Efficacy of endoscopic Lumbar Discectomy and Selective Physical Therapy Program in Single Lumbar Disc Prolaps

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ABSTRACT

The purpose *of the current study was to investigate the effects of endoscopic lumbar discectomy and selective physical therapy program on lumbosacral angle, level of lumbar pain and flexion range of motion of the trunk in the patients with single lumbar disc prolaps. Subjects, forty patients included in this study. All patients were suffering from single lumber disc prolaps. Their age ranged from forty five to fifty five years old. They were randomly classified into two equal groups. The first group (GA) (20 patients) treated by endoscopic discectomy only. The second group (GB) (20 patients) treated by endocsopic discectomy plus selective physical therapy program.* ***Assessment*** *of lumbosacral angle by plain x-ray, level of pain using Mc Gill Pain Questionnaire (MPQ) and flexion range of motion of the trunk through plurimeter-V-incIinometcr were performed after operation (12 hours post-operative) and after one month of operation.* ***The results*** *of this study showed significant differences in lumbosacral angle with percentage of improvement 8.43 %, and 22.9 % in GA and GB respectively , level of pain with level of reduction 21.8 % and 93.7 % in GA and GB respectively and improvement of flexion range of motion of the trunk with percentage of 31.9 % and 99.8 % in GA and GB respectively .The results were reflecting efficacy of both endoscopic discectomy plus selective physical therapy program rather than endoscopic discectomy only.* ***Conclusion,*** *it was concluded that, endoscopic discectomy plus selective physical therapy program were an effective treatment in the patients with single lumbar disc prolaps.*

INTROUDUCTION

Vertebral discs are the cushioning and connecting materials that lie between the bones of the spine, called "vertebrae." When the outer wall of a disc, called the annulus fibrosus, becomes weakened through age or injury, it may tear allowing the soft inner part of the disc, the nucleus pulposus, to bulge out. This is called disc herniation, disc prolapse, or a slipped or bulging disc. Once the inner disc material extends out the regular margin of the outer disc wall, it can press against very sensitive nerve tissue in the spine specially nerve roots. The "bulging" disc can compress or even damage the nerve tissue, and this can cause weakness, tingling, or pain in the back area and into one or both legs[10].

Not all patients with herniated discs are candidates for the open discectomy procedure. Most people may find pain relief in conservative treatments such as rest, physical therapy, anti-inflammatory medications and epidural injections. However, sometimes the pain does not respond to these therapies and may require a more aggressive intervention[8]. If back and leg pain does not respond to conservative treatment and continues for four to six weeks or longer, the physician may prescribe diagnostic tests, such as X-rays, MRI or a CT scan, to verify the source of the pain and extent of any jury. If a diagnosis of herniated disc is confirmed, discectomy may be recommended if no response to conservative management[12].

In addition, open discectomy uses surgery to remove the damaged disc decompress nerve roots and thus relieve the pressure on the nerve tissue and alleviate the pain. It is the most common surgical treatment for ruptured or herniated discs of the lumbar spine. The surgery involves a small incision in the skin over the spine, the removal of some ligament and bone material and the removal of some of the disc material[24].

Furthermore, possible complications from open discectomy include bleeding, infection, spinal fluid leak, injury to the veins and arteries near the spine, or injury to the nerve tissue of the spine or its surrounding protective layer (the dura mater).It is also possible for the same disc to be again after surgery, which is called recurrent disc herniation. Recurrent disc herniation has been shown to occur in approximately 5% to 10% of open discectomy cases[6,7].

On the other hand, the procedure of endoscopic discectomy may be performed under local anesthesia with the patient awake and in a prone or lateral position. The procedure takes about 30 minutes, on average. X-ray exposure is minimal. The supporting structure of the disc is not affected. [20,21].

The patient may feel relief from pain immediately following the discectomy. This is an outpatient procedure. Walking and mild exercise are usually encouraged on the same days. Some patients experience mild to moderate muscle spasms that can generally be treated with analgesics. [17]

Moreover, the physical therapy program followed disectomy including several modalities to overcome pain and muscle spasm with transcutaneous electrical nerve stimulation (TENS), acupuncture, massage, exercises and other several physical modalities. Unfortunately, the researches of laser puncture application in conjunction with spray stretch technique in these cases were not published. On the other hand, spray and stretch technique is considered as an alternative noninvasive approach, used in the treatment of trigger points and spasm[35]. A cold stimulation is used to provide hypothesia to area of spasm, thus allowing increased stretch with less pain.

