The Effect of Isolated Lumbar Extension Exercise Program on Clinical Outcome in Patients with Chronic Low Back Pain

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The Effect of Isolated Lumbar Extension Exercise Program on Clinical Outcome in Patients with Chronic Low Back Pain

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Neurosurgeon Young Keun Kim

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Abstract

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OBJECTIVE : Chronic back pain had been increased gradually in an aging society. Many treatment methods for chronic back pain, including physical therapy, medication, surgical operation, were used. Recently the importance of exercise and back muscle was on the rise. In this study, the effects of isolated lumbar extension exercise on pain, disability, and power of back muscle in patients with chronic low back pain were assessed.

METHODS : Fifty patients (twenty seven men, thirty women) with more than 12 weeks of low back pain and degenerative disc disease on magnetic resonance imaging were divided into an exercise group (thirteen men, fifteen women) and a control group (fourteen men, fifteen women). All patients underwent measurement of isometric strength of the lumbar extensor muscle with MedX (MedX, Ocala, FL, USA) lumbar extension machine and completed the visual analogue scale (VAS) for back pain and the Oswestry disability index (ODI) to assess pain and disability, respectively before and after 12 weeks of training. Control group was treated with physiotherapy and analgesics without programmed exercise training.

RESULTS : The mean lumbar extensor muscle power of the exercise group was improved from 125.67±56.92 lb to 178.52±56.98 lb after 12 weeks program of isolated lumbar extension exercise. The mean lumbar extensor muscle power of the control group was improved from 133.30±57.18 lb to 144.56±57.45 lb after 12 weeks of conservative treatment except exercise. The lumbar extensor muscle power was improved 42.05% and 8.45% in exercise group and control group, respectively ($P<0.05$). VAS was improved from 5.36 to 1.43 in exercise group, from 5.20 to 4.05 in control group ($P<0.05$). The improvement of lumbar extensor power and VAS shows positive correlation in both exercise and control group ($P<0.05$) ODI was improved from 27.89% to 17.44% in exercise group, from 21.06 to 20.09 in control group ($P<0.05$). The improvement of lumbar extensor power and ODI shows positive correlation in the exercise group ($P<0.05$). But in the control group, there was no correlation between the improvement of lumbar extensor power and ODI ($P=0.80$)

CONCLUSION : Isolated lumbar extension exercise program exerts a positive influence on chronic low back, disability and power of lumbar extensor muscles.

Key words : back pain, lumbar extension exercise, clinical outcome, MedX

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I. INTRODUCTION

During the course of their lives, 70-85% of individuals will experience low back pain.[1-3] It is estimated that 80-90% of patients will have recovered within 6 weeks, regardless of treatment.[4-7] However, 5-15% will develop chronic low back pain (longer than 12 weeks).[6, 8-11] This is more difficult to treat[12, 13] and treatment modality and their clinical outcome have variable results.[14, 15]

Passive modality of treatment for acute stage of low back pain includes bed rest, hot pack, massage, and brace.[16] But the rest longer than a week is basically contraindicated, because of disuse syndrome such as muscle weakness, osteoporosis, and soft tissue contracture.[16]

Therapeutic exercise is one of the few clearly effective treatment for chronic low back pain as the guide to activity resumption and functional restoration.[16-24] Other effective physical treatments for chronic low back pain includes laser, massage, spinal manipulation.[18]

Isolated lumbar extension exercise program is widely accepted for management of chronic low back pain.[20, 22, 25-29] Especially, lumbar extensor muscles effectively exercises through pelvic stabilization.[22, 25, 27, 29] Moreover, an imbalance in trunk muscle strength can be one risk factor for development of low back pain.[30]

The purpose of this study is to determine the effects of isolated lumbar extension muscle-strengthening program on pain, disability, and power of back muscle in patients with chronic low back pain.

II. MATERIALS and METHODS

In this retrospective study, we reviewed 57 patients who had chronic low back pain. The inclusion criteria were: 1) more than 12 weeks of chronic low back pain without radiating leg pain; 2) on lumbar MRI, only degenerative disc disease was observed; 3) at least 12 weeks of follow up period; 4) absence of associated systemic disease such as cardiopulmonary diseases or orthopedic contraindications for subsequent exercise program. All patients underwent a lumbar magnetic resonance imaging before exercise program for exact diagnosis.

In 28 patients (13 men, 15 women) of exercise group and 29 patients (14 men, 15 women) of control group, all patients underwent measurement of the isometric strength of the extensor muscles of the lumbar spine using MedX system (MedX, Ocala, FL, USA) (Figure 1-4). This marked baseline measurement. The measurements were obtained at various angles of lumbar flexion from 0 to 72 degrees (Figure 2-4). The maximal voluntary effort applied was calculated and was quantified by the machine as the torque generated.

