

The necessity and timing of exercise after lumbar disc herniation surgery

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Abstract. – OBJECTIVE: Physical therapy and rehabilitation may improve low back pain and quality of life after lumbar disc herniation. However, there is no agreement on its optimal start time and rehabilitative methods. This study evaluates the effects of early and late rehabilitation on low back pain and quality of life following unilateral microdiscectomy.

PATIENTS AND METHODS: A total of 204 patients who underwent surgery for lumbar disc herniation were included and subsequently randomized into five groups: 1. No exercise, 2. The 2nd-week walking group, 3. 1st-month walking group, 4. 2nd-week waist exercise, 5. 1st-month waist exercise. Visual analog scale (VAS) and Oswestry Disability Index (ODI) were assessed at the 1st week, 1st, 3rd, and 6th, and 12th-month follow-up after surgery.

RESULTS: 1st-month VAS scores were analyzed, and a significant difference was found between the VAS scores of the 2nd-week walk (3.60 ± 0.78) and 2nd-week waist exercise (3.38 ± 0.67) groups and the other groups ($p < 0.001$). 3rd-month VAS results were analyzed, and the VAS scores of the 1st-month walk group (2.67 ± 0.48) were significantly higher than those of the 2nd-week walk group (1.73 ± 0.45) ($p < 0.001$). A significant difference was observed between the no-exercise group (2.93 ± 0.91) and the other groups according to the 12-month VAS scores, with the VAS scores of the no-exercise group being significantly higher than the other groups ($p < 0.001$). There was a significant difference between the ODI scores of both the 2nd-week walk (38 ± 8.55) and the 2nd-week waist (33.8 ± 6.61) exercise groups and the other groups according to the 1st-month ODI scores ($p < 0.001$). A significant difference was observed between the no-exercise group (35.2 ± 8.25) and the other groups according to the 12-month ODI scores, and the ODI scores of the no-exercise group were significantly higher than the other groups ($p < 0.001$).

CONCLUSIONS: Regular exercise is highly recommended for long-term pain relief, as well as for achieving a speedy recovery after surgery,

which is crucial to maintaining a high quality of life and preventing loss of earning potential. We believe that early implementation of exercises is ideal, but even if initiated later, standard back exercises can still expedite rehabilitation.

Key Words:

Lumbar disc herniation, Microdiscectomy, Exercise, Physiotherapy, Pain.

Introduction

Lumbar disc herniation (LDH) is a frequently encountered ailment in neurosurgery clinics and is prevalent among the general populace, with a reported incidence of about 2%¹. As it is primarily observed in the workforce, it adversely affects their quality of life². One common reason for referring a patient for surgery is the co-occurrence of radiculopathy and low back pain³. Typically, LDH is observed in the adult population who are in active occupation⁴. Most patients with LDH can be treated conservatively, but surgery may be necessary for around 13% of cases⁵. The decision to operate depends on the individual patient, but persistent radicular pain and neurological dysfunction unresponsive to conservative treatment are common indications. Minimally invasive surgical techniques are becoming more prevalent. Currently, microsurgery is the most common approach for LDH⁶. In addition, endoscopic and minimally invasive surgeries have become more prevalent⁷.

Lumbar microdiscectomy is a surgical procedure that involves discectomy with the dissection of paravertebral muscles. Subsequently, patients may experience postoperative back pain, potentially impacting their quality of life⁸. Physical rehabilitation is frequently suggested after surgery⁹. Some studies¹⁰ have indicated that physical

therapy and rehabilitation may not significantly improve low back pain and quality of life after LDH. There is yet to be an agreement on the effectiveness of physical therapy, its optimal start time, and rehabilitative methods¹¹. This study evaluates the effects of early and late rehabilitation following unilateral microdiscectomy for LDH. It also examines the differences in low back pain and patients' quality of life due to exercise.

