Early Strengthening Versus Stretching after Surgical Management of Disc Prolapse and its Relation with Daily Activities

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ABSTRACT

Background and purpose: *Injuries to the intervertebral discs of the lumbosacral spine are invoked as a causative factor in one of the most common health problems. This study was conducted to evaluate two training programs, both of which started immediately after lumbar surgery.* ***Subjects and methods:*** *The study included fourty patients, age ranged from 25 to 40 year and divided into two groups. The first group with mean age 30.2±4.79 years followed a physical therapy program of exercises in the form of strengthening exercises for back, gluteus maximus and abdominal muscles with postural instructions, three sessions per week for 6 weeks. The second group with mean age 31.8±5.23 years, submitted to a physical therapy program of exercises in the form of isolated stretching of back muscles, and hamstrings muscles; and strengthening exercises for the abdominal muscles with postural instructions, three sessions per week for 6 weeks. Outcome measures were lateral view of loading x-ray, to detect any change in lordotic curve by measuring lumbo-sacral angle (LS), tape measurement to detect range of motion of trunk flexion, and visual analogue scale to measure the pain.* ***Results:*** *There was a significant difference in the first group (t of pain = 0.005, t of ROM = 0.009, but no significant difference in L.S angle where t = 0.04) than in the second group, there was a significant difference in pain, t = 0.01, but no significant difference in relation to ROM, where t = 0.06, and L/S angle where t = 0.07.* ***Discussion and Conclusion:*** *This study showed that patients rehabilitated according to the early stretching exercise is better than strengthening exercises in pain and ROM, and both of them had no effect on L/S angle which is the pathomechanics after surgical management of disc prolapse patients.*

Key words: *Lumbar disc bulge, Lumbar disc herniation, Lumbar disc protrusion, Low back pain, Pathomechanics. Lumbosacral angle, Surgical and Conservative management.*

INTRODUCTION

Injuries to the intervertebral discs of the lumbosacral spine are invoked as a causative factor in one of the most common health problems. Of the many possible etiologies of LBP, the intervertebral disc has been implicated as a more frequent source than muscular strain or ligamentous sprain. The lifetime incidence of LBP has been reported to be 60-90% with an annual incidence of 5%. LBP affects men and women equally[4,7].

Back pain is a common complaint. Numerous causes of lumbar disk disease in athletes exist. Ninety percent of patients' symptoms from this condition resolve within 4 weeks, but it also can develop into a long-standing situation that can threaten or end a career[1,10,35].

The lumbar spine is made of 5 vertebrae that are separated by disks and supported by ligaments and muscles. The intervertebral disk

is the largest avascular structure in the body. Intervertebral disks are located in the spinal column between successive vertebral bodies[5]. The vertebrae and disks act as shock absorbers for the spinal cord and its nerve roots[32]. Loss of water content in the disk increases with age, and, with further degeneration or herniation, pain and other symptoms can result. Disk herniation is the result of repeated loading in an abnormal spine position (hyperflexion and lateral bending with or without a load applied). This type of injury usually does not occur from a single event[1,9,11,17].

There are 3 phases of the degenerative cascade: The first phase is known as the dysfunctional phase. This phase is characterized by circumferential tears or fissures in the outer annulus. In addition, endplate separation or failure can disrupt the blood supply resulting in the loss of nutrition to the disc. These changes are thought to result from repetitive microtrauma. One hypothesis is that the discs' nuclear proteoglycans lose the capacity to absorb water and maintain their protective function. Phase II, or the unstable phase, is characterized by multiple annular tears (both radial and circumferential), internal disc disruption, and resorption or loss of disc space height. This phase is thought to result from the progressive loss of the mechanical integrity of the 3-joint complex[16,17]. Phase III also is known as the stabilization phase. Further disc resorption, disc space narrowing, endplate destruction, disc fibrosus, and osteophyte formation are present. Disc injuries are more likely to occur in phase I or II of the degenerative process[32].