Exercise group started with intensive schedule (two times per week) with a defined set of exercises for extensor muscle strengthening for the next 12 weeks. It was supervised and graded program that also included aerobic and limb-strengthening exercises. The exercises included both dynamic and isometric exercises for the lumbar extensors. This exercise program used the MedX system, which by restricting the hip and pelvic motion using restraints, isolates the lumbar extensor muscles. Also, progressive resistance exercises can be given by increasing the weight. Leg extension, leg curl, hip extension, torso flexion program was performed for three sets per day. Extension exercise was done in two seconds, and then suspended for one second. After extension, the patients were back to the start position slowly in four seconds. Extension strength was set on 60-70% of initial maximum power, and gradually increased for 5% every visits. The number of frequency was reached until the patients were fatigued copiously. Physiotherapy and analgesics were added in exercise group.

Control group was treated with physiotherapy and analgesics without programmed exercise training.

At the end of 12-week program, all patients underwent measurement of isometric strength of the extensor muscles of the lumbar spine again. The VAS for pain and ODI were also assessed by patient-completed questionnaires.

Figure 1. MedX lumbar extension machine.

Figure 2. Isolated lumbar extension exercise at 0 degree.

Figure 3. Isolated lumbar extension exercise at 72 degree.

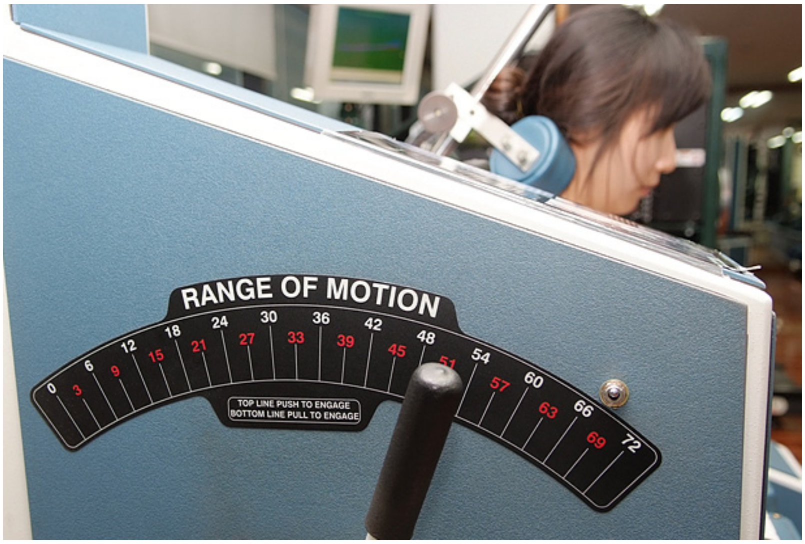

Figure 4. Degree of range of motion in MedX lumbar extension machine.

1. Statistical Analysis

The means and standard deviations in both the exercise and control groups were calculated and the difference for each group was compared. Also, the result including change (%) between, before and after the 12-week exercise program, was analyzed. Statistical analysis was performed using an independent and paired *t* test, and all *P* values less than 0.05 were determined to be statistically significant.

III. RESULTS

1. Demographic Data of The Exercise and Control Groups

Fifty-seven patients were divided into the exercise (13 men, 15 women) and control (14 men, 15 women) groups. The mean age of all the patients was 46.1 years (exercise group, 42.5 years; control group, 38.5 years), the mean height of all patients was 165.2 cm (exercise group, 165.0 cm; control group, 165.2 cm), and the mean weight of all patients was 63.2 kg (exercise group, 63.6 kg; control group, 63.3 kg) (Table 1). There were no statistically significant differences between two groups.

Table 1. Demographic data of the exercise and control groups

Group	n	Age (years)	Height (cm)	Weight (kg)
Exercise group	Total 28	42.54±14.66	164.78±7.59	64.25±9.80
	M 13	41.53±12.20	171.23±5.15	67.15±5.06
	F 15	42.54±12.16	164.79±7.59	56.33±4.32
Control group	Total 29	38.50±17.08	165.62±8.30	62.34±10.43
	M 14	40.05±11.99	167.19±7.95	66.57±9.17
	F 15	38.51±12.00	165.21±7.90	54.07±10.05

2. Comparison of Lumbar Extensor Power Between The Exercise and Control Groups

The mean lumbar extensor muscle power of the exercise group was improved from 125.67±56.92 lb to 178.52±56.98 lb after 12 weeks program of isolated lumbar extension exercise. The mean lumbar extensor muscle power of the control group was improved from 133.30±57.18 lb to 144.56±57.45 lb after 12 weeks of conservative treatment except exercise. The lumbar extensor muscle power was improved 42.05% and 8.45% in exercise group and control group, respectively. Statistically significant difference was observed between two groups (P<0.05) (Table 2).

