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Original Research Article

COMBINED EFFECTS OF NEURODYNAMICS AND LUMBAR TRACTION ON SCIATICA DUE TO DEGENERATIVE DISC DISEASE

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ABSTRACT

Introduction: Disc space variation, neural mobility and their relation to sciatica symptoms in degenerative disc disease is still a challenging area to work, Sciatica is a common diagnosis causing the pain, weakness, numbness or tingling in the leg, with compromise in quality of life, functional activity. , lifetime incidence of sciatica varying from 13% to 40%, annual incidence ranges from 1% to 6 % in India.

Materials and Methods: 42 subjects with sciatica due to degenerative disc disease were included and 35 completed study, with age >25 years, both sexes. Group1 (G1): control, Group2 (G2) received neurodynamics treatment, Group 3 (G3) received lumbar traction, Group 4 (G4) received both neurodynamics and lumbar traction. Efficacy of treatment of experimental groups (G2,3,4) was assessed on 1st day and at the end of 2 week with 1. Magnetic resonance imaging (MRI) for disc parameters, 2. pain by VAS, 3. Range of motion by goniometer and 4. functional rating scales sciatica bothersomeness index, maineseattle back questionaaire and Hopkins symptom checklist-25. The data subjected to statistical analysis using descriptive and inferential statistics.

Results: Combined group (G4) showed better outcome in all parameters than neurodynamics (G2) or traction alone (G3). Traction alone Group (G3), combined group (G4) have got similar changes in MRI disc parameters better than neurodynamics alone group (G2).

Discussion: Findings suggests that 2 weeks treatment showed variable improvements in all groups on MRI of L4-L5 and L5-S1, functional outcome, pain and ADL activities. Effectiveness of lumbar traction is evident in group 3 and 4, effectiveness of Neurodynamics is evident in group 2, only in group 4 all parameters improved this can be attributed to combined effect.

Conclusion: Neurodynamics may be effective on reducing the mechanosensitivity of nerve and traction may be useful for decompression of segment. In order to address pain, function and ADL activities combination of traction and Neurodynamics showed better results than traction or Neurodynamics alone in this study.

KEY WORDS: Neurodynamics, Lumbar traction, Sciatica, Degenerative disc disease.

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INTRODUCTION

Sciatica is a set of symptoms irritating the root of the nerve, causing the pain, weakness, numbness or tingling in the leg or in some cases pain radiating along the sciatic nerve, which runs down hip, one or both legs from the lower back, outer side of the leg and is defined as pain resulting from pressure or irritation of the sciatic nerve often caused by degeneration of inter vertebral disk.

Sciatica is a relatively common condition with a lifetime incidence varying from 13% to 40%. The common corresponding annual incidence of an episode of sciatica ranges from 1% to 6 % in India [1]. The sequelae of disc degeneration may lead to functional incapacity in both sexes and this chronic disability might affect their quality of life. The site of disc herniation appears to change with age. Majority of disc herniations occur at the L4/5 or L5/S1 level, as per the literature peak incidence is from 30 to 55 years of age, with 98% involving the L4-5 (L5 nerve root) or L5-S1(S1 nerve root) [2,3]. Disk degeneration involves structural disruption and cell-mediated changes. Variability of degree of cascade degeneration in different individuals may be related to variable factors like Mechanical, traumatic, nutritional, and genetic factors.

Presentation of pain in degenerative disease is a combination of mechanical deformation and the presence of inflammatory mediators. Degenerative disc disease (DDD) is fairly common whatever the reasons may be 85%-95% of adults show evidence of some degree of degenerative disc disease [4], in 30% of people aged between 30-50 years may have some degree of degeneration [5].

Sciatica pain management with Physiotherapy by Interferential therapy, transcutaneous electrical stimulation, Short wave Diathermy, Ultrasound therapy etc are becoming supportive modalities and treatment direction is more emphasized towards underlying pathophysiology of sciatica with more clinical reasoning. In sciatica with degenerative disc disease, treatment is mainly focused towards spinal decompression, reduction in mechano sensitivity of nerve along with electrotherapeutic modalities.