Furthermore, laser puncture is a method of irradiating acupuncture points with laser of low intensity[l3]. Also, it was believed that, the acupuncture system is apparently not only a bioelectrical system, but also a photobiological system, where biological energy is being transferred in the form of electromagnetic irradiation[4]. Several investigators suggested that laser puncture can produce analgesia in painful disorders and muscle spasm.

Fortunately, the present study is an attempt to enhance the neurosurgcry protocols and physical therapy programs followed endoscopic discectomy by adding SST and laser puncture as non invasive methods to overcome pain and muscle spasm and regain full range of motion of the trunk. Therefore, the aim of current study was to investigate the effects of endoscopic lumbar discectomy and selective physical therapy program on lumbosacral angle, level of lumbar pain and flexion range of motion of the trunk in the patients with single lumbar disc prolaps.

MATERIAL AND METHODS

Subjects

Forty patients included in this study (twenty eight males and twelve females). All patients were suffering from single lumber disc prolaps. They were ranging in age from forty five to fifty five years old. Patients were selected from the department of neurosurgery in El Kaser Eliny hospital; Naser institute and Aguza Hospital .They were randomly classified into two equal groups. The first

group (GA) consisted of 20 patients (15 male and 5 female) treated by endoscopic discectomy only. The second group (GB) consisted of 20 patients (13 male and 7 female) treated by endoscopic discectomy plus selective physical therapy program including spray and stretch technique (SST) and laserpuncture. The treatment was applied at El kaser Eliny hospital. The SST and laser puncture were applied three sessions per week for one month each session was continued for 30 minutes. The design of the study was pre-test, post -test design. The subjects included in the study were non obese (BMI< 25), free from gastrointestinal problems, had no previous operation in spine and were not athlete. All patients in both groups had a single lumbar disc prolaps, in GA disc prolaps was reported in L4-L5 in 12 patients, while 8 patients had disc prolaps in L5-S1. In GB 14 patients had disc prolaps in L4-L5 and 6 had disc prolaps in L5-S1.

Instrumentation

A) **Instrumentation and tools for evaluation**

1) Ordinary weight scale attached to height tape measurement to detect BMI.

2) Tape measurement for measuring the lower limb length.

3) Cunumeter: It is a device used to detect the patient's cun MAG, Japan SX.20D. It composed of two arms connected in the middle with fulcrum. During its measurement for patient's cun, it indicated 4 values, one in each side, indicating 1/2, 1, 1 1/2 and 2 cun.

4) Plain lumbar spine radiography: for detection of lumbosacral angle[9].

5) Mc Gill Pain Questionnaire (MPQ): for determining the pain level, it is pencil and paper test designed to quantify three dimensions of pain experience: The sensory (temporal, spatial, pressure and thermal); the effective (tension and fear aspects) and the evaluative (over all severity). It consists of a list of 78 adjectives, divided into 20 subclasses. Each subclass contains two to six words reflecting the pain experience.

6) Plurimeter-V-inclinometer: PVL type 180 degree U.S.A; was used to measure the lumbar flexion. It consisted of a container with a freely moving position. The housing is filled with special oil which lubricates the bearing of axis and dampens the oscillations of the needle-indicator when the instrument was rotated. The housing can be rotated 360 degrees. It looks automatically at 90 degree.

B) Instrumentation and tools for treatment

1) Laser device: Laser XL TU 904 H model, pulsed gallium arsenide (Ga As) with wave length of 904 nm, peak power was one Watt and average out put power was 0.5 mW, pulse repetition frequency 2500 Hz and pulse duration 200 ns. The device was recalibrated to increase accuracy of its parameters before treatment.

2) Ethyl chloride spray bottle: used in spray stretch technique.

Procedure

A) Evaluation Procedure: including:

a) Initial evaluation: these evaluations performed only pre -treatment and include:

- BMI through calculation of: weight in (Kg)/height in (m^2) to exclude obese patients who had BMI > 25 Kg/m^2. (BMI= weight (Kg)/ height (m^2).
- Lower limb length: This was performed in supine lying position from anterior superior iliac spine to medial malleolus to exclude persons with unequal limb's length.

b) Evaluation was performed before treatment (pre-test) and one month after treatment (post-test) included:

*1- **LSA:*** the LSA was calculated by drawing a horizontal line that meets a line drawn through the superior surface of sacral base[15].

