comparison of M.O.L.B.P.D.I score

Group	Pre	Post	'p'
	Mean± SD	Mean± SD	
A	72.4 ± 8.98	21.2 ± 4.70	<0.0001**
B	69.87 ± 9.33	12.13 ± 5.42	<0.0001**
'p'	0.4302	0.0002	

**= extremely significant (p≤ 0.0001)

In the present study pre-interventional mean lumbar flexion range was 1.53 ± 0.39 cms in Group A and 1.6 ± 0.59 cms in Group B whereas post-interventionally mean lumbar flexion range was 3 ± 1.002 cms in Group A and 4.67 ± 0.87 cms in Group B respectively.

Intra group statistical analysis showed extremely significant increase in lumbar flexion range post interventionally for both the groups Group A ($t_{14}=6.275$, $p<0.0001$), Group B ($t_{14}=15.267$, $p<0.0001$).

Pre intervention analysis showed no significant difference between Group A and Group B ($p=0.7199$). Post intervention analysis showed extremely significant difference between Group A and Group B (p=<0.0001).

Table 4: Comparison of lumbar flexion ROM

	Pre	Post	'p'
Group	Mean± SD	Mean± SD	
A	1.53 ± 0.39	3 ± 1.002	<0.0001**
B	1.6 ± 0.59	4.67 ± 0.87	<0.0001**
'p'	0.7199	<0.0001**	

**= extremely significant (p≤ 0.0001)

In the present study pre-interventional mean lumbar extension range was 1.2 ± 0.41 cms in Group A and 1.33 ± 0.46 cms in Group B, whereas post-interventionally mean lumbar extension range was 2.33 ± 0.48 cms in Group A and 2.73 ± 0.36 cms in Group B respectively.

Intra group statistical analysis showed increase in extension range post interventionally for both the groups Group A ($t_{14}=13.263$, $p<0.0001$), Group B ($t_{14}=12.393$, $p<0.0001$).

Pre intervention analysis showed no significant difference between Group A and Group B ($t_{28}=0.8244$, $p=0.4167$). Post intervention analysis showed significant difference between Group A and Group B ($t_{28}=2.550$, $p=0.0165$).

Table 5: Comparison lumbar extension ROM

	Pre	Post	'p'
Group	Mean± SD	Mean± SD	
A	1.2 ± 0.41	2.33 ± 0.48	<0.0001**
B	1.33 ± 0.46	2.73 ± 0.36	<0.0001**
'p'	0.4167	0.0165#	

**= extremely significant (p≤ 0.0001)
= significant difference (p < 0.001)

In the present study pre-interventional mean lumbar affected lateral flexion range was 8.907 ± 2.45 cms in Group A and 8.773 ± 2.8 cms in Group B respectively whereas post-interventionally mean lumbar affected lateral flexion range was 12.653 ± 1.55 cms in Group A and 14.14 ± 0.97 cms in Group B respectively.

Intra group statistical analysis showed increase in affected lateral flexion range post interventionally for both the groups Group A ($t_{14}=9.007$, $p<0.0001$), Group B ($t_{14}=8.323$, $p<0.0001$).

Pre intervention analysis showed no significant difference between Group A and Group B ($t_{28}=0.1379$, $p=0.8913$). Post intervention analysis showed significant difference between Group A and Group B ($t_{28}=3.132$, $p=0.0040$).

Table 6: Comparison of lumbar affected side lateral flexion ROM

	Pre	Post	'p'
Group	Mean± SD	Mean± SD	
A	8.907 ± 2.45	12.653 ± 1.55	<0.0001**
B	8.773± 2.8	14.14 ± 0.97	<0.0001**
'p'	0.8913	0.004	

**= extremely significant (p≤ 0.0001)

In the present study pre-interventional mean lumbar unaffected lateral flexion range was 11.64 ± 1.56 cms in Group A and 12.16 ± 1.23 cms in Group B respectively whereas post-interventionally mean lumbar unaffected lateral flexion range was 13.23 ± 1.51 cms in Group A and 14.44 ±0.78 cms in Group B respectively.

