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Research Article

COMPARISON OF EFFECT OF SPINAL DECOMPRESSION THERAPY IN PRONE AND SUPINE POSITIONS ON PAIN AND WALKING DURATION IN SUBJECTS WITH LUMBAR RADICULOPATHY

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A B S T R A C T

Background: Spinal Decompression Therapy (DTS) has been widely in use for subjects having low back pain with or without lower extremity pain. However, the studies have not been able to provide a recommended position for the application. Hence, this study was done to determine whether DTS in supine and prone position is effective in improving pain and walking duration and to compare effectiveness of both the positions.
Method: 40 subjects diagnosed as having Lumbar radiculopathy by an orthopedician were included in the study. They were divided into two groups by convenience sampling where Group A received the DTS in the prone position whereas Group B received it in the supine position for 20 days along with Transcutaneous electrical nerve stimulation, hot water fomentation and cold pack and core stabilization exercises.
Results: There was statistically significant improvement in both the groups for pain and walking duration ($p<0.001$). There was statistically significant improvement between the groups for pain ($p=0.011$) but no difference for walking duration ($p=0.315$).
Conclusion: Both prone and supine positions are helpful in improving pain and walking duration but prone position is better than supine position for pain relief for subjects having low back pain.

INTRODUCTION

Lumbar spine disorders rank fifth among disorders for the cost of hospital care. They also lead to higher absence from work and disability.[1] Lumbar Radiculopathy is defined as radiating leg pain below knee level into the foot and toes with neurological deficits (sensory, reflex or motor) in the distribution of the lumbosacral nerves. Lumbar radiculopathy is caused by the compression of nerve roots in the lumbar spine.[2]

Lumbar traction is one of the oldest treatments to be used for Low Back Pain (LBP).[3] However, recent studies, RCTs and Systematic reviews have failed to provide a firm conclusion about the use of Traction as a treatment for LBP or Lumbar Radiculopathy.[4-7] There has been no firm positive or negative conclusion that traction should or should not be given in subjects with LBP.[8]

Traction may be applied in form of motorized lumbar traction that uses a motorized pulley for the application of traction force, auto traction where the patient exerts the traction force through a pulling or pushing action, gravitational traction using a suspension device, or manual traction by the therapist. Autotraction, manual traction, and gravitational traction can be difficult to maintain for a specific period of time because of fatigue or intolerance to the force or position by the patient or therapist. Therefore, motorized traction can be more successfully standardized for repeatability in a trial.[9]

With the advancement in technology and research, newer computerized spinal decompression equipment have been invented which apply force at specific angles and in specific directions by adjusting the position of the disc. This has led to better improvements in pain, disc height, muscle activity and Straight Leg Raise.[3,10,11] Spinal decompression therapy (DTS) reduces the pressure on the intervertebral disc by supplying nutrients and oxygen to the intervertebral disc. This creates a state of non-gravitation or negative pressure by adjusting the direction and angle of traction to suit the location of the intervertebral disc, which is the target of the treatment. This in turn reduces the pressure inside the intervertebral disc by gradually and softly increasing the size of a specific part of the intervertebral disc through the decompression of a precise part of the lesion.[10]

Previous studies have used both prone and supine positions for the application of Spinal Decompression Therapy.[3,10,11] Hence, it has been unclear that which position should be used and which position is better. The need of this study was to determine whether Spinal Decompression Therapy applied in

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supine and prone positions is effective in improving pain and walking duration and which of the two positions is better.

METHODOLOGY

The quasi-experimental study was conducted in a Multispecialty Physiotherapy Centre in Ahmedabad from November 2018 to March 2019. Ethics approval was obtained from the local institutional review board. Male and female subjects diagnosed as having Lumbar radiculopathy by an orthopedician, having a confirmatory MRI report of nerve compression and referred for physiotherapy were included. The subject was diagnosed with lumbar radiculopathy if the subject presented with pain, numbness or parasthesia in the lower limb that followed a dermatomal pattern with or without back pain, muscle weakness or diminished reflexes that followed a myotomal pattern. Subjects were excluded if they had any other lower limb pathologies present like Osteoarthritis of the hip or knee, any previous history of lower limb surgery, back surgery, Diabetic neuropathy, history of back trauma, spinal fractures, limb length discrepancy, contra-indications to MRI, vascular claudication and spinal tumors. Also subjects who were uncomfortable to go into the prone position due to cardiac disorders or obesity were excluded.