Table 2. Mean lumbar extensor power at seven different angles in the exercise and control groups

Group	Angle	0°	12°	24°	36°	48°	60°	72°
Exercise group	Before Test	74.18 ±34.88*	98.82 ±41.19	117.25 ±47.45	131.79 ±51.25	142.04 ±53.73	152.71 ±55.78	162.93 ±59.35
	After Test	122.29 ±34.43	149.79 ±41.07	171.35 ±45.89	185.04 ±50.35	196.86 ±51.72	206.03 ±53.50	218.29 ±58.24
	Improvement (%)	64.86	51.58	46.14	40.41	38.59	34.92	33.98
	P-value	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Control group	Before Test	80.03 ±33.06	100.59 ±38.07	119.55 ±44.37	133.90 ±46.24	150.31 ±50.56	165.62 ±53.63	183.10 ±57.52
	After Test	95.17 ±42.69	110.24 ±39.87	127.38 ±43.81	143.86 ±45.97	162.52 ±49.51	177.93 ±51.58	194.79 ±55.68
	Improvement (%)	18.92	9.59	6.55	7.44	8.12	7.43	6.38
	P-vaule	0.14	0.35	0.50	0.41	0.36	0.38	0.43

* Lumbar extensor power (lb, mean ± standard deviation)

3. VAS

VAS was decreased in both the exercise and control groups after 12 weeks. But, decrease of VAS in the exercise group was significantly larger than the control group ($P<0.05$). In the exercise group, initial VAS was 5.36±1.03 and post-12 week VAS was 1.43±0.57. In the control group, initial VAS was 5.20±1.11 and post-12 week VAS was 4.05±0.98 (Figure 5). The improvement of lumbar extensor power and VAS shows positive correlation in both exercise and control group ($P<0.05$) (Figure 6). Coefficients of correlation were 0.57, 0.50, 0.49, 0.48, 0.43, 0.39, 0.26 in 0°, 12°, 24°, 36°, 48°, 60°, 72° respectively in the exercise group. Coefficients of correlation were 0.41, 0.39, 0.35, 0.39, 0.43, 0.41, 0.47 in 0°, 12°, 24°, 36°, 48°, 60°, 72° respectively in the control group.

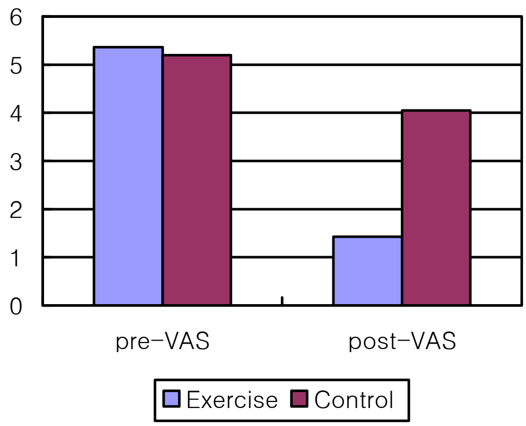

Figure 5. Graph demonstrating the change in VAS for low back pain before and after the exercise program in the exercise and control groups.