Patients and Methods

General Clinical Data

A total of 204 patients who underwent surgery for LDH were included and subsequently randomized into five groups. This study was designed as a retrospective review of prospectively collected data. One group served as the control and was advised not to participate in any postoperative exercise. The remaining groups were recommended different exercises, which began at various times after surgery. Prior to surgery, all patients received conservative treatment for a period of 4-6 weeks. Patients included in our study had **radicular pain that persisted despite 4-6 weeks of conservative treatment**, and magnetic resonance imaging (MRI) detection of **single-level disc herniation** resulted in lumbar microsurgery.

Inclusion Criteria

Those who underwent **single-level unilateral lumbar microsurgery** at the time of surgery and those with a surgical incision <3 cm were included in our study.

Exclusion Criteria

Those with more than one level of muscle exposure at the time of surgery and those with a skin incision >3 cm were excluded. Participants did not have any cardiopulmonary disease or physical limitations that would prevent them from performing exercise. Patients with a history of spinal surgery, unstable spines, or exercise restrictions due to internal or physical constraints and those who were found to have recurrent disc herniation during follow-up were excluded from the study.

Group Distributions

1. Group: The **non-exercise** group was selected as the control group. They were only instructed to perform their usual daily activities without any additional exercise.

2. Group: The **2nd-week walking** group was advised to walk at a moderate or relaxed pace for 20 minutes on 3 occasions each week, starting in the second week after the surgery.

3. Group: The **1st-month walking** group was advised to walk at a moderate or relaxed pace for 20 minutes on 3 occasions each week, starting in the first month after the surgery.

4. Group: The **2nd-week waist exercise** group received standard postoperative rehabilitation training commencing in the **1st postoperative week**.

5. Group: The **1st-month waist exercise** group received standard postoperative rehabilitation training commencing in the 1st month postoperatively. This exercise regime focuses on **strengthening the lumbar core muscles** for spinal stability¹².

Indicators of Observation

Visual analogue scale (VAS)¹³ and Oswestry Disability Index (ODI)¹⁴ were assessed at 1st week, 1st, 3rd, and 6th, and 12th-month follow-up after surgery. Follow-up was mainly conducted through outpatient examination and telephone consultations.

Statistical Analysis

The data processing was conducted using SPSS 26.0 software (IBM Corp., Armonk, NY, USA). The mean±standard deviation was used to express quantitative data using VAS and ODI values that followed a normal distribution. Intergroup comparisons were conducted using independent sample *t*-tests, whereas intragroup comparisons were performed using paired *t*-tests. The statistical technique of analysis of variance (ANOVA) was employed to assess and compare the Visual Analog Scale (VAS) and Oswestry Disability Index (ODI) scores across various time points within the study population. The count data were converted into percentages and analyzed using the Chi-square test. A significance level of $p < 0.05$ was deemed to indicate statistical significance.

Results

Basic Data

A total of 204 patients were included and operated on for single-level unilateral lumbar microdiscectomy in the study. The cases were divided into 5 groups. The number of patients in each group varied from 39 to 41. The mean age of all patients was 48±10.9 years, and there was no significant difference between the groups ($p=0.980$). In total, 51.9% of the patients

were men and 48.03% were women. There was no significant difference in gender between the groups ($p=0.802$) (Table I).

The VAS scores at 1 week post-operatively were similar in all groups ($p=1.000$). When the 1st-month VAS scores were analyzed, a significant difference was found between the VAS scores of the 2nd-week walking (3.60 ± 0.78) and 2nd-week waist exercise (3.38 ± 0.67) groups and the other groups ($p<0.001$). VAS scores were significantly higher in the 1st-month walking (5.00 ± 0.83) and 1st-month waist exercise (4.74 ± 0.77) groups. When the 3rd-month VAS results were analyzed, the VAS scores of the 1st-month walking group (2.67 ± 0.48) were significantly higher than those of the 2nd-week walking group (1.73 ± 0.45) ($p<0.001$). When the 3rd-month VAS results were analyzed, the VAS scores of the no-exercise group (4.80 ± 1.10) were significantly higher than all other groups ($p<0.001$) (Figure 1).

