The effect of intermittent lumbar traction on the intervertebral disc space in patients with lumbar disc prolapse

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Abstract

Background: Lumbar traction represents a medical procedure for treatment of discogenic low back pain. It facilitates the transfer of oxygen and nutrient into the disc, affects the metabolism of disc, reduces intradiscal pressure, relieves the irritation and compression on pain sensitive structures and enhances healing and repair of the disc lesion.

Purpose: The purpose of this study was to investigate the effect of supine intermittent lumbar traction on anterior and posterior intervertebral disc space in patients diagnosed as lumbar disc prolapse verified by MRI.

Methods: 15 patients (12 males, 3 females) diagnosed as chronic lumbar disc prolapse with one level L4/ L5 or L5 /S1, with unilateral radiculopathy participated in this study. Patients were treated by intermittent lumbar traction with traction loading force 50% of body weight and unloading force 25% of body weight for 20 minutes/session.3sessions per week (each other day)for 5 weeks . Patients were assessed before and after treatment session by measuring the anterior and posterior intervertbral disc space by using plain X-ray.

Results: There was significant increase of the posterior intervertebral disc space with no significant increase of the anterior intervertebral disc space.

Conclusion: Supine intermittent lumbar traction is an effective method in increasing the posterior intervertebral disc space and thus reducing the pressure on the affected nerve root in patient with lumbar disc prolapse.

Key words: lumbar disc prolapse, anterior intervertbral disc space, posterior intervertbral disc space, lumbar traction.

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Introduction

Low Back Pain (LBP) is one of the common musculoskeletal disorders in developed societies (Cai et al., 2009) This disorder leads to a high percentage of disabilities and socioeconomic loss (.Cai et al., 2009& Kamanli et al., 2009).

Low back pain resulting from lumbar disc prolapse is the common referral for therapy (Vroomen et al., 2002). Lumbar disc prolapse is one of frequent cause of acute, chronic or recurrent back pain. The most common levels of prolapse are L 4 – L5 or L5- S1 with a rate as high as 98%. It frequently develops in the weakest part of the disc which is the posterolateral side (Kamanli et al., 2009). The problem of prolapsed intervertebral disc has great importance in the world, because people are subjected to various physical stresses either due to their peculiar living habits, low socioeconomic status or live and work at places with poor infrastructure. The highest percentage of these patients (89.4%) were between the age of 21-60 years that might be because people between 21-60 years are involved in outdoor activities and are exposed to continuous trivial trauma to spine. With the increase in age, males suffer from multiple level disc prolapse than females (Prasad et al., 2006).

Lumbar traction is one of the oldest known conservative treatments for low back pain (Borman et al., 2003) Described by Hippocrates, lumbar traction in various forms has been used for centuries, and continues to be used in today's clinics.(Borman et al., 2003& Harte et al., 2005).

During the 1950's and 1960's it became popular, and until today it is used by physiotherapists for threatening patients with low back pain and leg pain. (Lee & Evans, 2001). Although its effectiveness is still being questioned by a few clinical trials, Several theories have been proposed to explain the possible clinical benefit of traction therapy: distraction to increase the intervertebral space Distracting the motion segment is thought to change the position of the nucleus pulposus relative to the posterior annulus fibrosus (Knutsson et al., 2008) or change the disc-nerve interface , tensing of the posterior longitudinal vertebral ligament and suction to draw the disc protrusion towards the center of the joint(Knutsson et al., 2008).

There are various types of traction which are used for treatment for lumbar disc prolapse; manual traction (Thomas et al., 2000), auto traction (Reust, 1988), motorized traction (Borman et al., 2003); the two main types of the

motorized traction can be applied in continuous or intermittent mode (Elnaggar et al., 2006; Beyki et al., 2007). There are also less common forms of traction, such as underwater traction (Konrad, 1992), gravitational traction (Tekeoglu et al., 1998) and inverted traction (Gianakopoulos et al., 1985).

Supine position is, though, more commonly employed method in practice. Flattening of lumbar lordosis can well be achieved with the patient in supine with both hips are flexed to approximately 90◦ with the legs on stool (Elnaggar et al., 2006; Cevik et al., 2007**).**

Methodology:

15 patients (12 males, 3 females) diagnosed as chronic lumbar disc prolapse with one level L4/ L5 or L5 /S1, with unilateral radiculopathy participated in this study with mean age (32.4±4.154)

Patients were treated by Infrared radiation for 20 minutes applied for the lumbar region.

