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Efficacy of Core Strengthening Exercises and Interferential Therapy on Lumbar Range of Motion in Patients with Spondylolisthesis

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ABSTRACT

Background: Spondylolisthesis is a presumed cause of back pain. Degenerative spondylolisthesis is most commonly observed at the L4-5 level (male 3.9%, female 8.8%, total 5.9%). Various studies are available that showed the beneficial effects in the management of spondylolisthesis, but there were only a few studies conducted comparing the effect of core strengthening exercises and electrotherapy modality. Thus, the present study was designed for the comparison of core strengthening exercises and interferential therapy in patients with spondylolisthesis.
Materials and Method: A total of 42 purposively selected confirmed cases of spondylolisthesis (both male and female) aged 25-40 years were considered for the present study. The subjects were further divided into two groups for intervention. Group-A consisted of 21 subjects who were treated with interferential therapy (IFT). Group-B consisted of 21 subjects who were treated with core strengthening exercises.
Results: The results of the present study revealed that statistically significant differences were noted for lumbar range of motion between pre- and post-treatment in patients treated both with interferential therapy ($p<0.001$-0.004) (Group-A) and core strengthening exercises ($p<0.003$-0.001) (Group-B). But in post-treatment, the patients treated with core strengthening exercises had higher percentage of increment in lumbar range of motion than the patients treated with interferential therapy.
Conclusion: The findings of the present study showed that both the five weeks of treatment protocol with interferential therapy and core strengthening exercises can be used to improve the functional disability and lumbar range of motion. But the core strengthening exercises protocol showed statistically greater improvement than interferential therapy protocol.

Key Words: Core strengthening exercises, Interferential therapy, Lumbar range of motion, Spondylolisthesis.

INTRODUCTION

Spondylolisthesis is described as anterior translation of one vertebral body over another adjacent vertebra in the absence of a defect of the pars interarticularis. Patients with this condition remain asymptomatic with only occasional back pain; chronic low back pain with or without radicular symptoms; radicular symptom with or without neurological deficit; and intermittent neurogenic claudication [1]. The incidence of spondylolisthesis varies considerably depending on ethnicity, sex, family history, relevant disease and sports activity [2]. Several epidemiological studies have revealed that the incidence of symptomatic spondylolisthesis in Caucasian populations varies from 4 to 6% [3], but rises

as high as 26% in secluded Eskimo populations [4] and varies from 19 to 69% among first-degree relatives of the affected patients [5].

Spondylolisthesis should be treated first with conservative therapy, which includes physical therapy, rest, medication and brace [6]. There have been various studies available that showed the beneficial effects in the management of spondylolisthesis, but there were only a few studies conducted to compare the effect of core strengthening exercises and electrotherapy modality i.e., interferential therapy (IFT) in management of spondylolisthesis. The present study was designed for the comparison of core strengthening exercises and IFT in patients with spondylolisthesis.

MATERIALS AND METHODS

Subjects

The present study dealt with purposively selected 42 confirmed cases of spondylolisthesis (both male and female) aged 25-40 years, collected from Amandeep Hospital, Amritsar, Punjab, India. The subjects meeting the inclusion criteria were included in the study with Grade1 and Grade 2 spondylolisthesis. The subjects were further divided into two groups for intervention. Group-A consisted of 21 subjects who were treated with Interferential Therapy (IFT). Group-B consisted of 21 subjects who were treated with core strengthening exercises. A written informed consent was taken from each participating subject. A prior explanation regarding the treatment was given to the subjects who were enrolled in the study. The study was approved by institutional ethical committee.

Intervention given to the subjects

The treatment program was performed daily for five days per week i.e., Monday to Friday for five weeks. Patients with spondylolisthesis in both the groups were assessed for Lumbar Range of Motion on flexion (normal range: 0^0-80^0 with 10^0 difference), extension (normal range: 0^0 to 25^0), lateral flexion (right and left, normal range: 25^0-35^0) and rotation (right and left, normal range: 45^0) and was measured using universal goniometer [7].