*2- **Pain assessment:*** patients were asked to choose no more than one word from each subclass that best described their pain. The evaluation of pain was on the basis of a pain rating index (PRI), which was based on numerical values of relative intensity of the words chosen (maximum pain 78/78). The procedure was repeated three times by the author and three times by other therapist to insure repeatability of test and the mean value was recorded.

*3- **Range of lumber flexion:*** each patient was in stride standing position. The plurimeter -V- inclinometer was supported at the level of L4-L5 and adjusted on zero, while both sides of it's arm were kept in contact with the spine using elastic strap. Each patient was asked to lean forward to the tolerate level of pain with maintaining both knees extended. The degree which was seen in the plurimeter was recorded. Patient was instructed to return to original position.

B) Treatment procedures

Patients in both groups received antirheumatics and analgesic drugs including Voltaren 100 ampules 1st, 2nd day, twice daily.and the following 3 days one ampule/day. Maintenance dose was continued included voltaren 50 tablet/day for another five days. Also site of operation was sterilized with antiseptic for three days after operation.

-Experimental group (GB): This group received selected program of physical therapy from the second day of operation including:

1) Spray and stretch technique

Each technique was performed five times. Stretching was applied in mild manner in the first session, moderate in the second session, and to the tolerable pain at the third session (six days after operation).

- ***For erector spine muscle:*** Each patient was positioned in long sitting and instructed to touch his feet with fingers. The author was sited behind patient and pushing the trunk forwards with one hand while he was applied cycles of spray of ethyl chloride from distal to proximal to increase range of motion[5,35].
- **Piriformus:** Each patient was positioned on the uninvolved side lying (uppermost thigh flexed 90°). The author applied parallel sweeps of vapocoolant (ethyl chloride spray) from distal over the pain trigger points. The author was pulled back on pelvis while the patient was asked to push down on his distal thigh of the treated side.
- **Glutens maximum:** Each patient was relaxed on the uninvolved side lying (hip and knee flexed). The ethyle chloride spray was applied downwards from crest to ilium and mid line of sacrum to mid thigh. The author gently increased flexion of hip towards chest. The procedure was continued 15 minutes (5 minutes for each muscle).

2) Lasernuncture

Each patient was instructed to relax in prone lying position with a small caution under the lumber region. The surface of skin to be treated was sterilized with an alcohol and soaked with cotton .Probe was sterilized with alcohol before treatment. The laser was emitted from a probe that was put directly on the skin after

identifying the acupuncture points and trigger points. The device parameters were adjusted to power output 0.5 W, pulse frequency 2500 HZ and pulse duration 200 ns. The main power switch was turned on. Detection of acupuncture points was performed using the cunumcter. The treatment switch was activated by the author's finger tip to irradiate DU 3(between dorsal spine of 4^{th} and 5^{th} lumbar vertebrae), DU 4 (between dorsal spine of 2^{nd} and 3^{ul} lumbar vertebrae), Ex21 on lumbar region, 5 pairs of points 0.5 cun lateral to the lower ends of the dorsal spines of 1^{st} to 5^{th} lumbar vertebrae. (Cun: the breadth of distal phalanx of the thumb of patient at its widest point). These points were irradiated with three trigger points that were identified for each patient. Each point was irradiated one minute with total time of laserpuncture fifteen minutes. Each patient was instructed to keep rest for ten minutes after the treatment. The battery was recharged daily by using laserex adapter for 15 hours.

RESULTS

The current study included forty subjects with age ranged from forty five to fifty five years old, they were classified into two equal groups, group A with mean age44.6± 1.6 years, weight 77±1.7 Kg, height 160,1.9 cm and group B with mean age 43.9±1.4 years, weight 75±1.8 Kg, height 163,1.9 cm . It was observed that there were no significant differences between the two groups in age and BMI. Statistical analysis of data was performed to detect the level of significant (P< 0.05), mean and standard deviation for effects of endoscopic discectomy and selective physical therapy program on lumbosacral angle, level of pain and flexion range of motion of the trunk in the patients with single lumbar disc prolaps.