Infrared radiation

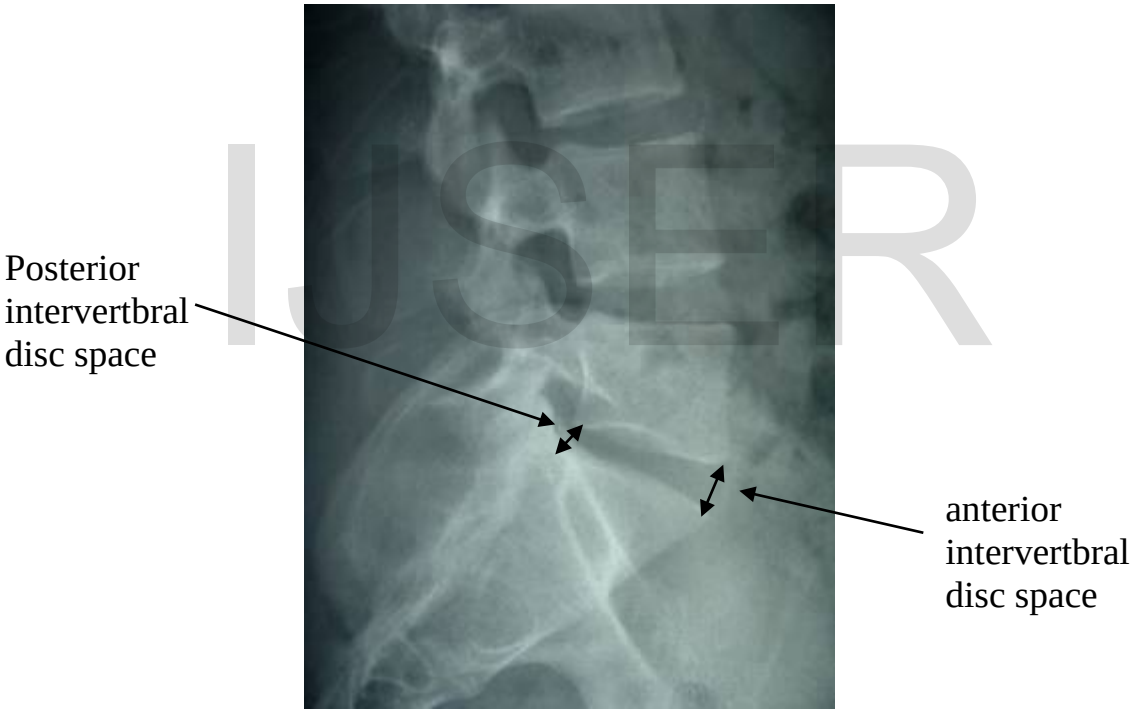
Infrared radiation was followed immediately by intermittent lumbar traction from supine lying position with both hips and knees flexed 90 degree supported in the traction stool. traction loading force 50% of body weight and unloading force 25% of body weight for 20 minutes/session with loading time 30 seconds and unloading time 15 seconds. 3 sessions per week (each other day) for 5 weeks.

Lumbar traction

Patients was assessed before the 1st session and after the last treatment session by using lateral view plain X ray from standing position. in X ray, the anterior and posterior intervertbral disc spaces of the prolapsed level which was verified by MRI were measured by using digital ruler.

Anterior intervertebral disc space was measured from the anterior part of the lower margin of the upper lumbar vertebra to the anterior part of the upper margin of the lower lumbar vertebra. (Hong et al., 2010)

Posterior intervertbral disc space was measured from the posterior part of the lower margin of the upper lumbar vertebra to the posterior part of the upper margin of the lower lumbar vertebra. (Hong et al., 2010).



Measurement of the anterior and posterior intervertebral disc space (lateral view X ray)

Results:

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	15	26.00	40.00	32.4000	4.15417
Valid N	15				