The VAS scores of the 1st-month walk group (2.41 ± 0.50) were significantly higher than those of the 2nd-week walking group (1.73 ± 0.45), according to the 6th-month VAS scores ($p<0.001$). The VAS scores of the no-exercise group were significantly higher than all other groups ($p<0.001$), according to the 6th-month VAS scores. A significant difference was observed between the no-exercise group (2.93 ± 0.91) and the other groups, according to the 12th-month VAS scores, with the VAS scores

of the no-exercise group being significantly higher than the other groups ($p<0.001$) (Table II).

There was a significant difference between the ODI scores of both the 2nd-week walking (38 ± 8.55) and the 2nd-week waist (33.8 ± 6.61) exercise groups and the other groups, according to the 1st-month ODI scores ($p<0.001$). The ODI scores of the 2nd-week walking and 2nd-month waist exercise groups were significantly lower. When looking at the 3rd-month ODI results, it was observed that the ODI scores of the 1st-month walking group (33.00 ± 4.30) were significantly higher than those of the 2nd-week walking group (23.4 ± 5.88) ($p<0.001$). When the 3rd-month ODI results were analyzed, it was observed that the ODI scores of the no-exercise group (48.90 ± 9.80) were significantly higher than all other groups ($p<0.001$).

The ODI scores of the 1st-month walking group (30.7 ± 4.48) were significantly higher than those of the 2nd-week walking group (23.4 ± 5.88) according to the ODI scores of the 6th month ($p<0.001$). The ODI scores of the no-exercise group (49.1 ± 10.6) were significantly higher than all other groups according to the ODI scores of the 6th month ($p<0.001$). A significant difference was observed between the no-exercise group (35.2 ± 8.25) and the other groups according to the 12th-month ODI scores, and the ODI scores of the no-exercise group being significantly higher than the other groups ($p<0.001$) (Table III).

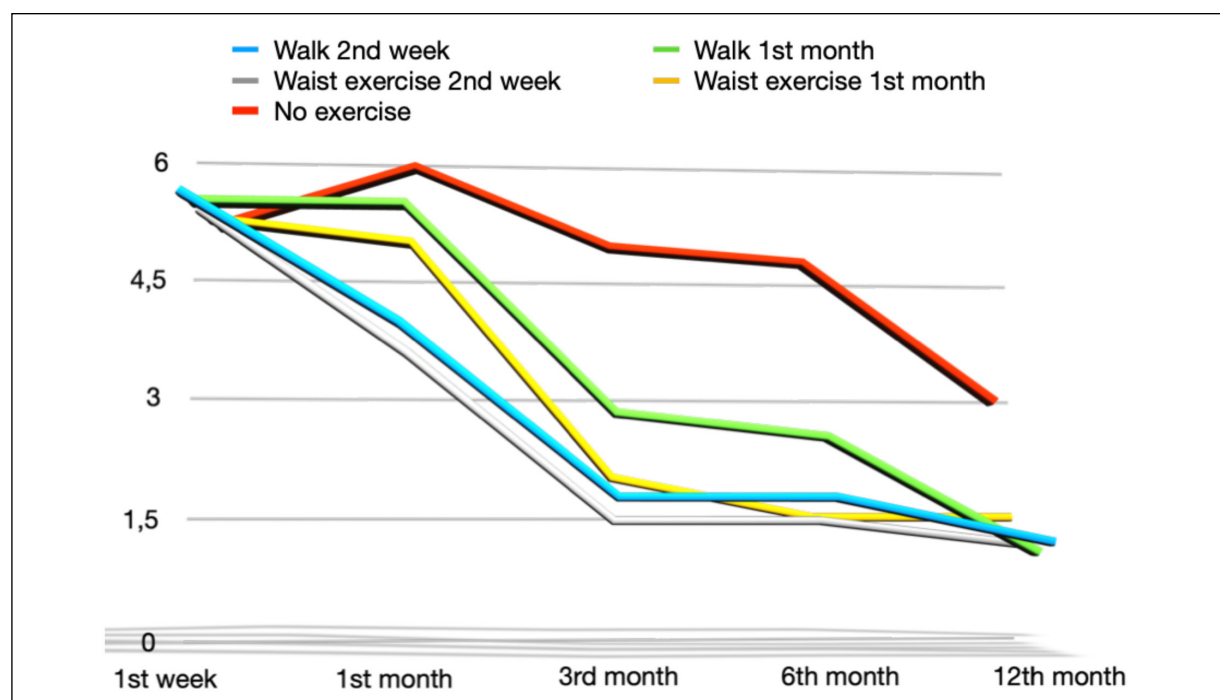


Figure 1. Chart showing the comparison of postoperative VAS scores between groups by exercise type and onset time.