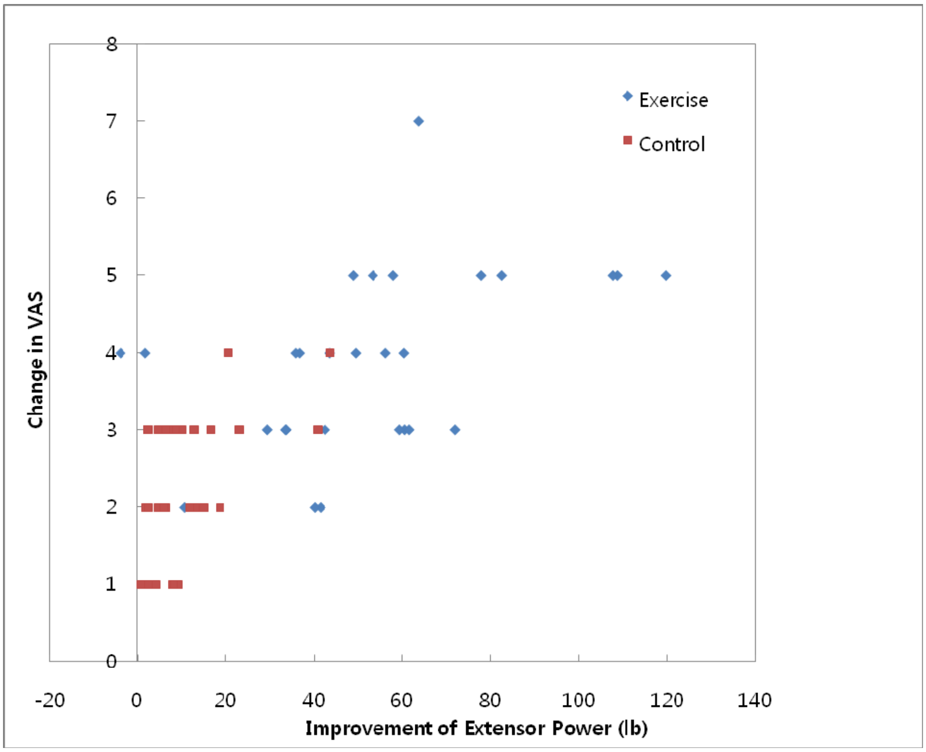

Figure 6. Correlation of improvement of lumbar extensor power and change in VAS.

4. ODI

In both groups, the ODI were improved. But, decrease of ODI in the exercise group was significantly larger than the control group (P<0.05). In the exercise group, initial mean ODI was 27.89 and post-12 week mean ODI was 17.44. In the control group, initial mean ODI was 21.06 and post-12 week mean ODI was 20.09 (Figure 7). The improvement of lumbar extensor power and ODI shows positive correlation in the exercise group (P<0.05). But in the control group, there was no correlation between the improvement of lumbar extensor power and ODI (P=0.80) (Figure 8). Coefficients of correlation were 0.12, 0.09, 0.10, 0.04, 0.07, 0.03, 0.01 in 0°, 12°, 24°, 36°, 48°, 60°, 72° respectively in the exercise group. Coefficients of correlation were 0.04, 0.04, -0.23, -0.16, -0.21, -0.15, -0.10 in 0°, 12°, 24°, 36°, 48°, 60°, 72° respectively in the control group.

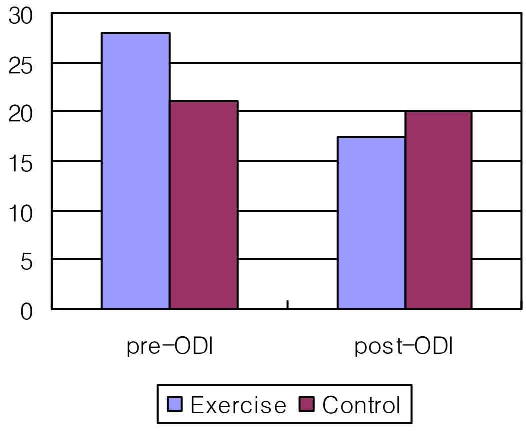

Figure 7. Graph demonstrating the change in ODI before and after the exercise program in the exercise and control groups.