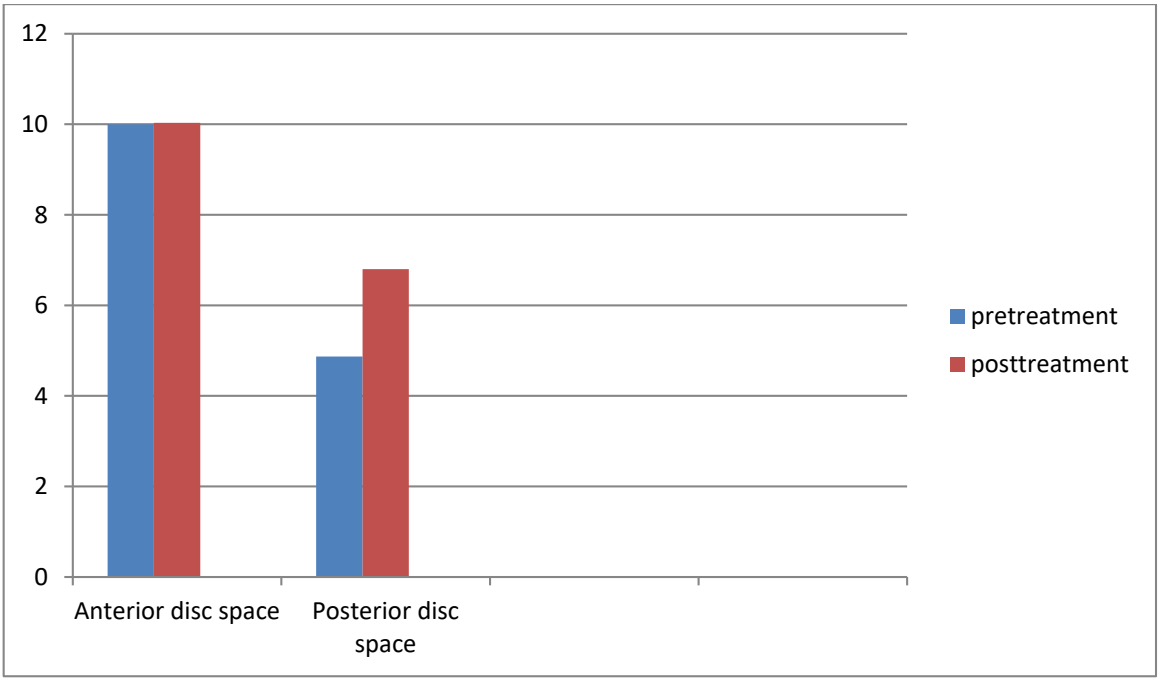
Comparing the pre-treatment and post treatment mean values of the each variables (Anterior disc space and Posterior disc space) :

It revealed significant difference in Posterior disc space as ($p < 0.05$), while there were no significant differences in anterior disc space ($p > 0.05$)

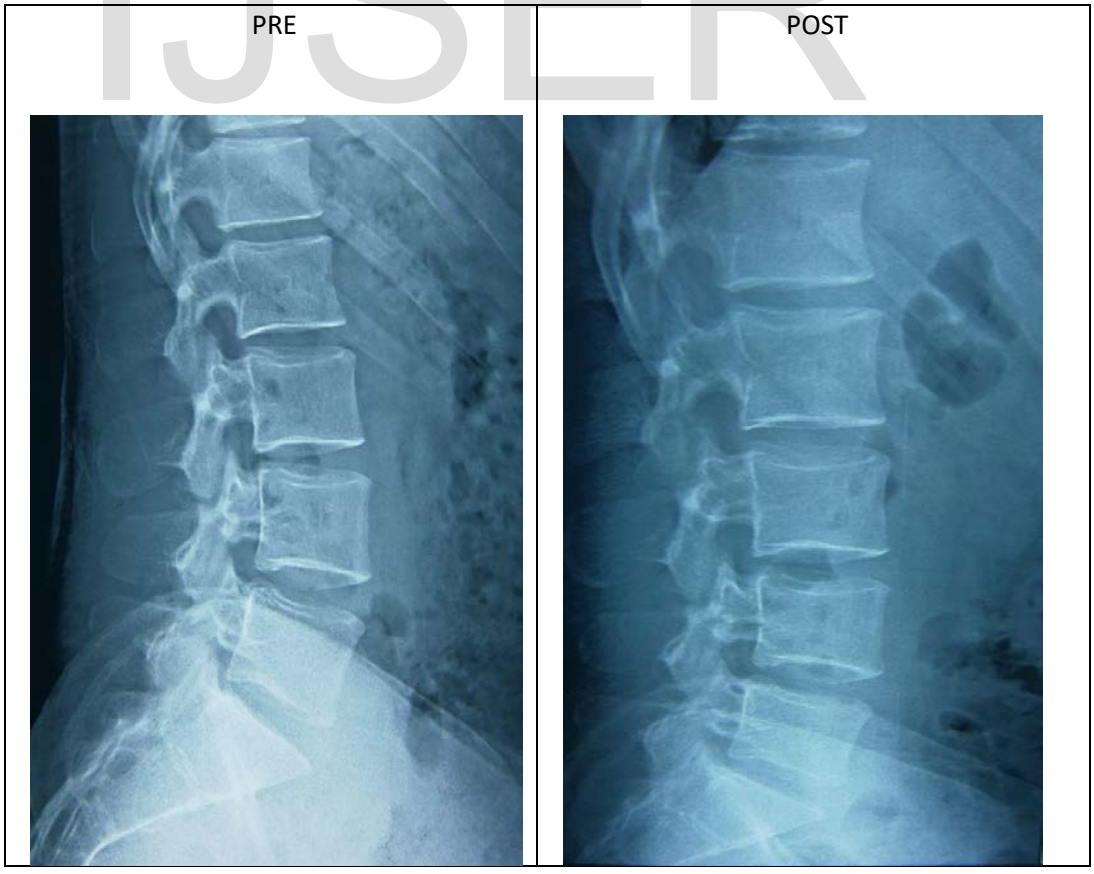
Item		$\bar{x}$ ±SD	MD	Percentage of difference	t value	P Value
Anterior disc space	Pre treatment	10 ± 1.51	0.33	3.3%	0.702	0.494
	Post treatment	10.03 ± 2.02				
Posterior disc space	Pre treatment	4.87±2.62	1.93	39.6%	7.25	*0.00
	Post treatment	6.8±2.11				