Forty subjects were included in the study based on the inclusion and exclusion criteria. Written informed consent was obtained from the participants. They were divided into two groups by convenience sampling and random allocation using a random number generator– Group A received the DTS in the prone position (Figure1) whereas Group B received it in the supine position (Figure 2). The intervention was applied for 20 days.

The Triton DTS system was used which consists of a spine table, traction unit and a harness belt. For the prone position treatment, the subject was positioned in the prone position on the spine table and secured using a pelvic harness. For the supine position treatment, the subject was positioned supine on the spine table and secured using a pelvic harness. The force to be exerted was calculated according to the weight of the subject. The force applied ranged from 1/3rd of the body weight to approximately 1/2 of the body weight ± 5 kgs. The decompression angle was set according to the most affected Lumbar spine level decided based on the MRI findings. The total treatment duration varied between 15-30 minutes depending on the number of levels involved.The subjects of both the groups received conventional Transcutaneous Electrical Stimulation from back up to the leg depending on the area of radiation for 15 minutes and Hot water fomentation for 10 minutes prior to DTS and Cold pack for 10 minutes after the DTS session. The subjects also performed core stabilization exercises for the activation of Transversus Abdominis – 3 sets of 10 repetitions.

The Outcome measures were assessed on the first day before the intervention and again on the 20th day after the intervention. Pain was assessed using Numerical Pain Rating Scale (0-10, 11 point scale)[12] whereas walking duration was assessed as duration recorded in minutes.[13]

RESULTS

Data of 40 subjects was analyzed using SPSS 16.0. The mean age of the sample was 53.5 ± 15.3 years. The demographics were as shown in Table 1.

The data was analyzed for normal distribution using Kolmogrov Smirnov test and the data was found to have a normal distribution ($p>0.05$). The two groups were also compared for age and any differences in the Lumbar spinal canal diameters measured using MRI using t test. There was no statistically significant difference between the groups for age ($p=0.085$, $t=-1.770$). There was also no statistically significant difference between the groups for Lumbar spinal canal diameters. The results are as shown in Table 2.

There was a statistically significant difference in both the groups before and after the intervention which was analyzed using paired t test ($p<0.001$). The results are shown in Table 3. Unpaired t test was used for analyzing the differences between the Groups. There was statistically significant difference between the groups for p value for NPRS ($p=0.011$) but no statistically significant difference p value for Walking Duration ($p=0.315$). Table 4 represents the results of between group analyses.

DISCUSSION

The current study was done to determine whether DTS is effective in improving pain and Walking duration when given in prone and supine positions and also to compare the effect of DTS applied in supine and prone positions on pain and walking distance.

Both groups showed statistically significant improvement in pain and walking distance. These changes may be attributed to the relief in pressure on the nerve roots that occurs due to the decompression of the disc. Guehring *et al* in 2006 concluded that Distraction results in disc rehydration, stimulated extracellular matrix gene expression, and increased numbers of protein-expressing cells in a rabbit model. Distraction resulted in gene expression up-regulation of collagen 1, collagen 2, biglycan, and decorin, while expression of fibromodulin, tissue-inhibitor of matrix metalloproteinase-1, and Bone Morphogenetic Protein-2 was decreased. These changes in the disc may lead to the disc bulge being reduced and subsequent reduction in the compression of the nerve roots.[14]Formation of the structural material of the matrix increases with increase in hydrostatic pressure through decompression, moisture content increases through the improvement in the combining ability with moisture, and nutrition supply can be expected to increase owing to improvement of degenerative change.[11]

Decompression therapy also leads to a reduction in the muscle activity of the erector spine muscle. Disc disease can lead to inflammation; pain caused by inflammation and neurological manifestations in the paraspinal muscles. This inflammation causes the paraspinal muscles to go into hypertonus. Increased intervertebral foramen diameter by decompression can induce an increase in the blood flow in the blood vessel within the foramen and intervertebral foramen which in turn leads to reduction in pain and muscle tension by removing inflammatory exudation.[15] A reduction in the pain and the hypertonus of the paraspinal muscle makes the subject become more functionally active and causes the subject to walk for

longer periods. Hence, this leads to improvements in the walking duration.