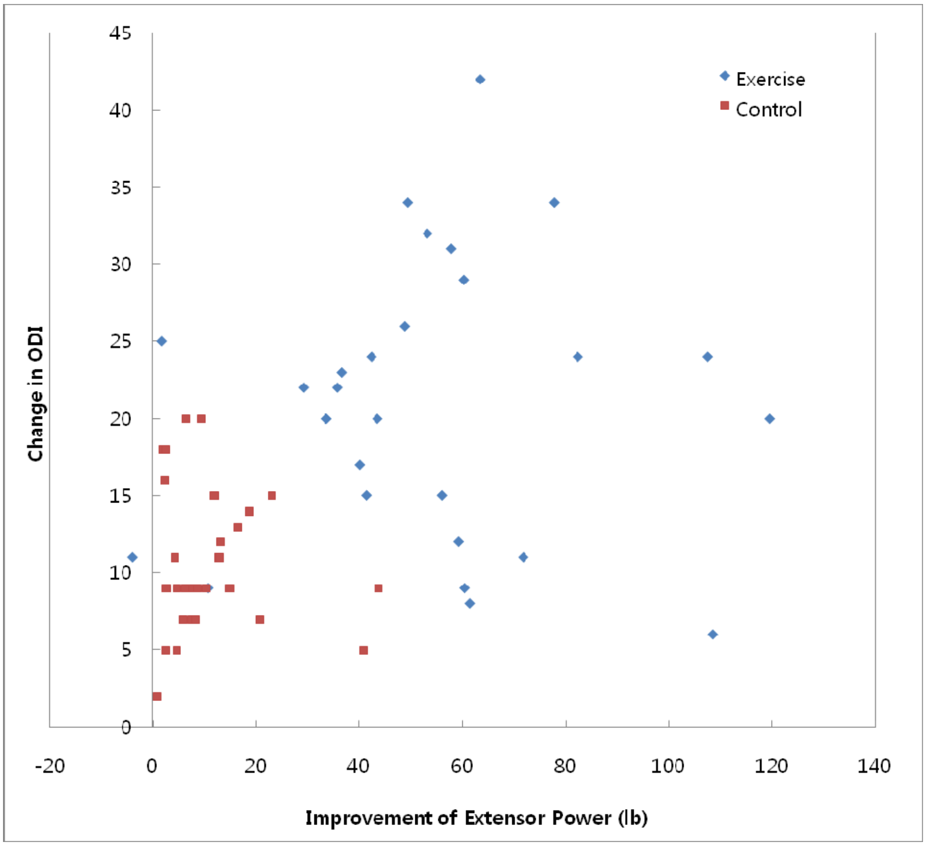

Figure 8. Correlation of improvement of lumbar extensor power and change in ODI.

IV. DISCUSSION

Nonsurgical treatment modality for chronic low back pain divided into noninvasive and invasive methods. Noninvasive methods includes medications, physical therapy, exercise. Invasive nonsurgical methods includes local injections, botulinum toxin injection, prolotherapy, epidural steroid injection, facet joint injection, therapeutic medial branch block, sacroiliac joint injection, intradiscal steroid injection, chemonucleolysis, radiofrequency denervation, intradiscal electrothermal therapy, percutaneous intradiscal radiofrequency thermocoagulation, coblation neucleoplasty, and spinal cord stimulation. Surgical intervention should be considered only if a comprehensive program of nonsurgical measures fails to improve patient's quality of life.

Physical therapy has been widely used for management of chronic low back pain. It is relatively inexpensive and had easy accessibility. But forced procedures causes injuries including burns. Pain block also has been actively performed. The advantages of pain block were more rapid effect and selective procedure. But risky disadvantage of pain block includes infections, nerve injuries and hematomas.

In management of chronic low back pain in outpatient department, one of important factor for continuous and effective treatment is patients' active participation. Exercise can give patients a sense of achievement, therefore satisfaction of patients increase gradually.

Panjabi et al[31, 32] reported the conceptual basis for the spinal stabilizing system consists of three subsystems. The vertebrae, discs, and ligaments constitute the passive subsystem. All muscles and tendons surrounding the spinal column constitute the active subsystem. The nerves and central nervous system comprise the neural subsystem. A dysfunction of a component of any one of the subsystems may lead to compensation, adaptation, or injury to one or more components of any subsystems.[31] Above-mentioned active subsystem can be strengthened by exercise most effectively and simply. Other subsystems were difficult to be strengthened actually.

Many authors emphasized the stabilizing effects of muscles on the mechanics of chronic low back pain.[15, 33-36] Other authors had been concerned about the histochemical and morphometric analysis of multifidus muscle.[33, 37-39] In prospective case-control study of multifidus muscle atrophy in 39 patients with unilateral lumbosacral radiculopathy and lumbosacral disc herniation and 20 controls, Hyun et al. concluded that asymmetric atrophy of multifidus muscle in lumbosacral region was found more in patients with unilateral radiculopathy than in patients with disc herniation only.[38]

The role of the paraspinal muscles in the maintenance of the equilibrium and optimum function of the spine as a whole is well studied.[31, 34] Significant reductions in paraspinal and psoas dimensions in patients with chronic compared to recent onset low back pain were demonstrated radiographically.[33] Thus, intensive supervised low back extensor muscle exercise program has long been a standard treatment for chronic low back pain.[15, 19, 34, 40-42] Aggressive exercise demonstrates restoration of normal back function and reduced disability.[15, 35, 41-43]

However, many physicians has recommended avoidance of painful activities or greater restrictions due to personal attitudes and patient's clinical symptoms.[44] Exercise can be prescribed for patients with chronic low back pain with three distinct goals.[24] The first and most obvious goal is to improve performance of endurance activity.[24, 45] The second goal of exercise is to reduce the intensity of back pain.[24] The third goal is to reduce back pain-related disability.[24]

As a matter of course, contrary concept exists. Helmhout et al showed that isolated lumbar extensor strengthening does not seem to offer incremental benefits in low back pain management compared with regular physical therapy in 129 cases of randomized controlled trial.[46]

About the training frequency, many debates are exists. Some authors insists that no differences were noted in muscle strength, pain intensity scores or Oswestry scores between two- and three times per week group.[47] Others advocates one per week program.[26]

In patients undergoing posterior lumbar surgical procedures, there is a decrease in trunk muscle strength, denervation atrophy resulting from damage to the dorsal rami. Lumbar extension exercises after surgery in patients undergoing discectomy helps achieve an early return to work and also improves spinal function and pain.[48]

Exercise seems to have infinite possibility in management of chronic low back pain. Further investigations of long-term effect of exercise, histochemical and morphometric changes in muscles after exercise, other methods of exercise will be necessary.