Mechanical spinal decompression of vertebral segments along longitudinal axis of the spinal column is done by traction with force up to one-third of body weight for lumbar disc decompression [6-8] and Neurodynamics is used to influence pain physiology *via* mechanical treatment of neural and non-neural structures surrounding the nervous system [9] to improve neural mobility, axoplasmic flow, intraneural blood flow, mechanosensitivity thereby reduction in inflammation of neural tissues [10,11]. With current understanding of individual modalities and their efficacy on sciatica with degenerative disc disease present study focused more on combined effects of neurodynamics and lumbar traction on sciatica due to degenerative disc disease and also lumbar traction or neurodynamics alone.

Aims and objectives: Present study aimed at Finding the effectiveness of traction on disc space of L4-L5 and L5-S1 regions. Neurodynamics on neural mobility, mechanosensitivity and Combined effects of traction and Neurodynamics and their correlation with functional outcome, pain and ADLs in patients with sciatica due to degenerative disc disease.

Inclusion criteria:

Experimental groups:

· Sciatica with degenerative disc disease verified by MRI.

· Subjects with Age above 25 years (both sexes)

· Symptoms correlating to Sciatica with subjective discomfort (interference of function and ADL activities).

Control group:

· Age matched normal volunteer subjects.

Exclusion criteria:

Subjects were not considered for the study with any condition that might cause sciatica symptoms other than degenerative disc disease like Acute Intervertebral Disc Prolapse, Spondylolisthesis, Spinal stenosis, Piriformis Syndrome, Osteoporotic spine, Pregnancy, Spinal trauma, Spinal tumors, Myelomalacia, Prior to surgery at the same disc level, Fracture, Infection, Malignancy and all other sciatica mimicking conditions apart from degenerative disc disease.

Materials used for the study: Magnetic resonance imaging, Universal Goniometer, Mechanical lumbar traction machine, Split table, Traction harness, Treatment couch.

Study Design: Randomized Control Trail

Study Setting: Department of Physiotherapy, Nazism's Institute of Medical Sciences. The subjects were recruited from the out-patient department of neurology who were referred to physiotherapy for treatment of sciatica due to degenerative disc disease.

Target Population: Sciatica caused due to degenerative disc disease with age above 25 years.

Sampling Method: Randomized chits method without replication

Outcome measures:

Visual analogue scale: (VAS): The subjects will be explained about 0-10 point VAS and asked to make one number that most closely describes their present pain which affects their ability to manage in everyday life and will be documented.

Goniometer: To assess the range of straight leg rising.

Sciatica Bothersomeness Index(SBI): Each symptom item is rated on a scale from 0 to 6, with 0 being not bothersome, 3 somewhat bothersome and 6 extremely bothersome.

Maine- Seattle back questionnaire(MSBQ): was used to assess disability and functional limits caused by sciatica and back pain. This questionnaire was developed from the Roland Morris disability Questionnaire and was modified for sciatica in the Maine study. The scale comprises 12 items. Each with the answer yes (1) or no (0). The score ranges from 0 to 12, and a higher score indicates worse symptoms.

The Hopkins symptom check list(HSCL) -25: was designed to measure emotional distress. The questionnaire includes 25 items on depression, anxiety, and somatization during the previous week, and the scores range from 1 (not at all) to 4 (extremely). Adding all item scores and dividing the sum by the number of completed items yields a mean score. A Norwegian epidemiological study found that patients with scores > or equal to 1.75 are in need of care.

MRI: subjects were examined for diagnosis of sciatica with degenerative disc disease, degenerative changes seen at L4-L5 and L5-S1 regions in sagittal and axial sections of T2 weighted images. Following parameters are recorded 1. Average thickness of the disc (ATD), 2. Disc: body ratio (DBR), 3. Nucleus: annulus ratio (NAR) and 4.Foraminal height (FH).