Symptoms such as back pain, muscle weakness, or numbness in the leg(s) or buttock region, difficulty walking, bowel or bladder difficulties, fever, malaise, weight loss, increased pain with the straining, or night pain should be considered in making a diagnosis and prognosis/treatment recommendation. In males, impotence or erectile dysfunction in association with back pain can be a sign of nerve root compression. The classic history indicative of herniated disk(s) includes worsening back pain with sitting, coughing or straining as when going to the bathroom, and relief of the pain when lying flat or flexing the ipsilateral hip. Lateral trunk deviation, may be present in lumbar disk disease with symptoms of sciatica[9,12].

In a review of the MRI of the spine, a bulge refers to a broad-based projection of outer annular fibers beyond the posterior bony margins of the adjacent vertebrae[12,23,24].

The goal of rehabilitation is to reestablish a pain-free ROM. Stretching of the hamstrings and low back is best performed lying on the back with the slightly bent leg flexed above the head. Gentle strengthening of the trunk, pelvic girdle, paraspinous, and abdominal muscles may be achieved. exercise stimulates tissue growth, slows or possibly reverses degenerative conditions, and enhances nutrition to the disk. Increasing the strength and endurance in the major muscle groups (quadriceps, hamstrings, hip, and abdominal muscles) is important. Spine flexibility has not shown to reduce the risk of future injury. Hip flexibility has been shown to be important. Muscle contraction with the spine in neutral position is the most successful exercise program[22,29,33,34].

Surgical Intervention Procedures for partial removal of the bone (partial laminectomy) and of the disk (diskectomy) are the best options for a herniated disk that has failed nonsurgical treatment[36,38]. Some studies indicate that these operations are extremely effective in athletes for pain control and return of function; other studies oppose these findings. Central decompression of the disk can be performed chemically with

chymopapain by laser ablation and vaporization or mechanically by aspiration and suction with a shaver such as the percutaneous lateral decompression or the nucleotome[6,33].

For patients with moderate or severe sciatica, surgical treatment was associated with greater improvement than nonsurgical treatment at 5 years. However, patients treated surgically were as likely to be receiving disability compensation, and the relative benefit of surgery decreased over time[2,3,28,30,37].

Patients rehabilitated according to the early active training program had a better short-term outcome of objective values. At 2 years' follow-up, more patients were satisfied with the result of the operation. The early active treatment program is recommended[13,14,15,18].

Chronic back patients after first time discectomy may benefit from an intensive rehabilitation protocol including intensive exercises[18,21,22,29]. The added use of hyperextension exercises does not confer any independent benefit. Furthermore, the training had to continue for more than 2-3 months before a statistical significant decrease in back pain was reported in the patient pain diary[26,27].

The aim of the current study is to compare between strengthening and stretching exercises after surgical management of disc prolapse and its relation with daily activities.

MATERIALS AND METHODS

Subjects

All subjects were post operative disc prolapse (lamenictomy, discectoy) patients of L4-5 , L5-S1. The study included 40 (2 females and 38 males) volunteer patients, age ranged from 25 to 40 years and divided into 2 groups. The first group with mean age 31.8±5.23 years followed a physical therapy program of exercises in the form of isolated stretching of back, and hamstrings muscles; and strengthening exercises for the abdominal muscles with postural instructions, three sessions per week for 6 weeks. The second group with mean age 30.2±4.79 years, is submitted to physical therapy program of exercise in the form of strengthening exercises for back, gluteus maximus and abdominal muscles with postural instructions, three sessions per week for 6 weeks. All the patients were listed at out clinic and internal orthopaedic departments at Cairo University hospitals. All of them were suffering from pain, limitation of ROM of trunk flexion with pathomechanics of lumbo-sacral curve.