Table (1) and Fig. (l) showed comparison between pre and post values of LSA in each group. Data presented in table (1) showed that there was a significant differences in the post value of lumbo sacral angle (LSA) in both groups. LSA values post-treatment were lower than their corresponding pre values in both groups. But the percentages of improvement were 8.43% and 22.9% in group (A) and in group (B) respectively providing more improvement in group (B) when compared with group (A).

Table (1): Mean value of LSA (degrees) before (pre), and after (post) treatment for each group (A&B).

	LSA (degrees)					
	Group (A) : (Disectomy)			Group (B) : (Disectomy) + PT		
	Pre Treatment	Post Treatment		Pre Treatment	Post Treatment	
X	42.7	39.1		44.2	34.05	
±SD	5.02	4.62		5.56	3.45	
T-value	7.44		s	15.33		s
P-value	0.01			0.01		
% of improvement	8.43%			22.9 %		

X: mean ±SD: standard deviation S: significant level

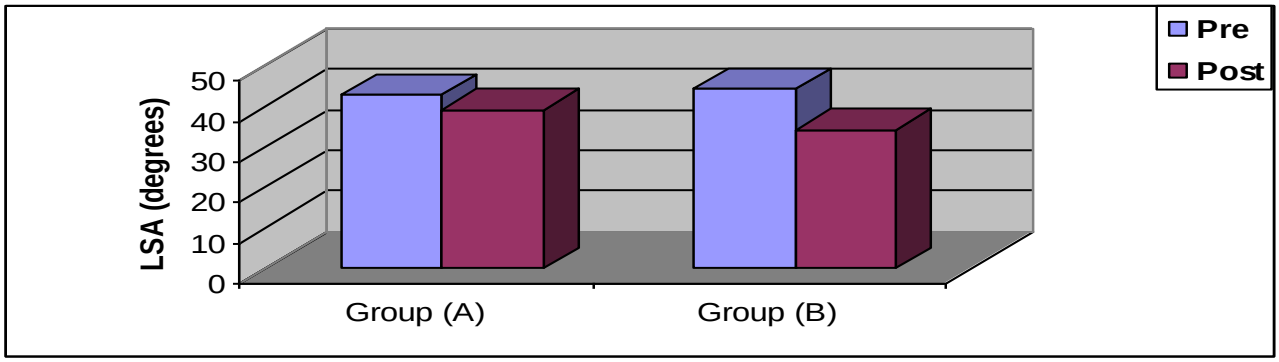

Fig. (1): Mean value of LSA (degrees) before (pre), and after (post) treatment for each group (A&B).

Table (2) and Fig. (2) showed comparison between pre and post values of pain intensity in each group. Data presented in table (2) showed that there was a significant differences in the post value of pain intensity in both groups. Pain intensity values post treatment were lower than their corresponding pre values in both groups. But the percentages of improvement were 21.8% and 93.7 % in group (A) and in group (B) respectively providing more improvement in group (B) when compared with group (A).

Table (2): Mean value of pain intensity before (pre), and after (post) treatment for each group (A&B).

	Pain intensity					
	Group (A) : (Disectomy)			Group (B) : (Disectomy) + PT		
	Pre Treatment	Post Treatment		Pre Treatment	Post Treatment	
X	56.32	27.75		51.95	3.2	
±SD	11.73	13.7		9.92	3.2	
T-value	12.28		s	22.45		s
P-value	0.01			0.001		
% of improvement	21.8 %			93.7 %		