Methodology:

160 subjects with sciatica due to degenerative disc disease were examined. Subjects participated in the study are requested to read the patients information sheet and sign the informed consent form approved by the institutional ethics committee prior to the recruitment process. 42 subjects who met inclusion criteria were randomly allocated into three experimental groups by simple random sampling using chit method without replication, out of 42 subjects 35 completed study. 10 age matched normal volunteer subjects were included in control group.

Subjects were recruited from the outpatient Department of physiotherapy and Neurology, Nizam's Institute of Medical Sciences, diagnosis made initially by the referring physician. Subjects with more than 25 years age, with complaints of sciatica are primarily examined by Neurologist for sciatica diagnosis, then screened by radiologist for degenerative disc disease, corresponding level, side, average thickness of the disc, disc: body ratio, nucleus: annulus ratio and foraminal height on magnetic resonance imaging and referred to Physiotherapist for assessment and documentation of symptoms and correlation of findings. All experimental groups subjects were examined for baseline values on 1st day and at the end of 2nd week of treatment protocol with Sciatica Bothersomeness Index, Maine-Seattle Back Questionnaire, Hopkins Symptom Checklist-25, Visual Analogue Scale, Goniometer and sagittal and axial sections of T2 weighted MRI ofL4-L5 and L5-S1 disc. Subjects of control group underwent MRI once for disc parameters as baseline to compare with experimental groups.

Treatment:

Neurodynamics group: Received 2 weeks of

Neurodynamics treatment. 5 days a week for two weeks, treated with sliders and tensioners techniques with 4-5 sets for one session of 12-15 oscillations/min with 1 min rest between each session for 10 days in supine and sitting positions as per Micheal shacklock guidelines.

Traction group: Subjects received 2 weeks of treatment with intermittent lumbar traction using following parameters: 12mins with 1/3 of total body weight of the patient with 75% hold time and 25% rest time. 5 days a week for two weeks.

Combined (Neurodynamics + Traction) group: subjects received 2 weeks of treatment with intermittent lumbar traction and Neurodynamics both (treatment of group 1 and 2) 5 days a week for two weeks.

RESULTS AND DISCUSSION

Table 1: Average Age.

	Mean	SD
G1	30	5
G2	43	9
G3	42	7
G4	53	10

Table 2: Average VAS and Goniometer values.

	VAS		Goniometer (SLR)	
	Mean pre	Mean po	Mean pre	Mean po
G2	5	2	59	79
G3	7	3	60	80
G4	7	2	55	84

Table 3: Average SBI, MSBQ, HSCL values.

	SBI		MSBQ		HSCL	
	Mean pre	Mean po	Mean pre	Mean po	Mean pre	Mean po
G2	8	3	7	3	0.04	0.02
G3	16	7	8	4	0.14	0.05
G4	11	2	9	2	0.16	0.05

Table 4: Average ATD values.

	ATD L4-L5 Pre	ATD L4-L5 po	ATD L5-S1pre	ATD L5-S1 po
G1	11.67		11.18	
G2	10.9	10.9	10.98	10.98
G3	12.65	12.84	10.28	10.63
G4	11.72	11.97	11.34	11.5

Table 5: Average DBR values.

	DBR L4-L5		DBR L5-S1	
	Mean pre	Mean po	Mean pre	Mean po
G1	0.51		0.5	
G2	0.52	0.52	0.53	0.53
G3	0.48	0.49	0.48	0.49
G4	0.57	0.58	0.52	0.53

Table 6: Average FH L4-L5 Rt and Lt side values.

	FH R, L4-L5 pr	FH R, L4-L5 po	FH L, L4-L5 pr	FH L, L4-L5 po
G1	3.022		2.775	
G2	2.045	2.045	2.221429	2.221429
G3	1.716667	1.84	1.561429	1.505
G4	1.797143	1.895714	1.63	1.6075

Table 7: Average FH L5-S1 Rt and Lt side values.