Table I. Distribution of demographic data according to the groups.

Demographic Data	Total (N=204)	2 nd -week walking group (a) (N=40)	1 st -month walking group (b) (N=39)	Waist exercise 2 nd -week group (c) (N=42)	Waist exercise 1 st -month group (d) (N=42)	No-exercise group (e) (N=41)	p-value
	n (%) or mean±SD	n (%) or mean±SD	n (%) or mean±SD	n (%) or mean±SD	n (%) or mean±SD	n (%) or mean±SD	
Age (years)	48±10.9	46.3±11.3	48.5±11.2	48.3±10.7	48.7±10.8	48.1±11	0.980
Gender							0.802
Male	106 (51.9)	20 (9.8)	20 (9.8)	23 (11.3)	22 (10.8)	21 (10.3)	
Female	98 (48.03)	20 (9.8)	19 (9.3)	19 (9.3)	20 (9.8)	20 (9.8)	

SD: Standart Deviation; a: 2nd-week walking group; b: 1st-month walking group; c: waist exercise 2nd-week group; d: waist exercise 1st-month group; e: No-exercise group.

Table II. Comparison of postoperative VAS scores based on the exercise type and commencement time across the groups.

VAS	Exercise					p-value
	2 nd -week walking group (a) (N=40)	1 st -month walking group (b) (N=39)	Waist exercise 2 nd -week group (c) (N=42)	Waist exercise 1 st -month group (d) (N=42)	No-exercise group (e) (N=41)	
	Mean±SD (Min-Max)	Mean±SD (Min-Max)	Mean±SD (Min-Max)	Mean±SD (Min-Max)	Mean±SD (Min-Max)	
1 st -week VAS	5.00±0.82 (4-6)	5.00±0.83 (4-6)	5.00±0.83 (4-6)	5.00±0.83 (4-6)	5.00±0.59 (4-6)	<i>p</i> =1.000
1 st -month VAS	3.60±0.78 (3-5)	5.00±0.83 (4-6)	3.38±0.67 (3-5)	4.74±0.77 (4-6)	5.76±0.86 (4-7)	<0.001*
3 rd -month VAS	1.73±0.45 (1-2)	2.67±0.48 (2-3)	1.48±0.51 (1-2)	1.98±0.60 (1-3)	4.80±1.10 (3-7)	<0.001**
6 th -month VAS	1.73±0.45 (1-2)	2.41±0.50 (2-3)	1.48±0.50 (1-2)	1.52±0.50 (1-2)	4.63±1.11 (3-7)	<0.001 [#]
12 th -month VAS	1.25±0.44 (1-2)	1.13±0.40 (1-2)	1.21±0.42 (1-2)	1.52±0.51 (1-2)	2.93±0.91 (2-4)	<0.001 ^{##}

SD: Standart Deviation, VAS: Visual Analogue Scale, *Between a-c and b-d-e, **Between b and a, between e and a-b-c-d, [#]Between b and a, between e and a-b-c-d, ^{##}Between e and a-b-c-d. a: 2nd-week walking group; b: 1st-month walking group; c: waist exercise 2nd-week group; d: waist exercise 1st-month group; e: No-exercise group.

Table III. Comparison of postoperative ODI scores based on the exercise type and commencement time across the groups.

