

Original Research Article

Effects of Four Different Hold and Rest Time Combinations of Intermittent Lumbar Traction in the Treatment of Lumbar Intervertebral Disc Prolapse: A Comparative Study

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ABSTRACT

Objective: The purpose of this study was to compare the effectiveness of four different hold and rest time combinations in the treatment of lumbar intervertebral disc prolapse.

Methodology: A total number of forty subjects who fulfilled the inclusion criteria were recruited in the study. The subjects were divided into four groups of 10 each. Group A received intermittent lumbar traction of 20second hold with 1second rest, group B received traction of 40second hold with 5second rest, group C received 60second hold with 10second rest and subjects in group D received 80second hold with 20second rest. The scores of Modified-Modified Schober's test, Modified Oswestry Low Back Pain Disability Questionnaire, VAS and Straight Leg Raise were collected from the subjects before and one week after the intervention.

Results: All four groups showed improvements after one week of intervention. Groups with a longer hold and rest times i.e., 60second hold with 10second rest and 80second hold with 20second rest showed a higher statistical significance with a value ($p < 0.05$) for modified-modified Schober's test, Modified Oswestry Low Back Pain Disability Questionnaire, VAS and Straight Leg Raise.

Conclusion: Based on the above results groups with longer hold and rest times i.e., groups 60s hold with 10s rest and 80s hold with 20s rest showed greater improvements in lumbar ROM, reduction in disability scores, improved mobility of the lower extremity during SLR test and a abatement in VAS scores. Thus the present study concludes that intermittent lumbar traction with longer hold and rest times is more effective in the treatment of lumbar intervertebral disc prolapse.

Key words: Intervertebral Disc Prolapse, Intermittent Lumbar Traction, Hold and Rest time.

INTRODUCTION

Intervertebral disc prolapse is rapidly emerging as a global health problem that might inflict a pandemic level by 2030. The prevalence rate of low back pain in a number of studies ranged from 22%-65% in one year and the lifetime prevalence ranged from 11%-84%.^[1]

Intervertebral disc prolapse is a medical condition affecting the spine in

which a tear in the outer, fibrous ring (annulus fibrosus) of an intervertebral disc allows the soft, central portion (nucleus pulposus) to bulge out beyond the damaged outer rings.^[2]

Traction has been used as a medical intervention since antiquity. Today, traction continues to be a commonly employed modality for treating patients with back and leg pain. Spinal elongation through an increase of

intervertebral space and relaxation of spinal muscles is assumed to be the most important of the proposed mechanisms by which traction could be effective. [3] It is the appliance of forces to stretch the periarticular tissues and musculature, separate joint surfaces, reduces intradiscal pressure and retracts the herniated disc material.” The traction effort may be continuous or intermittent, and may be applied manually or by machines. [4]

If intermittent traction is selected, the maximum traction force is applied during the hold time and a lower traction is applied during the relax time. The recommended ratio and the duration of hold and relax times depends on the patient’s condition and tolerance. In general, if intermittent traction is used for treatment of a disc problem, longer hold times, of approximately 60sec, and shorter relax time of approximately 20sec, are recommended. [5] Letchuman et al used intermittent traction with 10s hold and 10s rest and found the treatment effective in reducing symptoms and an improvement in activities of daily living. [6] Lidstrom in his study used intermittent pelvic traction with 4s hold and 2s rest for which traction appeared to reduce subjective symptoms of the participants in the study. [7]

MATERIALS AND METHODS

Subjects diagnosed with lumbar intervertebral disc prolapse by a primary physician/ orthopaedician of Justice. K.S Hegde Charitable Hospital, Mangalore were included in the study. Fifty subjects diagnosed with lumbar IVDP (acute / subacute) were enrolled for the study after taking the informed consent, out of which forty subjects who fulfilled the inclusion criteria were recruited in the study through purposive sampling. The subjects were randomly assigned into four groups of 10 each.

Subjects were included in the study if they satisfied the following inclusion criteria: Age 18-45 years, Sex-Male and

Female, subjects with lumbar IVDP stage of degeneration/protrusion (bulge) confirmed by radiography (x-ray, MRI etc) with or without radiculopathy, both single and multiple level lumbar disc prolapse, acute and sub-acute IVDP:- IVDP of less than 12 weeks duration, or a recurrent episode with a pain free period of at least three months prior to the onset of this episode, VAS score more than 3 on 10 point scale.