Instrumentations

1- Loading x-ray (siemens Poly phase 50 appartus, siemens).
2- Tape measurement is to detect range of motion(ROM) of trunk flexion by fingertip to floor test.
3- Visual analogue scale(VAS) is to measure the pain severity.

Procedures

The patients signed an informed consent form, and were informed about the whole procedures before testing and training:

Treatment procedures

The first group was submitted to physical therapy program which was in the form of strengthening abdominal exercises (from crock lying position and ask the patient try to touch the knees by his hands,10 repetitions with 3 sets, 6 seconds rest between each repetition, and 1 minute rest between the sets. the resistance is progressed according to repetitions). And isolated stretching of tight muscles was done (5 repetitions,30 seconds in position of stretching, 30 seconds in position of relaxation)for back muscles (from crock

lying position and the therapist taking both lower limbs toward the chest, hamstrings from crock lying position with one limb extended and press on the knee), and postural instructions for active daily living. The program continued for 6 weeks, 3 sessions per week performed and supervised by the same physical therapist.

The second group was submitted to physical therapy program which was in the form of strengthening abdominal exercises(from crock lying position and ask the patient try to touch the knees by his hands, 10 repetitions with 3 sets, 6 seconds rest between each repetition, and 1 minute rest between the sets. the resistance is progressed according to repetitions). And strengthening back exercises was done (from prone lying position and ask the patient try to raise his face and both shoulder from the bed as much as possible,10 repetitions with 3 sets, 6 seconds rest between each repetition, and 1 minute rest between the sets. The resistance is progressed according to repetitions), strengthening gluteus maximus exercises (from prone lying position and ask the patient try to extend one limb from the bed as much as possible,10 repetitions with 3 sets, 6 seconds rest between each repetition, and 1 minute rest between the sets. the resistance is progressed according to repetitions), and postural instructions for active daily living. The program continued for 6 weeks, 3 sessions per week performed and supervised by the same physical therapist.

Assessment procedures

All the patients were assessed before treatment and reassessed after 3 months by:

1- Lateral view of loading x-ray is to detect any change in lordotic curve by measuring lumbo-sacral(LS) angle (by meeting of two lines, a horizontal line from the superior surface of the first sacral bone and a horizontal line from the superior surface of first lumbar bone).
2- Tape measurement is to detect range of motion (ROM) of trunk flexion (fingertip-floor test) for both groups as following : The patient was instructed to bend as far forward as he could with his knees straight, and to try to touch his toes, then the distance from his fingertips to the floor was measured, pre and post the program of exercises and pre and post of surgical approach. So, detecting if there is a change or not.
3- Visual analogue scale (VAS) is to measure the pain which is represented from (0) grade to (10) grade. Zero grade means no pain, (10) grade means unbearable pain, from 1 to 10 means graduation intensities of pain. The subjects were asked to indicate the level of pain by placing a dash at the appropriate level on the 10 cm horizontal line.

Data Analysis

The collected data were statistically treated and the following values were found minimum, maximum, mean, S.D., one sample paired T-test to compare between pre and post in the group and two sample unpaired T-test to compare between 2 groups, at a confidence level of ($P = 0.05$).

RESULTS

The results of the stretching group

There was a significant improvement of pain after physical therapy treatment from (8.45±0.70) to (2.59±1.19), ROM of trunk flexion increased from (21.26±4.63) to (6.43±1.57), and lumbo-sacral angle decreased from (28.13±4.20) to (26.92±3.75), tab. (1) fig. (1).

Table (1): Pre and post values of pain, ROM of trunk flexion, and lumbo-sacral (LS) angle, in first group.