$\bar{x}$: Mean. SD: Standard Deviation. MD: Mean difference

t value: Paired t-value. P value: Probability value. *: Significant.



Pre and post treatment comparison of the intervertebral disc space by using lateral view X ray:



Discussion:

In our current study, there was significant increase of the vertical dimension of the intervertebral disc space in the supine traction group, this result is supported by the work of Komori et al. (1996) , Sari et al. (2005) and Apfel et al. (2010), Daniel et al.(2017)

Komori et al. (1996) found also that there was widening of the disc space with actual reduction of the herniated nucleus pulposus by using T1-weighted sagittal views MRI , this widening led to improving blood flow to the affected tissue which occurred prior to the actual reduction of the herniated nucleus pulposus.

Sari et al. (2005) studied the effect of supine continuous lumbar traction with traction force 45kg in patients with lumbar disc herniation. CT- scan was done before and during traction to observe the changes of spinal canal and herniated disc material. They found that there was significant increase of posterior intervertebral disc height while anterior intervertebral disc height remained unchanged when they used CT scan for measuring the intervertebral disc space of (L1-L2, L2-L3, L3-L4, L4-L5 and L5-S1) separately. There was also widening of the spinal canal area and the neural foraminal diameter.

Apfel et al. (2010) used computed tomography (CT) scans for investigating the effect of supine intermittent lumbar traction for patients with lumbar disc prolapsed, they concluded that the intervertebral disc space of (L3-L4, L4-L5, L5-S1) were increased significantly.

Daniel et al.(2017) studied the effect of continuous horizontal traction with traction force 42% of body for 30 minutes in the height of the intervertebral space by using MRI in normal subjects without back pain , they found that there was significant increase of the average disc height for all lumbar disc, significant increase of the posterior disc height more than the anterior and significant reduction of the lumbar lordosis.

This increase in vertical dimension might be caused by 3 different mechanisms: The first mechanism, while the patient is in supine with both hips and knees flexed, the lordotic curve of the lumbar spine is decreased with flattening of lumbar curve, thus traction force is more effective on the posterior elements of the spinal vertebral column while the anterior intervertebral disc height may be reduced (Lee & Evans, 2001; Sari et al., 2005; Beyki et al., 2007; Cevik et al., 2007).

The second mechanism, traction plays an important role in pain spasm cycle. Thus, once pain of the back is reduced, the spasm of the back muscles is

reduced and hence allowing vertebral separation and increasing of the intervertebral disc space (Krause et al., 2000; Cevik et al., 2007; Apfel et al., 2010).

The third mechanism, once traction is applied either in the supine, there is an initial increase of the sacrospinalis muscle activity. Following this increase, there is gradual decrease in its activity due to muscle fatigue which occurred during traction. Thus allowing intervertebral separation and increase the intervertebral disc space (Weatherell, 1987).

In our current study, the position of the patient while receiving traction in the was in supine lying with both hips and knees flexed 90° and legs were rested on a padded foot stool as used by (Elnaggar et al., 2006; Cai et al., 2009). This position produced three types of forces: Flexion moment of the lumbar spine, axial distraction and finally anterior shearing force. These forces flatten the lumbar spine, decrease lumbar lordosis, stretch the posterior soft tissues and posterior longitudinal ligament, this stretching will stimulate mechanoreceptors and reduce pain (Lee & Evans, 2001).

This position also stretches the posterior annulus which may prevent excessive posterior movement of the disc material and help to reduce the posterior disc prolapse as well as increase the posterior disc height and decrease the anterior disc height. Furthermore, it increases cross sectional area of the intervertebral foramina (Lee & Evans, 2001; Sari et al., 2005).

Conclusion:

Supine intermittent lumbar traction is an effective method in increasing the posterior intervertebral disc space and thus reducing the pressure on the affected nerve root in patients diagnosed as chronic lumbar disc prolapse with one level L4/ L5 or L5 /S1, with unilateral radiculopathy.

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