X: mean ±SD: standard deviation S: significant level

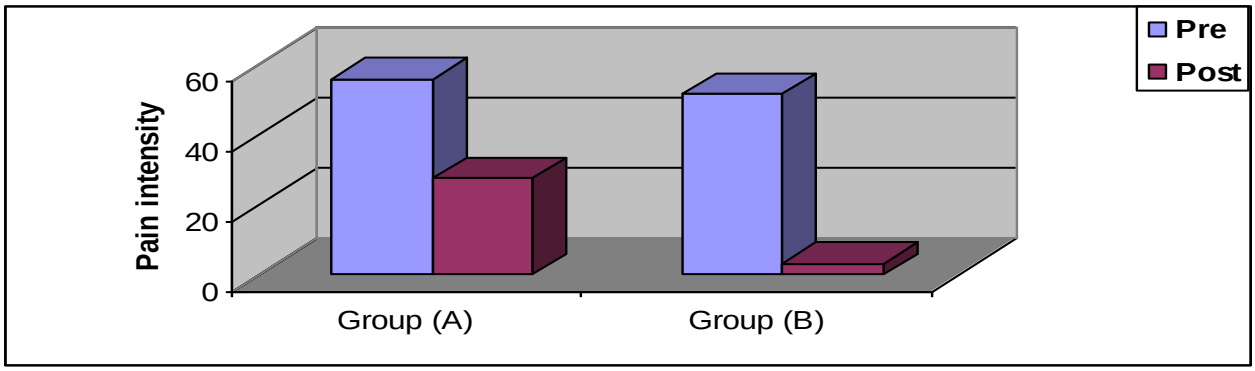

Fig. (2): Mean value of pain intensity before (pre), and after (post) treatment for each group (A&B).

Table (3) and Fig. (3) showed comparison between pre and post values of degree of ROM in each group. Data presented in table (3) showed that there was a significant differences in the post value of degree of ROM in both groups. Degree of ROM values post -treatment were higher than their corresponding pre values in both groups. But the percentages of improvement were 31.9 % and 99.8 % in group (A) and in group (B) respectively providing more improvement in group (B) when compared with group (A).

Table (3): Mean value of ROM (degrees) before (pre), and after (post) treatment for each group (A&li).

	ROM (degrees)					
	Group (A) : (Disectomy)			Group (B) : (Disectomy) + PT		
	Pre Treatment	Post Treatment		Pre Treatment	Post Treatment	
X	42.3	55.8	s	42.9	85.75	s
±SD	15.53	16.08		17.1	6.34	
T-value	-7.47			-12.52		
P-value	0.01			0.001		
% of improvement	31.9 %			99.8 %		

X: mean ±SD : standard deviation S: significant level

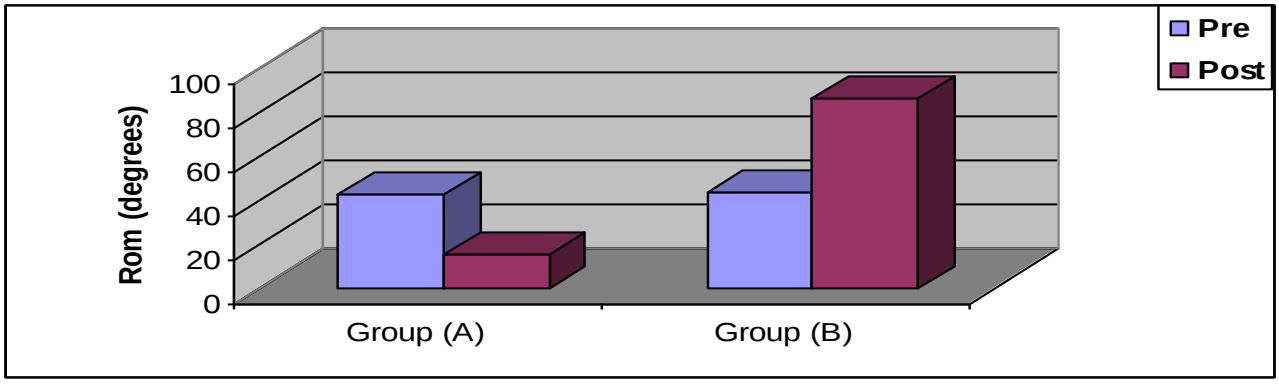

Fig. (3): Mean value of ROM (degrees) before (pre) and after (post) treatment for each group (A&B).

Table (4) and Fig. (4) showed that, there was no significant differences between both groups pre treatment in the LSA while there was a significant differences between them post treatment denoted that the discectomy and selective physical therapy program had more effect on decreasing LSA than the discectomy only.

Table (4): Mean value of LSA (degrees) before (pre), and after (post) treatment for between groups (A&B).

	LSA (degrees)			
	Pre treatment		Post treatment	
	Group (A)	Group (B)	Group (A)	Group (B)
X	42.7	44.2	39.1	34.05
SD	5.02	5.56	4.62	3.45
T-value	-0.89		3.91	
P-value	0.37		0.01	
Sig.	NS		S	

X: mean ±SD: standard deviation Sig: significant level NS: not significant.