	FH R, L5-S1 pr	FH R, L5-S1 po	FH L, L5-S1 pr	FH L, L5-S1 po
G1	4		3.73	
G2	2.203333	2.203333	2.571429	2.571429
G3	1.886667	1.973333	2.105714	2.221429
G4	1.874286	2.002857	2.134286	2.228571

Table 8: Average NAR values.

	NAR L4-L5 pr	NAR L4-L5 po	NAR L5-S1 pr	NAR L5-S1po
G1	1.6		1.45	
G2	1.1	1.1	0.97	0.97
G3	1.13	1.2	1.11	1.23
G4	1.06	1.12	1.08	1.12

Table 9: Control group(G1) average values.

Parameter	Mean and SD
Age	30 ± 5
ATD L4-L5	11.67 ± 2.08
ATD L5-S1	11.18 ± 2.60
DBR L4-L5	0.51 ± 0.06
DBR L5-S1	0.50 ± 0.12
FH L4-L5 Rt	3.02 ± 1.23
FH L4-L5 Lt	2.78 ± 1.20
FH L5-S1Rt	4.00 ± 1.19
FH L5-S1 Lt	3.73 ± 1.41
NAR L4-L5	1.60 ± 0.38
NAR L5-S1	1.45 ± 0.38

Fig. 1: pre and post means in VAS, SBI, MSBQ.

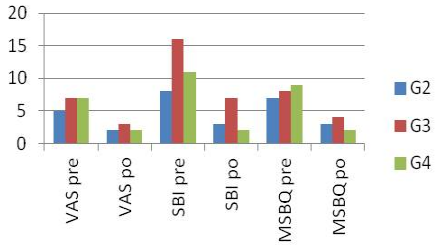


Fig. 2: pre and post means in SLR, HSCL.

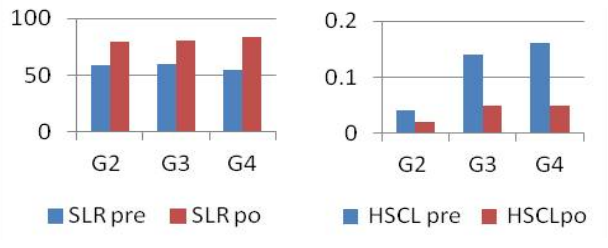


Fig. 3: pre and post means in ATD, DBR.

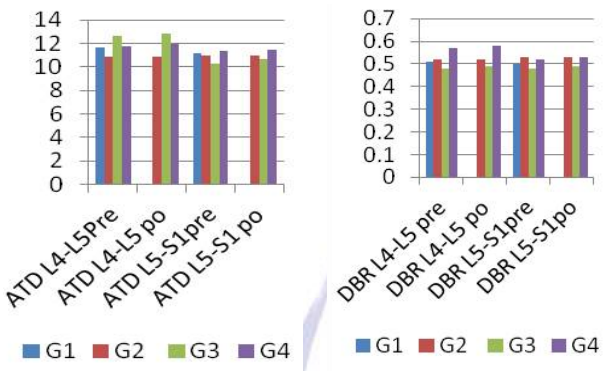
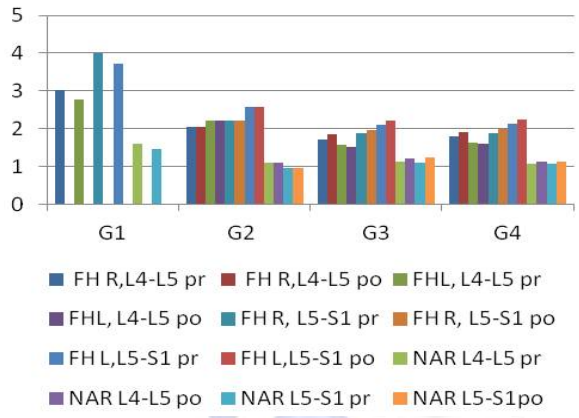


Fig. 4: mean differences in FH, NAR.