ODI	Exercise					p-value [#]
	2 nd -week walking group (a) (N=40)	1 st -month walking group (b) (N=39)	Waist exercise 2 nd -week group (c) (N=42)	Waist exercise 1 st -month group (d) (N=42)	No-exercise group (e) (N=41)	
	Mean±SD (Min-Max)	Mean±SD (Min-Max)	Mean±SD (Min-Max)	Mean±SD (Min-Max)	Mean±SD (Min-Max)	
1 st week ODI	54.50±8.15 (40-68)	54.3±9.34 (40-74)	50.6±8.41 (40-66)	50.00±8.26 (40-68)	59.5±8.35 (50-70)	
1 st -month ODI	38±8.55 (30-55)	50.00±8.27 (40-60)	33.8±6.61 (30-50)	47.4±7.67 (41-60)	58.4±9.96 (40-74)	<0.001*
3 rd -month ODI	23.4±5.88 (14-27)	33.00±4.30 (27-36)	20.2±6.57 (14-27)	26±6.77 (14-36)	48.90±9.80 (36-70)	<0.001**
6 th -month ODI	23.4±5.88 (14-27)	30.7±4.48 (27-36)	20.7±6.57 (14-27)	20.8±6.57 (13-27)	49.1±10.6 (36-72)	<0.001 [#]
12 th -month ODI	17.3± 5.70 (14-27)	15.7±4.40 (14-27)	16.8±5.4 (14-27)	20.8±6.57 (12-26)	35.2±8.25 (27-49)	<0.001 ^{##}

ODI: Oswestry Disability Index *Between a-c and b-d-e, **Between b and a, between e and a-b-c-d, [#]Between b and a, between e and a-b-c-d, ^{##}Between e and a-b-c-d. a: 2nd-week walking group; b: 1st-month walking group; c: waist exercise 2nd-week group; d: waist exercise 1st-month group; e: No-exercise group.

Discussion

LDH is characterized by pain that is mainly localized in the lower back and sometimes radiates down the leg¹⁵. Patients may have LDH because of muscle weakness, but LDH itself can also cause weakness in the back and leg muscles¹⁶. Chronic back pain and leg pain may result in structural and deformity disorders of the entire spine. This, in turn, can lead to an inability to walk and carry out ordinary physical activities¹⁷. LDH surgery involves removing the degenerated and herniated disc material that compresses the spinal cord and decompresses adjacent nerves. The surgical field is accessed during the procedure by dissecting the muscles from the bone they are attached to¹⁸. The greater the number of levels involved in lumbar surgeries, the more muscles must be dissected, potentially resulting in further weakening of muscles that are already atrophied. This ultimately results in more weakened muscle strength and spinal instability¹⁹. As a consequence, patients might experience chronic low back pain in the long term, as documented in 14.97% of patients subjected to surgical intervention for LDH²⁰. Although endoscopic techniques, which require less muscle dissection, have been used to eliminate instability²¹, microsurgery remains the most widely accepted and employed method globally²². However, in microsurgery, depending on the surgeon's experience and approach, carrying out surgery through the tiniest incision may be crucial for recovery after the operation and reducing morbidity²³. Patients who have undergone lumbar disc surgery may experience low back pain, which can persist for both the short and long term, regardless of whether nucs discs are identified using lumbar MRI or not²⁴.

Studies²⁵ have demonstrated that patients suffering from low back pain perceive discomfort due to insufficient physical activity, which leads to the production of lactic acid from glycogen when the muscle tissue remains hypoxic. The objective of postoperative rehabilitation and functional exercises following lumbar disc surgery is to enhance the recovery rate by eliminating muscle atrophy, strengthening lumbar muscles, and ensuring spinal stability²⁶. In addition, following the attainment of muscle stability, there is a reduction in compression of the surgically decompressed neural foramen and subsequent surgeries to treat constriction are prevented²⁷.

It is a subject of discussion as to when exercise should commence in the postoperative period