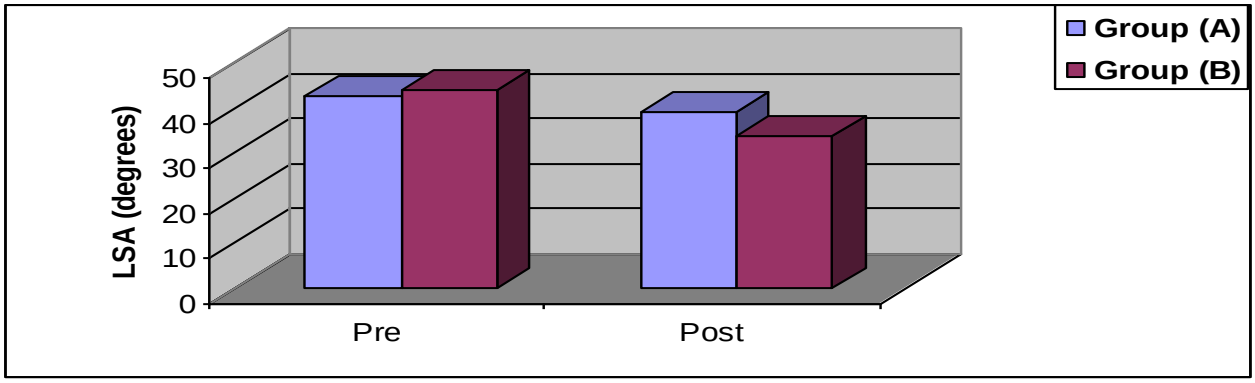

Fig. (4): Mean value of LSA (degrees) before (pre), and after (post) treatment between both groups (A&B).

Table (5) and Pig.(5) showed that, there was no significant differences between both groups pre treatment in the pain intensity while there was a significant differences between them post treatment denoted that the discectomy and selective physical therapy program had more effect on decreasing pain intensity than the discectomy only.

Table (5): Mean value of pain intensity before (pre), and after (post) treatment for between groups (A&B).

	Pain intensity			
	Pre treatment		Post treatment	
	Group (A)	Group (B)	Group (A)	Group (B)
X	56.32	51.95	27.75	3.29
SD	11.73	9.92	13.53	3.2
T-value	0.41		7.19	
P-value	0.81		0.01	
Sig.	NS		S	

X: mean ±SD: standard deviation Sig: significant level NS: not significant.

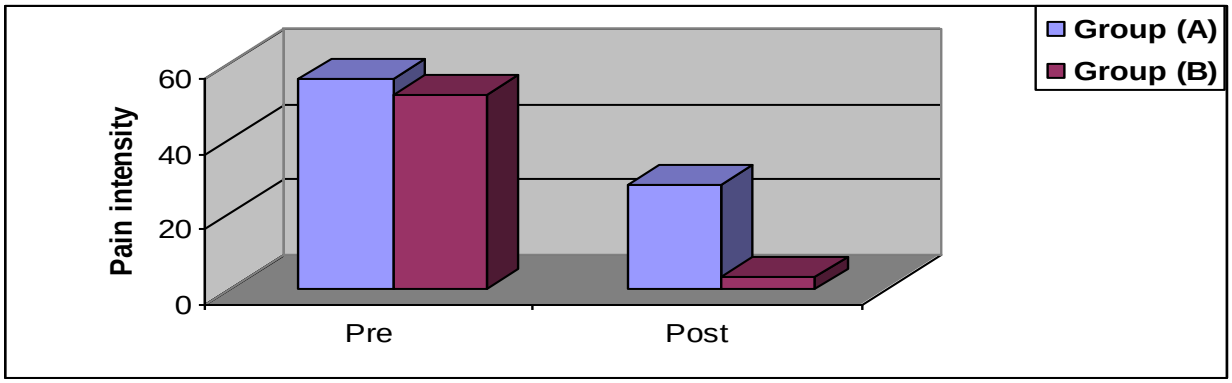

Fig. (5): Mean value of pain intensity before (pre), and after (post) treatment between both groups (A&B).