	Pain		ROM		LS angle	
	PRE	POST	PRE	POST	PRE	POST
MIN	7	1	16	3	20	16
MAX	9	5	29	12	35	29
MEAN	8.45	2.59	21.26	6.43	28.13	26.92
SD	0.70	1.19	4.63	1.57	4.20	3.75
T-test	0.005*		0.009*		0.04*	

* = significant, P ≤ 0.05. ** = no significant, P ≥ 0.05

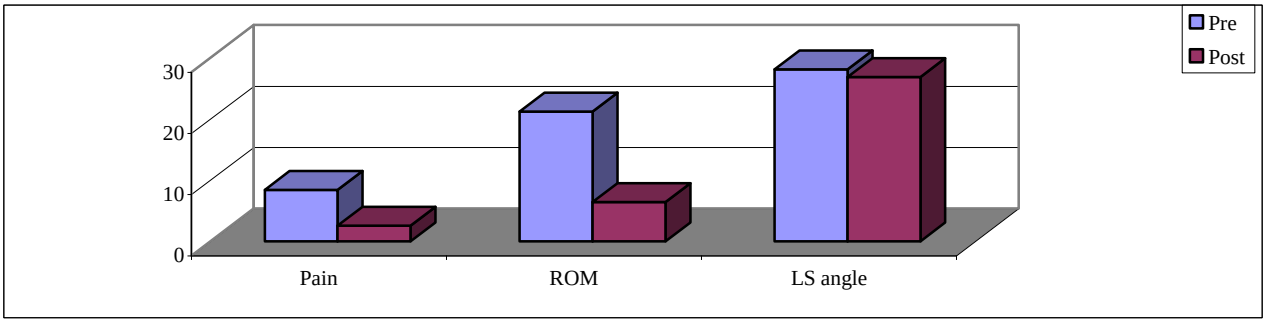

Fig. (1): The mean values of pain, ROM of trunk flexion, and lumbo-sacral angle in first group.

The results of the second group

There was a significant improvement of pain after physical therapy treatment from (7.81±0.64) to (2.45±1.07), but no significant improvement in ROM of trunk flexion where changed from (21.45±4.66) to (21.05±4.59), and lumbo-sacral angle from (26.72±3.95) to (26.43±3.79), tab. (2) fig. (2).

Table (2): Pre and post values of pain, ROM of trunk flexion, and lumbo-sacral (LS) angle, in second group.

	Pain		ROM		LS angle	
	PRE	POST	PRE	POST	PRE	POST
MIN	6	2	15	13	20	18
MAX	9	6	30	27	33	31
MEAN	7.81	2.45	21.45	21.05	26.72	26.43
SD	0.64	1.07	4.66	4.59	3.95	3.79
T-test	0.01*		0.06**		0.07**	

* = significant, P ≤ 0.05. ** = no significant, P ≥ 0.05

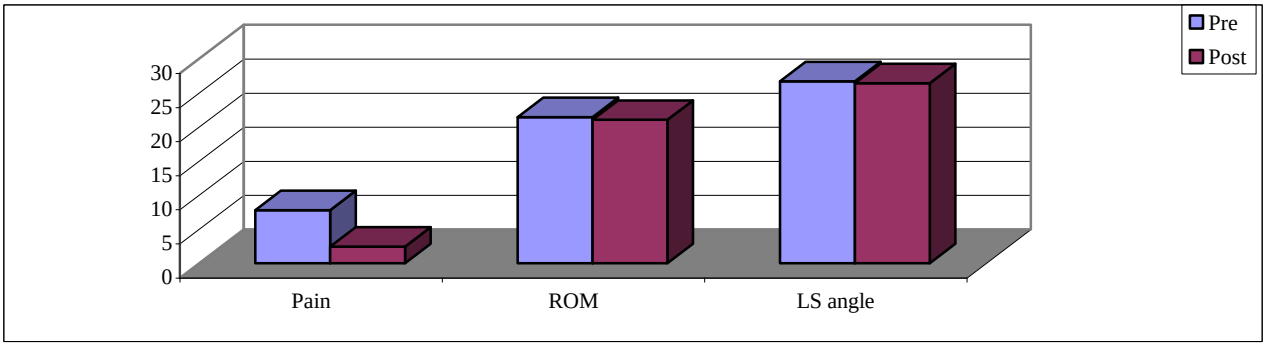

Fig. (2): The mean values of pain, ROM of trunk flexion, and lumbo-sacral angle in second group.