The subjects were excluded if they had a previous spinal surgery, last stage of IVDP (sequestration stage), formal therapeutic or medical intervention within the last three months e.g.: steroid injections, co-existing conditions like ankylosing spondylitis, RA, spinal stenosis, spondylolisthesis, recent spinal fracture, spinal tumour or a patient where secondary metastases was suspected, any systemic condition, long term oral steroid intake, osteoporosis, pregnancy, hip pathologies, VAS score less than 3 on 10 point scale.

Ethical approval was granted from the Central Ethical Committee of Nitte University, Mangalore. An informed written consent was collected from all the subjects included in the study after being diagnosed with lumbar intervertebral disc prolapse by a primary physician/ orthopaedician of Justice. K.S Hegde Charitable Hospital, Mangalore. Forty subjects who met the inclusion criteria were included in the study.

Before treatment allocation baseline parameters such as height, weight, BMI and waist- hip ratio was measured. Outcome measures such as:

VAS: It is a simple robust pain measurement tool. It can be used to measure severity and improvement. The VAS is usually designed as a 10cm line with descriptors at each end. In the reliability study p values varied from 0.60 to 0.77; and the validity from 0.76 to 0.84. [8]

Modified Oswestry Low Back Pain Disability Questionnaire: The Modified Oswestry Disability Index is an extremely important tool that researchers and disability evaluators use to measure a patient's permanent functional disability. Test-Retest reliability varies from 0.88 to 0.94. [9]

Modified- Modified Schober's test: This technique involves using a tape measure held directly over the spine between points 10cm above the lumbosacral junction with the patient in the neutral standing position. Pearson product- Moment Correlation Coefficients for test-retest reliability varied from 0.78 to 0.89 for lumbar flexion and from 0.69 to 0.91 for extension. [10]

SLR: With the patient in the supine position, the hip medially rotated and adducted and the knee extended, the examiner flexes the hip until the patient complains of pain or tightness in the back or back of the leg. It has 0.93 reliability and 98% validity. [11]

These were measured at baseline before the treatment. All subjects were treated with similar traction apparatus and the four intervention groups were treated once a day for one week for 15-20 minutes per session.

Group A:

Subjects in this group received intermittent lumbar traction of 20s hold with 1s rest.

Group B:

Subjects in this group received intermittent lumbar traction of 40s hold with 5s rest.

Group C:

Subjects in this group received intermittent lumbar traction of 60s hold with 10s rest.

Group D:

Subjects in this group received intermittent lumbar traction of 80s hold with 20s rest.

After one week of intervention post test scores of VAS, Modified Oswestry Low Back Pain Disability Questionnaire, Modified- Modified Schober's test and SLR were assessed.

RESULTS

Table 1: Descriptive statistics for Height, Weight, BMI and Waist-hip ratio

		20s hold + 1s rest	40s hold +5s rest	60s hold +10s rest	80s hold +20s rest
Height (cm)	Minimum	150	150	158	157
	Maximum	168	180	177	184
	Mean	158.5	161.5	163.6	167.2
	Standard Deviation	5.12	9.81	6.41	8.72
Weight (kg)	Minimum	40	44	50	56
	Maximum	56	69	72	70
	Mean	50.10	57.00	58.60	62.20
	Standard Deviation	5.40	8.47	6.78	5.13
BMI (kg/m ²)	Minimum	16.86	14.80	16.90	17.70
	Maximum	23.30	24.40	28.84	27.23
	Mean	19.80	21.65	21.94	22.39
	Standard Deviation	2.27	2.79	3.44	2.98
Waist-hip ratio (cms)	Minimum	0.72	0.78	0.72	0.74
	Maximum	0.87	0.97	0.87	0.94
	Mean	0.79	0.85	0.80	0.85
	Standard Deviation	0.04	0.05	0.05	0.05

Based on the above descriptive statistics, the baseline parameters were not equally distributed in all the four groups

Table 2: Paired sample statistics of Modified-modified Schober's test for flexion

Schobers Test for flexion	Mean	S.D	Std. Error Mean	95% C.I for difference	Paired t test value	P value	
20s hold+ 1s rest	Pre	16.56	1.321	0.467	-1.365 to 0.365	1.366	0.214
	Post	17.06	1.116	0.395			
40s hold+5s rest	Pre	16.33	1.000	0.333	-0.745 to -0.144	3.411	0.009
	Post	16.78	1.034	0.345			
60s hold+10s rest	Pre	17.45	1.423	0.450	-0.989 to -0.311	4.333	0.002
	Post	18.10	1.197	0.379			
80s hold+20s rest	Pre	17.20	1.619	0.512	-2.433 to -0.667	3.969	0.003
	Post	18.75	0.677	0.214			