Interferential Therapy (IFT)

IFT was performed after Hurley et al. [8]. Patients were asked to lie down in prone position. Two electrodes were placed unilaterally or bilaterally at the periphery of the LBP painful area. In subjects with unilateral pain, the, cathode (-) electrode was positioned at the proximal extent and the anode (+) electrode at the distal extent of the painful area. Treatment of subjects with bilateral LBP involved paraspinal application of the cathode and anode electrode at the lateral limits of the painful area, parallel to the vertebral column. IFT spinal nerve root electrode placement technique involved the placement of the midpoint of the cathode and anode electrodes lateral to the intervertebral foramen of the target spinal nerve, parallel to the vertebral column. For unilateral symptoms. The proximal cathode was placed 2 cm lateral intervertebral foramen and the distal anode electrode was placed 2 cm further laterally. Treatment of subject with bilateral LBP involved paraspinal application of the cathode and anode electrodes parallel to the vertebral column at the level of the intervertebral foramen of the paraspinal target spinal nerves. The treatment session lasted for 20-25 min.

Core Strengthening Exercises

The core strengthening exercises were performed after Venu et al. [9]. The treatment session lasted for 40-45 minutes with the protocol - day 1-3: back flexion exercises, day 3-6: pelvic tilt exercises, day 7-11: bridging Exercises, day 11-15: partial sit ups, day 11-15: partial sit ups, 3rd week: glutei stretch, 4th week: unilateral knee to chest exercises, 5th week: quadruped arm/ leg raises (bird dog exercise).

STATISTICAL ANALYSIS

Data were analyzed using SPSS (Statistical Package for Social Science) version 20.

Standard descriptive statistics (mean± standard deviation) were determined for directly measured variables. The independent t-test was used for the comparison of selected variables between patients with Group-A and B as well as within group comparison; paired t-test was applied. A 5% level of probability was used to indicate statistical significance.

RESULTS

Table 1 showed the descriptive statistics of age, height, weight and BMI in patients treated with Group-A and Group- B. The patients treated in Group A had lower mean values of age (32.19 years) and higher mean value of height (160.10 cm), weight (74.33 kg), and BMI (28.97 kg/m^2) than the patients treated in Group-B (32.76 years, 156.90 cm, 68.20 kg and 27.74 kg/m^2 respectively). However, no significant difference was noted in any case.

The descriptive statistics of different variables between pre- and post-treatment of patients treated in Group-A were shown in Table 2. The pre-treatment group had lower mean values of Lum. Flex. (62.28), Lum. Ext. (17.47), Lum. LT. Flex. Rt. (17.52), Lum. LT. Flex. Lt. (18.47), Lum. Rot. Rt. (28.52) and Lum. Rot. Lt. (29.14) as compared to post-treatment group (20.40, 4.42, 18.71, 5.80, 64.71, 19.52, 18.95, 20.61, 30.42 and 32.14 respectively). Statistically significant differences (p<0.001-0.004) were noted in Lum. Flex. (t=4.808), Lum. Ext. (t=4.982), Lum. LT. Flex. Rt. (t=3.521), Lum. LT. Flex. Lt. (t=3.305), Lum. Rot. Rt. (t=3.9071) and Lum. Rot. Lt. (t=6.275).

Table 3 showed the descriptive statistics of different variables between pre- and post-treatment of Group-B. The patients with pre-treatment group had lower mean values of Lum. Flex. (63.00 cm), Lum. Ext. (17.95 cm), Lum. LT. Flex. Rt. (17.38 cm), Lum. LT. Flex. Lt. (17.90 cm), Lum. Rot. Rt. (28.95 cm) and Lum. Rot. Lt. (28.00 cm) as compared to post-treatment (70.0 cm, 22.57cm, 25.57cm, 27.28 cm, 35.09 cm and 36.47 cm respectively). Statistically significant differences (p<0.003-0.001) were found in Lum. Flex. (t=12.298), Lum. Ext. (t=7.462), Lum. LT. Flex. Rt. (t=10.385), Lum. LT. Flex. Lt. (t=10.202), Lum. Rot. Lt. (t=8.327) and Lum. Rot. Lt. (t=6.489).