Table (6) and Fig.(6) showed that, there was no significant differences between both groups pre treatment in the ROM while there was a significant differences between them post treatment denoted that the discectomy and selective physical therapy program had more effect on increasing ROM than the discectomy only**.**

Table (6): Mean value of ROM (degrees) before (pre), and after (post) treatment between groups (A&B).

	ROM (degrees)			
	Pre treatment		Post treatment	
	Group (A)	Group (B)	Group (A)	Group (B)
X	42.3	42.9	55.8	85.75
SD	13.53	17.1	16.08	6.34
T-value	-0.12		-7.74	
P-value	0.9		0.001	
Sig.	NS		S	

X: mean ±SD: standard deviation Sig: significant level NS: not significant.

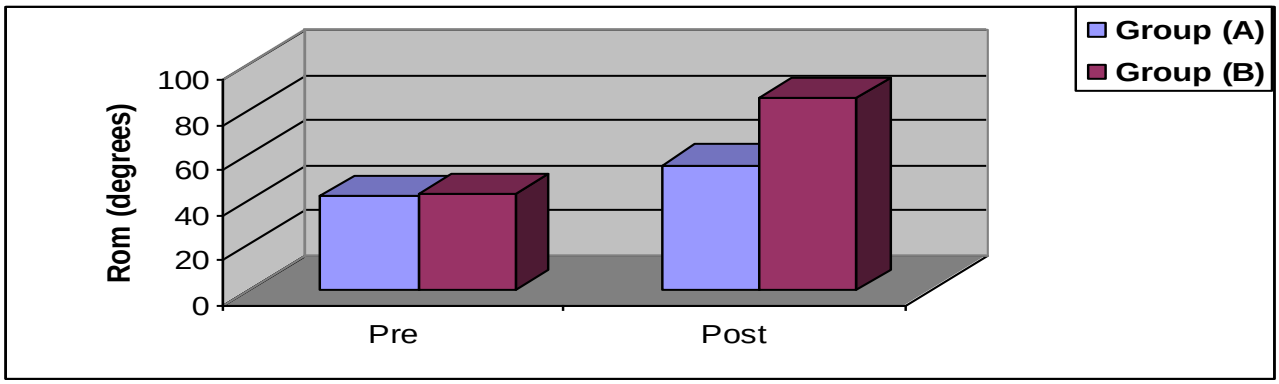

Fig. (6): Mean value ROM (degrees) before (Pre) and after (Post) treatment between both groups (A&B).

DISCUSSION

The aim of this work was to investigate the effect of endoscopic discectomy plus selective physical therapy program in the patients with single lumber disc prolaps.

Currently, spine surgery is undergoing a revolution in the way certain surgeries are performed. Discectomies can now be performed arthroscopically, that is through a smaller incision using specialized tools under general or local anesthesia[25].

Few studies have described the incidence of muscle weakness and spasm and its recovery after conventional surgery[2,29,37] or microsurgery[27] for herniation of a lumbar disc. Even fewer investigations, carried out on patients who had conventional surgery[25], have considered the postoperative restoration of muscle power , but one have focused only on the muscles supplied by the L5 nerve root[6,11] or extensor hallucis longus (EHL). There have been contradictory results concerning the proportion of patients who recover and the degree of recovery[13]. Little and conflicting information is available on the factors which may affect the postoperative restoration of lumbar ROM. Furthermore, no investigation has analyzed the patient's functional disability resulting from a persistent muscle weakness and spasm[30].

On the other hand, it was noticed that in the static spine the fast majority of painful feeling is due to an increasing LSA with exaggeration of lumber lordosis[15]. Also it was proposed that, the shearing stress is proportional to the angle of sacral inclination[34]. This anterior shear stress causes postural back pain followed by muscle spasm in cases of lumbar disc prolaps.