V. CONCLUSION

Isolated lumbar extension exercise program exerts a positive influence on chronic low back pain, disability and power of lumbar extensor muscles.

REFERENCES

1. Andersson GB. Epidemiological features of chronic low-back pain. Lancet 1999;354:581-5.
2. Deyo RA, Weinstein JN. Low back pain. N Engl J Med 2001;344:363-70.
3. van Tulder MW. Treatment of low back pain: myths and facts. Schmerz 2001;15:499-503.
4. Bronfort G, Goldsmith CH, Nelson CF, Boline PD, Anderson AV. Trunk exercise combined with spinal manipulative or NSAID therapy for chronic low back pain: a randomized, observer-blinded clinical trial. J Manipulative Physiol Ther 1996;19:570-82.
5. Indahl A, Velund L, Reikeraas O. Good prognosis for low back pain when left untampered. A randomized clinical trial. Spine 1995;20:473-7.
6. Klaber Moffett JA, Chase SM, Portek I, Ennis JR. A controlled, prospective study to evaluate the effectiveness of a back school in the relief of chronic low back pain. Spine 1986;11:120-2.
7. Lahad A, Malter AD, Berg AO, Deyo RA. The effectiveness of four interventions for the prevention of low back pain. JAMA 1994;272:1286-91.
8. Bigos SJ, McKee JE, Holland JP, Holland CL, Hildebrandt J. Back pain, the uncomfortable truth - assurance and activity problem. Schmerz 2001;15:430-4.
9. Johannsen F, Remvig L, Kryger P, Beck P, Warming S, Lybeck K, et al. Exercises for chronic low back pain: a clinical trial. J Orthop Sports Phys Ther 1995;22:52-9.
10. Quittan M. Management of back pain. Disabil Rehabil 2002;24:423-34.
11. Torstensen TA, Ljunggren AE, Meen HD, Odland E, Mowinckel P, Geijerstam S. Efficiency and costs of medical

exercise therapy, conventional physiotherapy, and self-exercise in patients with chronic low back pain. A pragmatic, randomized, single-blinded, controlled trial with 1-year follow-up. Spine 1998;23:2616-24.

12. Cottingham JT, Maitland J. A three-paradigm treatment model using soft tissue mobilization and guided movement-awareness techniques for a patient with chronic low back pain: a case study. J Orthop Sports Phys Ther 1997;26:155-67.
13. Hildebrandt J, Pfingsten M, Saur P, Jansen J. Prediction of success from a multidisciplinary treatment program for chronic low back pain. Spine 1997;22:990-1001.
14. Carpenter DM, Nelson BW. Low back strengthening for the prevention and treatment of low back pain. Med Sci Sports Exerc 1999;31:18-24.
15. Rainville J, Sobel J, Hartigan C, Monlux G, Bean J. Decreasing disability in chronic back pain through aggressive spine rehabilitation. J Rehabil Res Dev 1997;34:383-93.
16. Shirado O, Watanabe Y, Kawase M. [Rehabilitation for the patients with low-back pain]. Clin Calcium 2005;15:103-8.
17. Maher C, Latimer J, Refshauge K. Prescription of activity for low back pain: What works? Aust J Physiother 1999;45:121-32.
18. Maher CG. Effective physical treatment for chronic low back pain. Orthop Clin North Am 2004;35:57-64.
19. Cohen I, Rainville J. Aggressive exercise as treatment for chronic low back pain. Sports Med 2002;32:75-82.
20. Deutsch FE. Isolated lumbar strengthening in the rehabilitation of chronic low back pain. J Manipulative Physiol Ther 1996;19:124-33.
21. Rainville J, Hartigan C, Jouve C, Martinez E. The influence of intense exercise-based physical therapy program on back pain anticipated before and induced by physical activities. Spine J