The descriptive statistics of different variables between post –treatment of Group-A and Group-B were given in Table 4. Patients treated with Group-A had lower mean values in Lum. Flex. (64.71 cm), Lum. Ext. (19.52 cm), Lum. LT. Flex. Rt. (18.95 cm), Lum. LT. Flex. Lt. (20.61 cm), Lum. Rot. Rt. (30.42 cm) and Lum. Rot. Lt. (32.14 cm) than the patients treated with Group-B (70.09 cm, 22.57 cm, 25.57 cm, 27.28 cm, 35.09 cm and 36.47 cm respectively). Nevertheless, statistically significant differences (p<0.oo5-0.001) were observed in Lum. Flex. (t=3.368), Lum. Ext. (t=3.371), Lum. LT. Flex Rt. (t=6.066), Lum. LT. Flex. Lt (t=4.402), Lum. Rot. Rt. (t=3.869) and Lum. Rot. Lt. (t=2.941).

Table 1. Descriptive statistics of age, height, weight, BMI in patients treated with Group-A and Group- B

Variables	Group-A (IFT)		Group-B (CSE)		t- value	p-value
	Mean	SD	Mean	SD		
Age (years)	32.19	3.54	32.76	4.59	4.51	6.54
Height (cm)	160.10	6.21	156.90	5.34	1.787	0.82
Weight(kgs)	74.33	8.27	68.20	7.09	2.575	0.014
BMI (kg/m^2)	28.97	3.38	27.74	2.94	1.259	0.215

Table 5 showed the percentage increment of different variables of the patients treated with Group-A and Group-B. Patients with Group-B had higher percentage of increment in lumbar Range of Motion Lum. Flex. (11.25%), Lum. Ext. (25.73%), Lum. LT. Flex. Rt. (47.12%), Lum. LT. Flex. Lt. (52.40%), Lum. Rot. Rt. (21.20%), Lum. Rot. Lt. (30.24%) than Group A (3.90%, 11.73%, 8.16%, 11.58%, 6.66% and 10.29% respectively).

Table 2. Descriptive statistics of different variables between pre- post treatment in Group-A

Variables	Pre-treatment		Post-treatment		t-value	p-value
	Mean	SD	Mean	SD		
Lum.Flex.(Degree)	62.28	4.49	64.71	4.40	4.808	<0.001
Lum. Ext.(Degree)	17.47	2.37	19.52	2.71	4.982	<0.001
Lum.LT. Flex. Rt. (Degree)	17.52	1.91	18.95	2.39	3.521	<0.002
Lum.LT. Flex. Lt.(Degree)	18.47	1.66	20.61	3.69	3.305	<0.004
Lum.Rot. Rt.(Degree)	28.52	3.23	30.42	3.23	3.907	<0.001
Lum.Rot. Lt.(Degree)	29.14	2.10	32.14	2.68	6.275	<0.001

Table 3. Descriptive statistics of different variables pre- post treatment in Group B

Variables	Pre-treatment		Post-treatment		t- value	p-value
	Mean	SD	Mean	SD		
Lum. Flex.(Degree)	63.00	7.12	70.0	5.84	12.298	<0.001
Lum. Ext.(Degree)	17.95	2.59	22.57	2.52	7.462	<0.001
Lum.LT. Flex. Rt. (Degree)	17.38	3.12	25.57	4.38	10.385	<0.001
Lum.LT. Flex.Lt.(Degree)	17.90	2.82	27.28	5.87	10.202	0.001
Lum.Rot. Rt.(Degree)	28.95	3.74	35.09	4.48	8.327	<0.001
Lum.Rot. Lt.(Degree)	28.00	4.30	36.47	6.19	6.489	<0.001