Comparison between both group

1- There is no significant difference between pre measures of the first group and pre measures of the second group of pain, ROM of trunk flexion, and lumbosacral angle , where T.value of pain 0.7, T.value of ROM of trunk flexion 0.33, and T.value of lumbo-sacral angle 0.09 tab.(3) fig.(3).

Table (3): The mean values of pre test of pain, ROM of trunk flexion, and lumbo-sacral (LS) angle , in both groups.

	Pain		ROM		LS angle	
	1st gr.	2nd gr.	1st gr.	2nd gr.	1st gr.	2nd gr.
MIN	7	6	16	15	20	20
MAX	9	9	29	30	35	33
MEAN	8.45	7.81	21.26	21.45	28.13	26.72
SD	0.70	0.64	4.63	4.66	4.20	3.95
T-test	0.07**		0.33**		0.09**	

* = significant, P ≤ 0.05 ** = no significant, P ≥ 0.05 gr. = group

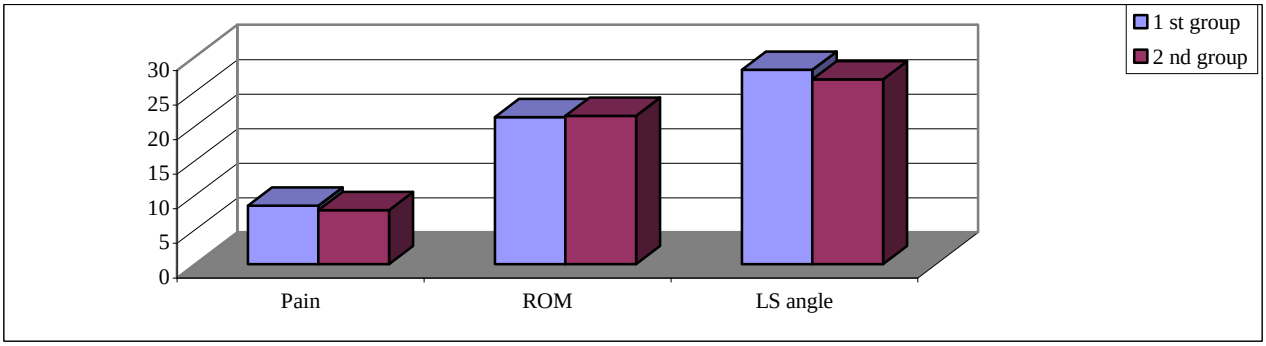

Fig. (3): The mean values of pre test of pain, ROM of trunk flexion, and lumbo-sacral angle , in both groups.

2- There is a significant difference between post measures of the first group and post measures of the second group of ROM of trunk flexion, where T. value of ROM of trunk flexion 0.005. With no significant difference in pain and lumbo-sacral angle , where T. value of pain 0.068, and T. value of lumbo-sacral angle 0.14. tab.(4) fig.(4).

Table (4): The mean values of post test of pain, ROM of trunk flexion, and lumbo-sacral (LS) angle, in both groups.

	Pain		ROM		LS angle	
	1st gr.	2nd gr.	1st gr.	2nd gr.	1st gr.	2nd gr.
MIN	1	2	1	13	16	18
MAX	5	6	5	27	29	31
MEAN	2.59	2.45	6.43	21.05	26.92	26.43
SD	1.19	1.07	1.19	4.59	3.75	3.79
T-test	0.068**		0.005*		0.14**	