Intra group statistical analysis showed increase in unaffected lateral flexion range post interventionally for both the groups Group A ($t_{14}=9.357$, $p<0.0001$), Group B ($t_{14}=11.011$, $p<0.0001$).

Pre intervention analysis showed no significant difference between Group A and Group B ($t_{28}=1.010$, $p=0.3210$). Post intervention analysis showed significant difference between Group A and Group B ($t_{28}=2.760$, $p=0.0101$).

Table 7: Comparison of lumbar unaffected side lateral flexion ROM

	Pre	Post	'p'
Group	Mean± SD	Mean± SD	
A	11.64 ± 1.56	13.23 ± 1.51	<0.0001**
B	12.16 ± 1.23	14.44 ± 0.78	<0.0001**
'p'	0.321	0.0101+	

**= extremely significant (p≤ 0.0001)
+ = significant (p < 0.01)

In the present study pre-interventional mean lumbar affected rotation range was 3.2 ± 0.72 cms in Group A and 3.10 ±

0.43 cms in Group B respectively whereas post-interventionally mean lumbar affected rotation range was 4.31 ± 0.51 cms in Group A and 4.26 ± 0.58 cms in Group B respectively.

Intra group statistical analysis showed increase in lumbar affected rotation range post interventionally for both the groups Group A (t_{14}=10.129, p<0.0001), Group B (t_{14}=9.947, p<0.0001).

Pre intervention analysis showed no significant difference between Group A and Group B (t_{28}=0.4292, p=0.6710). Post intervention analysis showed no significant difference between Group A and Group B (t_{28}=0.2321, p=0.818).

Table 8: Comparison of lumbar affected side rotation ROM

	Pre	Post	'p'
Group	Mean± SD	Mean± SD	
A	3.2 ± 0.72	4.31 ± 0.51	<0.0001**
B	3.10 ± 0.43	4.26 ± 0.58	<0.0001**
'p'	0.6710	0.818	

**= extremely significant (p≤ 0.0001)

In the present study pre-interventional mean lumbar unaffected rotation range was 4.21 ± 0.45 cms in Group A and 4.14 ± 0.58 cms in Group B respectively whereas post-interventionally mean lumbar unaffected rotation range was 4.42 ± 0.51 cms in Group A and 4.33 ± 0.55 cms in Group B respectively.

Intra group statistical analysis showed increase in unaffected rotation range post interventionally for both the groups Group A (t_{14}=5.323, p=0.0001), Group B (t_{14}=5.209, p=0.0001).

Pre intervention analysis showed no significant difference between Group A and Group B (t_{28}=0.3846, p=0.7034). Post intervention analysis showed no significant difference between Group A and Group B (t_{28}=0.4781, p=0.6363)

Table 9: Comparison of lumbar unaffected side rotation ROM.

	Pre	Post	'p'
Group	Mean± SD	Mean± SD	
A	4.21 ± 0.45	4.42 ± 0.51	0.0001**
B	4.14 ± 0.58	4.33 ± 0.55	0.0001**
'p'	0.7034	0.6363	

6. Discussion

The age distribution showed no statistical difference in the groups, which represents the homogeneity of the participants. The average mean age of participants in Group A was 39.53 ± 4.897 and Group B was 38.93 ± 5.922, which showed there is no significant difference in age of subjects in both groups (t= 0.3024, p=0.7646).

Baseline treatment of SWD, ILT and IFT was common for both groups. SWD by increasing metabolic activity, blood flow and stimulation of neural receptors caused decrease in pain, muscle spasm.[14] ILT by creating a suction effect due to decreased intra discal pressure in disc caused central migration of herniated nuclear material thus helping reduce disc prolapse but research has proven that this effects last for a short period of time.[15] IFT modulates pain by blocking pain gate mechanism, physiological blocking and increasing blood flow.[16] But as all the three interventions were common to both the groups, the beneficial effect cannot be completely attributed to SWD, ILT and IFT alone.