Table 4. Descriptive statistics of different variables between post- treatment of Group-A and Group-B

Variables	Group A (IFT)		Group B (CSE)		t-value	p-value
	Mean	SD	Mean	SD		
LumFlex.(Degree)	64.71	4.40	70.09	5.84	3.368	<0.002
Lum Ext.(Degree)	19.52	2.71	22.57	2.52	3.771	<0.001
LumLT. Flex. Rt.(Degree)	18.95	2.39	25.57	4.38	6.066	<0.001
Lum.LT Flex. Lt.(Degree)	20.61	3.69	27.28	5.87	4.402	<0.001
Lum.Rot. Rt.(Degree)	30.42	3.23	35.09	4.48	3.869	<0.001
Lum.Rot. Lt.(Degree)	32.14	2.68	36.47	6.19	2.941	<0.005

Table 5. Descriptive statistics of percentage increment of lumbar range of motion variables in Group A and B

Variables	Group A(IFT)	Group B(CSE)
Lum.Flex.(Degree)	3.90%	11.25%
Lum.Ext.(Degree)	11.73%	25.73%
Lum. LT.Flex. Rt.(Degree)	8.16%	47.12%
Lum.LT.Flex.Lt.(Degree)	11.58%	52.40%
Lum. Rot.Rt.(Degree)	6.66%	21.20%
Lum.Rot.Lt.(Degree)	10.29%	30.24%

DISCUSSION

Spondylolisthesis is a presumed cause of back pain. Degenerative spondylolisthesis was most commonly observed at the L4-5 level (male 3.9%, female 8.8%, total 5.9%). (Kalichman et al., 2010).

The finding of present study showed that the patients treated with both IFT and core strengthening exercises had the significantly higher mean values in post- treatment phase for Lum. Flex., Lum. Ext., Lum. LT. Flex. Rt., Lum. LT. Flex. Lt., Lum. Rot. Rt. and Lum. Rot. Lt. as compared to pre-treatment phase. But the core strengthening exercises group had significantly greater improvement in lumber range of motion.

These differences were seen due to effectiveness of core strengthening of back muscles. According to Arab and Nourbakhsh [10], specific muscle tightness (i.e. erector spinae, psoas, iliotibial band, hip external rotators, hamstrings, and gastrocnemius) was commonly found in association with low back pain. Tightness of these specific muscles affected the biomechanics of the lumbar spine, diminishing the shock absorbing capacity of the lumbar segments and increasing compression force on the lumbar spine. Muscular stretching programs are designed to progressively stretch. The muscle groups which are assumed to be too tight and improve the body biomechanics [11], the results of this study supported by the previous studies and there are evidences to support exercise therapy for patients with chronic low back pain, spondylolisthesis. Exercise therapy can be performed as self-care exercise performed by the patient or as supervised exercise. Supervised exercise therapy is recommended by clinical practice guidelines as an effective intervention for

patients with chronic low back pain. So the exercise therapy or core strengthening exercises should be done in case of spondylolisthesis in order to reduce pain and increase lumbar range of motion.

Core strength is essential for functional strength and the ability of the neuromuscular system to reduce force, produce force and stabilizes dynamically the kinetic chain; the core musculature also helps to protect it from unwanted forces that are part of functional movements [13-15].

When comparing the post-treatment means for the Group-A and Group-B, we found that Group-A had lower mean value in Lum. Flex. (64.71), Lum. Ext. (19.52), Lum. LT. Flex. Rt. (18.95), Lum. LT. Flex. Lt. (20.61), Lum. Rot. Rt. (30.42), Lum. Rot. Lt. (32.14) than the Group B (17.57, 2.52, 16.42, 3.95, 70.09, 22.57, 25.57, 27.28, 35.09 and 36.47 respectively) and statistically significant difference was observed in ODI ($t=2.247$; $p<0.030$) VAS ($t=5.500$; $p<0.001$), MG. S (1.904; $p<0.064$) MG. A ($t=5.860$; $p<0.001$), Lum. Flex. ($t=3.368$; $p<0.002$), Lum. Ext. ($t=3.371$; $p<0.001$) Lum. LT. Flex Rt. ($t=6.066$; $p<0.001$) Lum. LT. Flex. Lt. ($t=4.402$)