In the present study, it was noticed a significant differences towards normal values of LSA in the second group after endoscopic lumbar discetomy and application of SST and laser puncture. The study had an agreement with many investigators and surgeons who had performed many operations of endoscopic lumbar discetomy and noticed releasing of pressure on nerve roots caused by disc with minor lesion to the area of operation[2,20,21,31,38] .This procedure might chair in changing value of LSA towards normalization in current study. Moreover, the improvement in GB might be attributed to the effect of laser puncture and the effect of SST which decrease pain and muscle spasm with subsequently increasing in flexion ROM. The study had an agreement with a work concluded that vapocoolant spray cools the skin by evaporating quickly and a sudden drop in skin temperature causes stimulation of skin afferent sensory fibers that affect polysynaptic reflexes in the spinal cord, closing the pain gate and preventing hyper stimulation of muscle or sensation of pain at higher centers. This temporary anesthesia results in an increase of passive stretching of muscle that has direct effect on trigger point and restoration of normal muscle lenght.[1,14,16,18,32]

On the other hand, it was suggested that vapocoolant spray decrease the metabolic rate and inflammation. Vasoconstriction also causes a decreased blood flow in the lumbar area. The muscle can no longer contract, the metabolic rate drops relieving muscle spasm, reducing nerve activity and increasing ROM[23,34,35].

Furthermore, the improvement in experimental group which was noticed after one month might be attributed to laserpuncture. As it was suggested that laser puncture stimulates the gate control to inhibit pain pathway, also it was believed that, laser puncture stimulate the raphe system to release 5 hydroxy tryptumine (serotonin) that inhibit

pain through dorsolateral fibers[33] In addition, it was proposed that laserpuncture. Stimulate the secretion of pituitary and mid brain endorphins which has potent analgesic effects[36] . Moreover, it was proposed that laserpuncture stimulate mitochondria and transformation of laser energy into chemical energy which restore normal properties of muscle tissue on a cellular level via ATP formation and energy activity[4,19,22].

In addition, it was believed that laserpuncture decrease the production of prostaglandins E, due to acceleration of superoxide dismutase that act as blocker in the production of prostaglandin. It was suggested that laserpuncture improves local microcirculation and can also improve oxygen supply to hypoxic cells and remove wast products[13,32,36,38].

In the present study the improvement which was noticed in the second group was attributed to the double effects of endoscopic lumbar discectomy plus SST and laserpuncture.

Conclusion

According to the results of this work, it was concluded that endoscopic lumbar discectomy plus selective physical therapy program were an effective treatment in the patients with single lumbar disc prolaps.

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الملخص العربي

فاعلية منظار إزالة غضروف المنطقة القطنية وبرنامج العلاج الطبيعي المختار في الانزلاق الغضروفي القطني الاحادي

اجري هذا البحث بهدف دراسة تأثير منظار إزالة غضروف القطنية وبرنامج العلاج الطبيعي المختار علي الزاوية القطنية العجزية، مستوي الالم ومدي الثني للجذع في مرضي الانزلاق للغضروف الاحادي في المنطقة القطنية. تم إجراء هذا البحث علي أربعين مريضا . جميع المرضي كانوا يعانون من انزلاق غضروفي احادي في المنطقة القطنية. تراوحت أعمارهم بين خمسة وأربعين وخمسة وخمسين عاما. وتم تقسيمهم عشوائيا إلي مجموعتين متساويتين. المجموعة الأولي (20 مريضا) تم علاجهم باستخدام منظار إزالة غضروف المنطقة القطنية فقط. أما المجموعة الثانية (20 مريضا) تم علاجهم باستخدام منظار إزالة غضروف المنطقة القطنية بالاضافة إلي برنامج العلاج الطبيعي المختار. تم التقييم للزاوية القطنية العجزية باستخدام اشعة أكس، مستوي الالم باستخدام اسئلة تقييم لماك جيل ومدي الثني للجذع عن طريق جهاز بليوميتر تم التقييم بعد العملية (12 ساعة بعد العملية) وبعد شهر من العلاج . وقد أسفرت النتائج عن وجود فروق ذو دلالة إحصائية بين المجموعتين في الزواية القطنية العجزية حيث بلغت نسبة التقدم في الزواية القطنية العجزية 8.43% ، 22.9% في المجموعة الأولي والثانية علي التوالي. أما مستوي اقلال الالم 21.8% ، 93.7% في المجموعة الأولي والثانية علي التوالي. وبالنسبة لمدي ثني الجذع فقد وصل إلي 31.9% ، 99.8% في المجموعة الأولي علي التوالي. وقد خلصت الدراسة إلي أن منظار إزالة غضروف المنطقة القطنية وبرنامج العلاج الطبيعي المختار لهما تأثير فعال في علاج الانزلاق الغضروفي الاحادي في المنطقة القطنية.