* = significant, P ≤ 0.05 ** = no significant, P ≥ 0.05 gr. = group

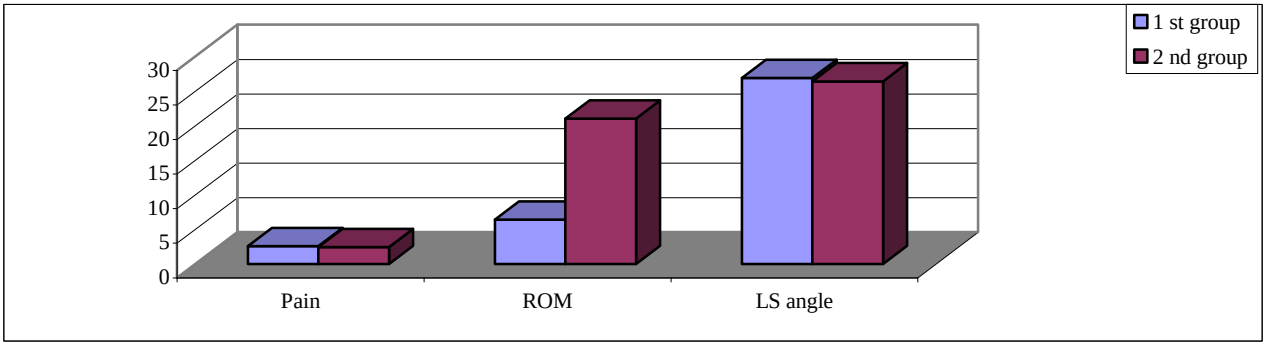

Fig. (4): The mean values of post test of pain, ROM of trunk flexion, and lumbo-sacral angle, in both group.

DISCUSSION

The early active training program has a positive effect on the way patients cope with pain in their daily lives, if we use stretching or strengthening exercises[19].

The results of this study showed that, there was a significant results of the stretching program for pain and ROM of trunk flexion due to using of exercises program which include: Stretching exercises of back muscles which is decreasing spasm of the muscles and improving the circulation which decreases the concentration of metabolites, and decreasing the hypertonicity and hyperactivity of the lumbar erector spinae, and increasing ROM due to increasing elasticity of the back muscles. Stretching exercise of hamstrings muscles was decreasing spasm and tightness of the muscles, where forward bending is a complex movement of combined lumbar and hip motion and is considered an important activity and can be restricted due to shortening of back and hamstrings muscles with low back pain. Short hamstring muscles is found, because of their attachments to the posterior leg and to the ischial tuberosity , may limit forward bending and cause back pain due to their influence on lumbar pelvic rhythm. So, stretching of hamstring must be carried out at the same exercise of stretching back muscles, to guaranty stretching of all the muscle attachments[20,25].

Strengthening of the abdominal muscles which is considered the anterior wall of the spine and must be strong enough to protect the spine from anterior aspect. A recent focus in the physiotherapy management of patients with back pain has been the specific training of muscles surrounding the spine (deep abdominal muscles and lumbar multifidus), considered to provide dynamic stability and fine control to the lumbar spine[31].

The program of stretching was creating a controlling and balancing between agonist and antagonist muscles of the lumbo-sacral region and coordination of lumbar-pelvic rhythm i.e, decreasing of hypertonicity of the back muscles and anterior tilting of the pelvis, and the line of gravity come back approximately to the normal passway. There was no significant results in the lumbo-sacral angle.

In the strengthening group, improvement of pain was due to increasing the power of the lumbar erector spinae muscles which break down the pain circle. But no significant results in ROM and lumbo-sacral angle is due to decreasing elasticity of the back muscles. The poor elasticity of the back is due to shortening of the back, and hamstrings muscles. The

results of this study come in agreement with many previous findings as following:

Positive effects of the postoperative early lumbar extension muscle-strengthening program on pain return to work, and strength of back muscles in patients after operation of herniated lumbar disc[5,8].

Manniche et al., 1993 concluded that, chronic back patients after first time discectomy may benefit from an intensive rehabilitation protocol including intensive exercises. The added use of hyperextension exercises does not confer any independent benefit[26,27,28]. Vigorous strengthening exercise therapy, started 4 weeks after surgery for lumbar disc herniation reduced disability and pain after surgery[6,8].