The effect of McKenzie approach on pain and functional disability which showed that there was significant reduction in pain (p< 0.0001) and functional disability (p< 0.0001) post treatment. The lumbar ROM showed that there was significant improvement in flexion (t_{14}=6.275, p<0.0001), extension (t_{14}=13.263, p<0.0001), affected lateral flexion (t_{14}=9.007, p<0.0001), unaffected lateral flexion (t_{14}=9.357, p<0.0001), affected rotation (t_{14}=10.129, p<0.0001) and unaffected rotation (t_{14}=5.323, p=0.0001) post treatment.

The above result correlates with the previous study.[17] The above findings may be due to the McKenzie's conceptual model behind treatment of the herniated disc is that in the case of an intact annular wall during spine segment motion, the nucleus will move away from the side of compression loading, i.e., the nucleus will move towards the convexity. Simply put, with annular fibres present to exert force on the nucleus during flexion, the nucleus will move posteriorly and during extension the nucleus will move anteriorly. Centralization only occurs in the derangement syndrome & as pain is reduced there is reduction in the disability an improvement in the ROM.[6]

The effect of Mulligan mobilisation on pain and functional disability which showed that there was significant reduction in pain (p< 0.0001) and functional disability (p< 0.0001) post treatment. Lumbar ROM which showed that there was significant improvement in flexion (t_{14}=15.267, p<0.0001), extension (t_{14}=12.393, p<0.0001), affected lateral flexion (t_{14}=8.323, p<0.0001), unaffected lateral flexion (t_{14}=11.011, p<0.0001), affected rotation (t_{14}=9.947, p<0.0001) and unaffected rotation (t_{14}=5.209, p=0.0001) post treatment.

SNAGS as a treatment modality can be applied to all the spinal joints, the rib cage and the sacroiliac joint.[10]They provide a method to improve restricted joint range when symptoms are movement induced. It facilitates the appropriate accessory zygapophyseal joint glide while the subject performs the symptomatic movement result in full-range pain-free movement. [18] Thus effect of SNAG correlates with the above statements.

Comparison between both groups shows that Mulligan's mobilisation SNAGS was more efficient in reduction of pain (p= 0.0012) and functional disability (p= 0.0002) than McKenzie approach post treatment. Also lumbar ROM except affected & unaffected rotation show more improvement in Mulligan's mobilisation SNAG group than McKenzie approach group.

In summary, both interventions showed significant decrease in VAS and MOLBPDI score and improved lumbar ROM. But Mulligan's mobilisation SNAGS showed extremely significant reduction in VAS and MOLBPDI score whereas significant improvement in lumbar flexion, extension, affected and unaffected lateral flexion ROM as compared with McKenzie approach in subjects with PIVD with unilateral radiculopathy.

7. Conclusion

In conclusion, the present study provided evidence to support the use of both manual therapy techniques viz McKenzie approach and Mulligan's mobilisation (SNAGS) approach in relieving pain, improving ROM and reducing functional disability in subjects with PIVD with unilateral radiculopathy. In addition, results supported that Mulligan's mobilisation (SNAGS) technique was more effective than McKenzie approach in PIVD with unilateral Radiculopathy. Thus findings of this study suggest that Mulligan's mobilisation SNAGS if added to baseline treatment is effective.

8. Future scope

The study was carried on only one stage of PIVD other stages can also be included for future studied. Studies with long term follow up & larger sample size are recommended for generalization of result. Future studies can be done using MRI scan as an outcome measure to record the changes in disc before & after the interventions so as to get objective result to support the findings. In future studies centralization of pain after each treatment session can be recorded by using body charts to know which technique causes early centralization.

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