There was a statistically significant difference in the subjects receiving DTS in the prone position as well as the supine position for both pain and walking duration. These results are similar to the results concluded by a study where patients with activity-limiting low back pain with or without lower extremity pain were included. They concluded that spinal decompression therapy delivered in prone position was associated with significant improvements in pain intensity and disability scores in both short- and long-term follow-up.[3]Another study by Choi J, Lee S and Hwangbo G studied the effect of DTS applied in the supine position. They also concluded that DTS in supine position improves pain and disability in subjects who complained of radiating pain caused by chronic lumbar pain.[10]

On comparison of the effects of DTS on pain and walking duration in the supine and prone positions, the current study concluded that prone position during DTS gives better outcomes for pain than supine position. But however, there was no statistically significant difference between the groups for walking duration. The improvement in prone position can be attributed to the disc movement that occurs in the prone position due to the effect of gravity. The gravitational force displaces the disc from posterior position to a comparatively more anterior position, thus relieving larger amount of pressure on the nerve roots. This gravitational force acts as an additional factor since the prone position in itself relieves a lot of intradiscal pressure. The supine and prone positions exert almost equal amounts of pressure on the disc. An intradiscal pressure of 0.10 MPa is exerted when the subject lies supine whereas, prone position exerts an intradiscal pressure of 0.11 MPa.[16]Thus the prone position gives an additional displacement of the disc which is not observed in the supine position and leading to better pain relief. There was no statistically significant difference seen in the walking duration since the intradiscal pressure increases to almost 5 folds to 0.53-0.65 MPa while walking.[16]Also the difference between both the groups was not adequate enough to cause a significant clinical or functional difference.

One of the limitations of the study was the absence of a control group. Future studies including a control group should be done.

CONCLUSION

The present study concludes that DTS applied in supine as well as prone positions is effective in improving pain and walking duration. Also, the prone position is better for pain relief than the supine position but not for walking duration improvement.

Table 1 Demographic Details of the subjects

	Group A	Group B
Age (Mean ± SD) years	49.3 ± 16.3	57.7 ± 13.3
Males	7	13
Females	10	10

Table 2 Comparison between Both Groups for Spinal Canal Diameters (In mm)

Level	Group A (Mean ± SD)	Group B (Mean ± SD)	p value	t value
L1-L2	14.6 ± 1.9	14.1 ± 1.9	0.371	0.906
L2-L3	13.8 ± 1.9	13.9 ± 2.3	0.469	0.731
L3-L4	13.5 ± 1.9	13.1 ± 1.9	0.519	0.651
L4-L5	12.8 ± 1.9	12.6 ± 2	0.758	0.311
L5-S1	12.1 ± 2	11.8 ± 2	0.692	0.399

Table 3 Comparison of Nprs and Walking Duration Before and After Intervention

		Pre-Intervention	Post-Intervention	p value	t value
NPRS	Group A	7.65 ± 0.8	2.05 ± 0.7	<0.001	22.862
	Group B	6.4 ± 1.5	1.8 ± 0.8	<0.001	18.294
walking duration (mins)	Group A	10.2 ± 5.1	26.8 ± 8.9	<0.001	-11.281
	Group B	9.4 ± 6.2	24.2 ± 6.5	<0.001	-16.754

Table 4 Comparison between the Groups for Nprs And Walking Duration

	Group A	Group B	p value	t value
NPRS	5.6 ± 1.1	4.6 ± 1.1	0.011	2.691
Walking duration (mins)	16.6 ± 8.6	14.8 ± 3.9	0.315	5.019

Figure 1 Treatment using DTS in prone position

Figure 2 Treatment using DTS in supine position

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