According to paired t test Group C and Group D showed significant values of 0.002 and 0.003 respectively (p=0.05)

Table 3: Paired sample statistics of Modified-modified Schober's test for extension

Schober's test for extension		Mean	S.D	Std. Error Mean	95% C.I for difference	Paired t test value	P value
20s hold+ 1s rest	Pre	13.81	0.458	0.162	- 0.124 to 0.499	1.426	0.197
	Post	13.62	0.443	0.157			
40s hold+5s rest	Pre	13.67	0.500	0.167	-0.096 to 0.763	1.789	0.111
	Post	13.33	0.500	0.167			
60s hold+10s rest	Pre	13.40	0.937	0.296	0.249 to 0.551	6.000	0.001
	Post	13.00	0.850	0.269			
80s hold+20s rest	Pre	13.55	0.497	0.157	0.123 to 0.877	3.000	0.015
	Post	13.05	0.158	0.050			

Paired t test results were highly significant for group C (0.001).

Table 4: Paired sample statistics of Modified Oswestry Low Back Pain Questionnaire

Modified Oswestry Questionnaire		Mean	S.D	Std. Error Mean	95% C.I for difference	Paired t test value	P value
20s hold+ 1s rest	Pre	28.50	5.503	1.946	3.019 to 11.231	4.103	0.005
	Post	21.38	8.815	3.116			
40s hold+5s rest	Pre	25.11	7.769	2.590	3.451 to 5.882	8.854	0.001
	Post	20.44	6.654	2.218			
60s hold+10s rest	Pre	26.40	6.947	2.197	6.457 to 11.743	7.787	0.001
	Post	17.30	5.078	1.606			
80s hold+20s rest	Pre	24.60	6.802	2.151	8.925 to 15.875	8.072	0.001
	Post	12.20	4.392	1.389			

Paired t test results for the post treatment period was significant in all four groups (p<0.05)

Table 5: Paired sample statistics for Straight Leg Raise

Straight Leg Raise		Mean	S.D	Std. Error Mean	95% C.I for difference	Paired t test value	P value
20s hold+ 1s rest	Pre	40.00	2.673	0.945	-4.734 to -0.266	2.646	0.033
	Post	42.50	2.673	0.945			
40s hold+5s rest	Pre	34.44	7.265	2.422	-17.471 to -1.418	2.713	0.027
	Post	43.89	8.937	2.979			
60s hold+10s rest	Pre	38.00	12.517	3.958	-23.462 to -9.538	5.361	0.001
	Post	54.50	10.395	3.287			
80s hold+20s rest	Pre	41.00	3.944	1.247	-26.002 to -15.998	9.498	0.001
	Post	62.00	8.233	2.603			

Post treatment values of SLR proved to be highly significant in group C and D (p= 0.001) respectively.

Table 6: Wilcox on Signed Rank Test for VAS Scores

	VAS	median	25 th percentile	75 th percentile	P value
20s hold + 1s rest	Pre	9.00	8.00	10.00	0.011
	Post	7.00	6.25	8.00	
40s hold + 5s rest	Pre	7.00	7.00	9.00	0.006
	Post	5.00	3.50	7.00	
60s hold + 10s rest	Pre	8.00	7.00	9.00	0.004
	Post	5.00	3.00	6.25	
80s hold + 20s rest	Pre	8.00	7.00	9.00	0.004
	Post	4.00	3.00	4.00	

According to the results obtained from Wilcoxon Signed Rank Test group C and D showed higher significance with a value p<0.05.

Descriptive statistics of Age, Gender, Height, Weight, BMI and Waist-hip ratio was done by using Mean and Standard Deviation. Between group comparison for VAS score was performed using Wilcox on Signed Rank Test. Between group comparison for Schober's test, Modified Oswestry Disability Questionnaire and Straight Leg Raise was done using Paired t test. Software SPSS 16.0 was used.

DISCUSSION

The objective of the study was to compare the effectiveness of four different

hold and rest time combinations of intermittent lumbar traction in the treatment of lumbar intervertebral disc prolapse.

The results of this study demonstrated an improvement in all four groups after one week of intervention with greater improvement in group C (60s hold with 10s rest) and group D (80s hold with 20s rest).