CONCLUSION

The findings of the present study showed that both the five weeks of treatment protocol with interferential therapy and core strengthening exercises can be used to improve the functional disability and lumbar range of motion. But the core strengthening exercises protocol showed statistically greater improvement than interferential therapy protocol in all the variables studied.

Declaration by Authors

Ethical Approval: Approved.

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Conflict of interest: The authors declare no conflict of interest.

REFERENCES

1. Leonidou A, Lepetsos P, Pagkalos J, Antonis K, Flieger I, Tsiridis E, Leonidou O. Treatment for spondylolysis and spondylolisthesis in children. Journal of Orthopaedic Surgery 2015, Dec; 23(3):379-382.
2. Foreman P, Griessenauer CJ, Watanabe K, Conklin M, Shoja MM, Rozzelle CJ, Loukas M, Tubbs RS. L5 spondylolysis/spondylolisthesis: a comprehensive review with an anatomic focus. Child's Nervous System 2013 Feb 29(2):209-216.
3. McTimoney CA, Micheli LJ. Current evaluation and management of spondylolysis and spondylolisthesis. Current Sports Medicine Reports 2003, Feb; 2(1):41-46.
4. Stewart TD. The age incidence of neural-arch defects in Alaskan natives, considered from the standpoint of etiology. Joint and Bone Joint Sugery 1953, Oct; 35(4):937-950.
5. Lonstein JE. Spondylolisthesis in children: cause, natural history, and management. Spine 1999, Dec; 24(24): 2640.
6. Serena SH. Spondylolisthesis and spondylolysis/S. Hu Serena, B. Tribus Clifford, M. Diab, AJ Ghanayem. Journal of Bone and Joint Surgery 2008, 90:656-671.
7. Norkin CC, White DJ. Measurement of joint motion: A guide to goniometry. FA Davis, 2016.
8. Hurley DA, Minder PM, McDonough SM, Walsh DM, Moore AP, Boxter DG. Interferential therapy electrode placement technique in acute low back pain: A preliminary investigation. Archives of Physical Medicine and Rehabilitation 2001, 82(4): 485-493.
9. Venu A, Andrea F, Tamara M, Michael F. Core stability exercise principles. Current Sports Medicine Reports 2008, 7(1): 39-44.
10. Arab AM and Nourbakhsh MR. The relationship between hip abductor muscle strength and iliotibial band tightness in individuals with low back pain. Chiropr Osteopat, 2010, 13; 18: 1.
11. Page P. Current concepts in muscle strengthening for exercise and rehabilitation. International Journal of Sports and Physical Therapy 2012, 7(1): 109-119.

12. Verma SL, Sheikh J, Mehato RK, Sheth MS. Prevalence of forward head posture among 12–16-year-old school going students-A cross-sectional study. Journal of Applied Medical Research 2018, 4(2):18-21.
13. Bliven KCH and Anderson BE. Core stability training for injury prevention. Sports Health 2013, 5(6): 514-522.
14. Hebert JJ, Koppenhaver SL, Magel JS, Fritz JM. The relationship of transversus abdominis and lumbar multifidus activation and prognostic factors for clinical success with a stabilization exercise program: a cross-sectional study. *Arch Phys Med Rehabil*. 2010; 91(1):78-85.
15. Hodges PW, Richardson CA. Inefficient muscular stabilization of the lumbar spine associated with low back pain. A motor control evaluation of transversus abdominis. *Spine (Phila Pa 1976)*. 1996;21: 2640-2650 Muscolino J. Upper Crossed Syndrome. Journal of the Australian Traditional-medicine Society 2015, 21(2): 80-85.

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