after lumbar microsurgery for functional exercise to be successful. Furthermore, it is unclear which exercises can alleviate the patient's pain. This study displayed that performing walking or standard lumbar exercises at home reduced VAS and ODI scores significantly in patients compared to a non-exercising control group, both in the short and the long term, from the beginning of the exercise regime. Our findings indicate that engaging in physical exercise may help prevent muscle atrophy, improve muscle strength, and prevent instability, resulting in a reduction of low back pain during the postoperative period. Significant differences were observed in VAS and ODI scores between patients who started walking or lumbar exercises in the second week compared to those who started in the first month. Low back pain remained higher in the group who began exercising late until the third month compared to the group who started exercising earlier. At six months, the group that performed low back exercises had lower VAS and ODI scores compared to the walkers. The early initiation of walking or lumbar exercise had an equal effect on reducing postoperative pain; however, lumbar exercise was more effective in reducing pain more quickly and in a shorter period. It is advisable for patients to commence exercising as soon as possible. If exercising is commenced late, lumbar exercise may be recommended to provide faster pain relief. At 12 months, the exercise group showed no significant difference in their results, whereas the control group still exhibited high VAS and ODI scores. This indicates that all forms of exercise are efficacious for long-term alleviation of low back pain.

In a study conducted by Dorow et al²⁷, it was demonstrated that sociodemographic and psychological factors are powerful risk factors for postoperative pain following lumbar surgery. The impact of physical activity on mental well-being is widely recognised²⁸. This implies that physical activity ought to be suggested during the recovery phase.

Willems et al²⁹ investigated the reasons for the varying effectiveness of rehabilitation and recovery during the postoperative period, identifying that a crucial factor is the involvement of numerous parameters, such as the patient's preoperative pain status and personal factors. Patients' physical factors, such as muscle mass and body mass index (BMI), may have a positive impact on postoperative pain relief. Therefore, it is crucial to improve muscle mass.

Both age and physical structure are significant factors in postoperative pain rehabilitation. Zhu et

al²⁶ have demonstrated a discrepancy in pain alleviation during the recovery process depending on the intervertebral disc type and the patient's age group. Patients commonly experience pain after surgery, which often results in physical restraints being implemented. Pester et al³⁰ highlighted the significance of early mobility in both the acute and chronic development of low back pain, emphasizing that postoperative movement should not be feared. Oosterhuis et al³¹, in a systemic review, stated that there must be no restriction on movement after lumbar disc surgery and physical exercise should be initiated by the 4th-6th week. Ostelo et al¹¹ suggest that there should be no restrictions following lumbar surgery and that home exercises should commence at least 4-6 weeks later. Hebert et al⁹ have demonstrated that initiating exercises on the 2nd week after lumbar microsurgery and engaging in multimodal exercise for 8 weeks is essential in developing the spinal trunk's strength and improving the surgery's quality. Our study indicates that early exercise is an effective approach to reducing pain and enhancing the quality of life after lumbar microsurgery.

Additionally, ongoing research is being conducted to determine the most effective type of exercise to be performed following lumbar surgery, although a consensus has not yet been reached. Filiz et al³² conducted a study in which physical exercise was initiated one month after surgery, demonstrating that intensive exercises had greater short-term effectiveness than standard home exercises. In our study, we did not examine intensive exercise. However, we found that exercises targeting the lumbar muscles were more effective in correcting graying than moderate-paced walking. Gencay-Can et al³³ observed that starting aerobic exercises one month after the surgery was highly effective at the end of the second and eighth months. Nonetheless, the study did not investigate the long-term results.

Limitations

During follow-ups, exercises can be performed for a longer period of time and with different exercise groups. Since the patients' exercises were not followed exactly, it can be considered a limitation of the study. In addition, the fact that the pain scale is a rating scale that can vary from person to person is a limitation of the study.

Conclusions

We suggest that exercising can provide long-term pain relief. In addition, a prompt recovery

following surgery is vital to maintaining a good quality of life and preventing loss of income. Physical exercises should be initiated as early as possible, and if delayed, we believe that standard back exercises can promote quicker rehabilitation.

Conflict of Interest

The authors declare no conflict of interest.

Funding

No funds were received.

Informed Consent

Written informed consent was obtained.

Ethics Approval

Ethics approval was obtained from Istanbul Medeniyet University Ethical Committee No.: 456/2023.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' Contributions

Research concept and design: HSC, EU, EÇ.
Data analysis and interpretation: HSC, EU, EÇ.
Collection and/or assembly of data: HSC, EU, EÇ.
Writing the article: HSC, EU, EÇ.
Critical revision of the article: HSC, EU, EÇ.
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