Recruitment occurred over a one year period with 50 subjects screened to achieve a target of 40 subjects for the study. The reasons for exclusion from the trial were that the subjects did not meet the

specified inclusion criteria, i.e., six subjects were of chronic IVDP, three subjects were cases of previous spinal surgery, and one subject was diagnosed of lumbar spondylolisthesis. During the commencement of the study there were two dropouts in group A and one dropout in group B. The reasons of dropout were that two subjects underwent spinal surgery and one subject discontinued the treatment.

In the present study the ROM of spine measured by Modified-Modified Schober's test showed significant results with a mean and standard deviation of (16.92±1.39) for flexion and (13.59±0.633) for extension during the pre-treatment period, which increased upto (17.73±1.26) for flexion and (13.23±0.584) for extension during the post-treatment period. The values obtained from paired t test were significant during the post treatment (p= 0.001).

Between group comparison showed a higher significance in groups 60s hold with 10s rest and 80s hold with 20s rest (p=0.002) and (p=0.003) respectively.

According to the results interpreted in the present study it could be hypothesized that application of traction force to the spine can cause distraction of the spinal apophyseal joints. For distraction to occur the force must be great enough to cause sufficient elongation of the soft tissues surrounding the joint for the joint surfaces to separate whereas a smaller amount of force will increase the tension on, or elongate only the soft tissues of the spine without separating the joint surfaces.

M Krause in her study stated some evidence which suggests that a transitory increase in physiological range of motion occurred with alteration of length and mobility of connective tissue structures. Separation of the vertebral bodies may provide a stretch to the spinal soft tissues that is adequate to induce a transitory increase in length. [12]

The mean values of Modified Oswestry Disability Questionnaire demonstrated a reduction after one week of intervention i.e., from (26.05±6.71) to (17.57±7.03). The paired t test results were also significant after one week of intervention (p=0.001).

A comparison done between the groups showed an equally significant result in group B (40s hold with 5s rest), group C (60s hold with 10s rest) and group D (80s hold with 20s rest) with a value (p=0.001) indicating a reduction in functional disability following traction therapy.

In the present study an overall improvement in the functional status of the subject could be due to an increased separation of the vertebral bodies. The mechanical effects of vertebral separation may induce neurophysiological changes that are responsible for pain reduction.

The pain intensity of the subjects evaluated by VAS presented with abatement in the mean and standard deviation values from pre-treatment (8.32±1.98) to post-treatment (5.08±1.81). The results of paired t test also revealed a statistical significance in the VAS scores during the post-treatment period (p= 0.001).

Between group comparisons exhibited a similar statistical significance in group B (40s hold with 5s rest), group C (60s hold with 10s rest) and group D (80s hold with 20s rest) i.e.; (p=0.001).

From the present study it could be contemplated that pain reduction due to high force traction was probably due to stretching of the soft tissue structures and increase joint mobility which in turn stimulated the mechanoreceptors and thus reduced pain by gating the afferent transmission of pain stimuli.

Van der Heijden stated the efficacy of lumbar traction in reducing pain in the treatment of lumbar IVDP. He concluded that neurological deficits associated with radicular pain are thought to arise from mechanical compromise, inflammation

and ischemia of the spinal nerve root which resolved after the application of high force traction.^[13]

The mean and standard deviation values of SLR enhanced from pre-treatment (38.38 ± 7.91) to (51.35 ± 11.34) after one week of intervention. The results of the paired t test presented a statistical significance ($p= 0.001$) during the follow up.

A comparison done between the groups elucidated a similar statistically significant result in group C (60s hold with 10s rest) accompanied by group D (80s hold with 20s rest) with a value ($p=0.001$).

In the present study improvement in SLR is assumed to be due to an increased separation of the vertebrae by high force traction, which increases the diameter of the intervertebral foramen which decompresses the neural tissues and thus reduces neural sensitivity to movement. This could reduce radicular pain and normalize neurological deficits by relieving direct pressure or contact forces in sensitized neural tissues.

The limitations of the study were less sample size and effects of medications could not be controlled. A similar study with a larger sample size can be carried out to know the effectiveness of different combinations of hold and rest times in the treatment of IVDP.

CONCLUSION

The application of intermittent lumbar traction in the treatment of lumbar IVDP showed improvements in all the four groups in comparison to the pre-treatment level. Groups with longer hold and rest times i.e., groups 60s hold with 10s rest and 80s hold with 20s rest showed greater improvements in lumbar ROM, reduction in disability scores, improved mobility of the lower extremity during SLR test and an abatement in VAS scores. Thus the present study concludes that intermittent lumbar traction with longer hold and rest times is

more effective in the treatment of lumbar intervertebral disc prolapse.

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