2004;4:176-83.
22. Miltner O, Wirtz DC, Siebert CH. [Strengthening lumbar extensors--therapy of chronic back pain--an overview and meta-analysis]. Z Orthop Ihre Grenzgeb 2001;139:287-93.
23. Sokunbi O, Watt P, Moore A. Experiences of patients with chronic low back disorder of the use of spinal stabilisation exercises--a qualitative study. Nig Q J Hosp Med 2008;18:231-43.
24. Rainville J, Hartigan C, Martinez E, Limke J, Jouve C, Finno M. Exercise as a treatment for chronic low back pain. Spine J 2004;4:106-15.
25. Pollock ML, Leggett SH, Graves JE, Jones A, Fulton M, Cirulli J. Effect of resistance training on lumbar extension strength. Am J Sports Med 1989;17:624-9.
26. Graves JE, Pollock ML, Foster D, Leggett SH, Carpenter DM, Vuoso R, et al. Effect of training frequency and specificity on isometric lumbar extension strength. Spine 1990;15:504-9.
27. Graves JE, Webb DC, Pollock ML, Matkozich J, Leggett SH, Carpenter DM, et al. Pelvic stabilization during resistance training: its effect on the development of lumbar extension strength. Arch Phys Med Rehabil 1994;75:210-5.
28. Handa N, Yamamoto H, Tani T, Kawakami T, Takemasa R. The effect of trunk muscle exercises in patients over 40 years of age with chronic low back pain. J Orthop Sci 2000;5:210-6.
29. Browder DA, Childs JD, Cleland JA, Fritz JM. Effectiveness of an extension-oriented treatment approach in a subgroup of subjects with low back pain: a randomized clinical trial. Phys Ther 2007;87:1608-18; discussion 577-9.
30. Lee JH, Hoshino Y, Nakamura K, Kariya Y, Saita K, Ito K. Trunk muscle weakness as a risk factor for low back pain. A 5-year prospective study. Spine 1999;24:54-7.

31. Panjabi MM. The stabilizing system of the spine. Part I. Function, dysfunction, adaptation, and enhancement. J Spinal Disord 1992;5:383-9; discussion 97.
32. Millisdotter M, Stromqvist B, Jonsson B. Proximal neuromuscular impairment in lumbar disc herniation: a prospective controlled study. Spine 2003;28:1281-9.
33. Cooper RG, St Clair Forbes W, Jayson MI. Radiographic demonstration of paraspinal muscle wasting in patients with chronic low back pain. Br J Rheumatol 1992;31:389-94.
34. Goel VK, Kong W, Han JS, Weinstein JN, Gilbertson LG. A combined finite element and optimization investigation of lumbar spine mechanics with and without muscles. Spine 1993;18:1531-41.
35. Danneels LA, Cools AM, Vanderstraeten GG, Cambier DC, Witvrouw EE, Bourgois J, et al. The effects of three different training modalities on the cross-sectional area of the paravertebral muscles. Scand J Med Sci Sports 2001;11:335-41.
36. Leinonen V, Kankaanpaa M, Luukkonen M, Kansanen M, Hanninen O, Airaksinen O, et al. Lumbar paraspinal muscle function, perception of lumbar position, and postural control in disc herniation-related back pain. Spine 2003;28:842-8.
37. Zhao WP, Kawaguchi Y, Matsui H, Kanamori M, Kimura T. Histochemistry and morphology of the multifidus muscle in lumbar disc herniation: comparative study between diseased and normal sides. Spine 2000;25:2191-9.
38. Hyun JK, Lee JY, Lee SJ, Jeon JY. Asymmetric atrophy of multifidus muscle in patients with unilateral lumbosacral radiculopathy. Spine 2007;32:E598-602.
39. Mattila M, Hurme M, Alaranta H, Paljarvi L, Kalimo H, Falck B, et al. The multifidus muscle in patients with lumbar disc herniation. A histochemical and morphometric analysis of