In comparison of results of both groups, there is no significant improvement of pain, and lumbo-sacral angle but there is significant improvement of ROM of trunk flexion only in the first group than in the second group, because the elasticity of the back is increased from stretching exercises of back, and hamstrings muscles.

The results of this study was found that the improvement in the stretching group was significant more than in the strengthening group in ROM of trunk flexion only. But no significant results in pain, and lumbo-sacral angle.

From all of the above, we showed that stretching of tight muscles and following postural instructions are more beneficial than strengthening exercises immediately after disc surgery.

Conclusion

Using of stretching exercises and following postural instructions are more beneficial than strengthening exercises immediately after disc surgery. But we need a further search about collection of both stretching and strengthening exercises at the same time after surgical management of disc prolapse.

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الملخص العربي

مقارنة بين تمرينات التقوية وتمرينات الشد لعضلات الظهر بعد العلاج الجراحي للانزلاق الغضروفي مباشرة وعلاقتها بالأنشطة اليومية

الهدف من هذه الدراسة تقييم مدى تأثير برنامجين مختلفين للعلاج الطبيعي مباشرة بعد عملية إزالة الغضروف أو إزالة الجزء العظمى الضاغط على العصب ، حيث يعتبر الانزلاق الغضروفي بالمنطقة القطنية من أهم أسباب آلام أسفل الظهر مما يؤدى إلي إعاقة الأنشطة اليومية . تشمل الدراسة أربعون مريضا من الذكور والإناث تتراوح أعمارهم من خمسة وعشرون إلى أربعون عاما. بعد أن تم تشخيص المرضى اكلينيكيا ، تم تقسيم المرضى عشوائيا إلى مجموعتين متساويتان في العدد ، المجموعة الأولى : عشرون مريضا خضعت لبرنامج العلاج الطبيعي المتمثل في عمل تمرينات لتقوية عضلات البطن ، شد عضلات الظهر ، و شد عضلات ثنى مفصل الركبة لعمل توازن عضلي حول منطقة الظهر مع البطن وقد أجرى البرنامج لمجموعة واحدة ثلاث جلسات أسبوعيا لمدة ستة أسابيع ، نفس البرنامج بنفس الأخصائي لكل مريض ويتضمن البرنامج أيضا التعليمات الصحيحة للأنشطة اليومية. المجموعة الثانية : عشرون مريضا ، تم استخدام تمرينات لتقوية عضلات البطن ، تقوية عضلات الظهر ، وتقوية عضلات فرد مفصل الفخذ وقد أجرى البرنامج لمجموعة واحدة ثلاث جلسات أسبوعيا لمدة ستة أسابيع ، نفس البرنامج بنفس الأخصائي لكل مريض ويتضمن البرنامج أيضا التعليمات الصحيحة للأنشطة اليومية . تم تقييم الالم بالمدرج البصري للألم والمدى الحركي لثنى الجزء العلوي من الجسم بمقياس المدى الحركي للمفصل وانحناء الفقرات القطنية بأشعة اكس . وقد بينت النتائج الإحصائية وجود تحسن ملحوظ في الألم والمدى الحركي في المجموعة الأولى ولا يوجد تحسن في انحناء الفقرات القطنية وفي المجموعة الثانية وجود تحسن ملحوظ في الألم ولا يوجد تحسن في المدى الحركي وانحناء الفقرات القطنية ، ووجود فوارق ذات دلالة إحصائية بينهما في المدى الحركي عند المقارنة . وقد ظهر من الدراسة أن برنامج العلاج الطبيعي الأول المتمثل في الشد أكثر تأثيرا لعلاج المرضى بعد عملية إزالة الغضروف أو إزالة الجزء العظمى الضاغط على العصب من برنامج التقوية في المدى الحركي فقط .