Total study population is 52 (experimental (42) plus control group (10)): only 35 subjects in experimental groups completed two weeks protocol (8 in Neurodynamics group, 8in traction group and 9 in combined group ; Seven dropouts). 10 subjects in control group as age matched people for MRI comparison.

Age of subjects in Years ranging from 30±5 in control group (G1), 43±9 in Group 2 (G2), 42±7 in Group 3 (G3) and 53±10 in Group 4 (G4). The efficacy of treatment is assessed by visual analogue scale, Goniometer, Sciatica bother-someness index, Maineseattle back questionaaire, Hopkins symptom checklist-25 and Magnetic resonance imaging.

VAS scores of each group varied differently in different experimental groups, though all groups showed reduction in Vas scores G4 has much greater reduction. VAS score were significantly different on wilcoxon signed ranks test.

SBI, MSBQ and HSCL scores were analyzed using paired T test. On SBI, G3 and G4 showed similar outcome and better than G2. MSBQ showed similar resultsin G2, G3 but less than G4 scoring. (Table 3), (Fig:1).

On Goniometer (SLR), G2 and G3 showed similar results in SLR range improvement but G4 has greater degrees of improvement. This indicates both Neurodynamics and Traction are effective, Neurodynamics works on mobility of nerve and traction helps in reducing the pressure on nerve. Combination of both helps in providing more physiological benefit for recovery. On HSCL three groups showed different outcomes but improvements are G4 >G3>G2 (Table:3), (Fig:2).

At the end of 2nd week treatment G3 and G4 showed improvement in disc thickness (ATD) and DBR than G2, at L4-L5 and L5-S1 region (Table 4,5),(Fig. 3).

Foraminal height variations are not that significant in neurodynamics group when compared with group 3 and group 4, VAS variations were not exactly correlating with the foraminal compression, NAR also following same trend. Underlying reasons can be taken up as new study (Table 7,8), (Fig. 4).

Age matched subjects were taken in to control group (G1) to have normative data for comparison of experimental groups MRI parameters. Total number of subjects in control group are 10, age 30±5, average thickness of disc (ATD) in millimeters at L4-L5 is 11.67, at L5-S1 is 11.18, Disc to body ratio (DBR) at L4-L5 is 0.51 , at L5-S1 is 0.51, Foraminal Height (FH) in millimeters at L4-L5 Right (Rt) side is 3.02, Left (Lt) side 2.78, at L5-S1 Right (Rt) side is 4, Left (Lt) side 3.73. Nucleus to Annulus ratio at L4-L5 is 1.60 , at L5-S1 is 1.45 (Table 8)

CONCLUSION

The inference from the overall study revealed that group 4 with combined neurodynamics and traction showed better improvement in terms of decreased pain, improved functional outcome , activities of daily living , decreased anxiety and emotional distress when compared to neurodynamics and lumbar traction alone .But traction(G3) and combined neurodynamics and traction(G4) have shown equal improvement in MRI outcome and is shown better than neurodynamics group(G2<G3,G4). MRI outcome is not significant after two weeks but they showed reduction in VAS, it incurs that mechanosensitivity of the nerve also causes

symptoms without actual disc compression. This area can be taken up as further study to identify neural sensitivity markers and its relation to pain in sciatica due to degenerative disc disease.

Hence from the study it can be concluded that combined effects of neurodynamics and lumbar traction produces more effect than using lumbar traction or neurodynamics alone which helps in both foraminal decompression and reduction of mechanosensitivity of nerve in sciatica due to degenerative disc disease.

ABBREVIATIONS

G - group
Pre/pr - prior
Po - Post
L/ Lt - Left
R/ Rt - Right
VAS - Visual Analog Scale
SLR - Straight Leg Raise
Rom - Range of Motion
SBI - Sciatica Bothersomeness Index
MSBQ - Maine- Seattle back questionnaire
HSCL - Hopkins symptom check list
ATD - Average thickness of disc
DBR - Disc to body ratio
FH - foraminal height
NAR - Nucleus to annulus ratio

Conflicts of interest: None

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