intraoperative biopsies. Spine 1986;11:732-8.
40. Frost H, Klaber Moffett JA, Moser JS, Fairbank JC. Randomised controlled trial for evaluation of fitness programme for patients with chronic low back pain. BMJ 1995;310:151-4.
41. Frost H, Lamb SE, Klaber Moffett JA, Fairbank JC, Moser JS. A fitness programme for patients with chronic low back pain: 2-year follow-up of a randomised controlled trial. Pain 1998;75:273-9.
42. Holmes B, Leggett S, Mooney V, Nichols J, Negri S, Hoeyberghs A. Comparison of female geriatric lumbar-extension strength: asymptotic versus chronic low back pain patients and their response to active rehabilitation. J Spinal Disord 1996;9:17-22.
43. Smeets RJ, Wade D, Hidding A, Van Leeuwen PJ, Vlaeyen JW, Knottnerus JA. The association of physical deconditioning and chronic low back pain: a hypothesis-oriented systematic review. Disabil Rehabil 2006;28:673-93.
44. Rainville J, Carlson N, Polatin P, Gatchel RJ, Indahl A. Exploration of physicians' recommendations for activities in chronic low back pain. Spine 2000;25:2210-20.
45. Mailloux J, Finno M, Rainville J. Long-term exercise adherence in the elderly with chronic low back pain. Am J Phys Med Rehabil 2006;85:120-6.
46. Helmhout PH, Harts CC, Viechtbauer W, Staal JB, de Bie RA. Isolated lumbar extensor strengthening versus regular physical therapy in an army working population with nonacute low back pain: a randomized controlled trial. Arch Phys Med Rehabil 2008;89:1675-85.
47. Rainville J, Jouve CA, Hartigan C, Martinez E, Hipona M. Comparison of short- and long-term outcomes for aggressive spine rehabilitation delivered two versus three times per week.

Spine J 2002;2:402-7.

48. Choi G, Raiturker PP, Kim MJ, Chung DJ, Chae YS, Lee SH. The effect of early isolated lumbar extension exercise program for patients with herniated disc undergoing lumbar discectomy. Neurosurgery 2005;57:764-72; discussion -72.

Abstract (in Korean)

만성 요통 환자에서 독립된 요추부 신전 운동 프로그램이
임상 경과에 미치는 영향

<지도교수 진동규>

연세대학교 대학원 의학과

김영근

서론 : 인구의 노령화와 더불어 만성 요통 환자가 증가하고 있다. 물리 치료,약물 치료, 또는 수술적 치료 등 요통에 대한 여러가지 치료법이 민상에서 사용되고 있으며, 최근 운동과 척추 근육의 중요성이 대두되고 있다. 본 연구에서는 만성 요통 환자에서 요추부의 독립된 신전 운동 프로그램이 요추부 신전 근력, 요통, 장애 등 임상 경과에 미치는 영향에 대해 알아보고자 하였다.

재료 및 방법 : 12주 이상 지속되는 만성 요통이 있는 환자 중 요추부 자기공명 영상 검사상에서 퇴행성 추간판 질환으로 진단된 총 57명(남 27명, 여 30명)의 환자를 대상으로 하여 28명의 운동 치료군 (남 13명, 여 15명)과 29명의 비 운동 치료군 (남 14명, 여 15명)으로 나누어 12주간의 운동 프로그램 전, 후에 MedX 운동 기구를 이용한 요추부 신전 근력 및 Visual Analogue Scale (VAS), Oswestry Disability Index (ODI)를 비교, 측정하였다. 비 운동 치료군은 물리치료와 진통제를 사용하였고, 운동 치료 프로그램은 시

행하지 않았다.

결과 : 운동 치료군에서 요추부 신전 근력은 치료 시작 전 125.67±56.92 lb에서 12주간의 독립된 요추부 신전 운동 프로그램 시행 후에는 178.52±56.98 lb로 42.05% 증가하였고, 비 운동 치료군에서는 요추부 신전 근력이 치료 시작 전 133.30±57.18 lb에서 12주간의 운동을 제외한 보존적 치료 시행 후에는 144.56±57.45 lb로 8.45% 증가하여 두 군 간에는 통계학적으로 유의한 차이를 보였다 ($P<0.05$). VAS는 운동 치료군에서는 5.36에서 1.43으로 감소하였으며, 비 운동 치료군에서는 5.20에서 4.05로 감소하였으며, ODI는 운동 치료군에서는 27.89%에서 17.44%로 감소하였고, 비 운동 치료군에서는 21.06%에서 20.09%로 감소하여, VAS와 ODI 모두 두 군 간에 통계학적으로 유의한 차이를 보였다 ($P<0.05$). 요추부 신전 근력의 증가 정도와 VAS 감소 정도는 운동 치료군과 비 운동 치료군 모두에서 통계학적으로 유의한 정상관 관계를 보였다 ($P<0.05$). 요추부 신전 근력의 증가 정도와 ODI 감소 정도는 운동 치료군에서 통계학적으로 유의한 정상관 관계를 보였으나 ($P<0.05$), 비 운동 치료군에서는 상관 관계를 보이지 않았다 ($P=0.80$)

결론 : 독립된 요추부 신전 운동 프로그램은 만성 요통 환자의 요추부 신전 근력, 통증, 장애에 통계학적으로 유의한 긍정적인 효과가 있다.

핵심되는 말 : 요통, 신전, 운동, 임상 경과, MedX