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Investigation Of The Role Of Multifidus Muscles In The Development Of Recurrent Lumbar Disc Herniation

Multifidus Adalelerinin Rekürren Lomber Disk Hernisi Gelişimindeki Rolünün Araştırılması

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ABSTRACT

Introductıon: In our study, we used magnetic resonance imaging (MRI) to assess whether the atrophy of the multifidus muscle, which plays a crucial role in lumbar spine stabilization, could be prevented following a back exercise program after lumbar disc herniation surgery.
Objective: This research investigated the effect of multifidus muscles that undergo atrophy after lumbar disc herniation surgeries on the development of recurrent disc herniation.
Method: A total of 59 patients who underwent recurrent lumbar disc herniation surgeries were retrospectively examined. Multifidus muscle Cross-Sectional Area (CSA) and Muscle-Lamina Distance (MLD) of the patients before primary lumbar disc surgery and before recurrent surgery were measured radiologically using lumbar magnetic resonance imaging (MRI) images. Within the scope of these measurements, the effect of the multifidus muscle development exercise program application after lumbar disc herniation surgeries on the development of recurrent discs was statistically evaluated.
Results: The MLD measurement of the multifidus muscle before primary lumbar disc herniation surgery was not statistically significant between the exercise and non-exercise groups, while the MLD measurement of the multifidus muscle on the pathological disc side before lumbar recurrent disc surgery (p= 0.017) was statistically significant between the exercise and non-exercise groups. In the measurements taken by the first observer before lumbar recurrent disc herniation surgery, the mean MLD measurement of the multifidus muscle in the exercise group was 5.34. In contrast, the mean MLD measurement of the multifidus muscle in the non-exercise group was 6.83, which was statistically significant (p= 0.017). In addition, the first observer's measurement of the upper pathological disc distance before lumbar recurrent disc herniation surgery was statistically significant (p= 0.024). According to the evaluation made by the second observer, the mean MLD measurement of the multifidus muscle before lumbar recurrent disc herniation surgery was 5.56 in the exercise group. At the same time, it was 6.81 in the non-exercise group (p= 0.038), same result as the first observer.
Conclusion: Our study shows that exercise shortens the MLD distance and that an appropriate lumbar exercise program can prevent multifidus muscle atrophy.

Keywords: Lumbar Disc Herniation, Multifidus Muscle, Cross-Sectional Area (CSA) and Muscle-Lamina Distance (MLD), Exercise Program.

ÖZET

Giriş: Çalışmamızda lomber bölge stabilizasyonunda önemli görevi olan multifidus kasının lomber disk hernisi ameliyatı sonrası verilen bel egzersiz programı ile atrofiye gitmesinin engellenip ya da engellenmeyeceğini değerlendirmek için manyetik rezonans görüntüleme (MRG) kullandık.
Amaç: Lomber disk hernisi ameliyatları sonrası atrofiye giden multifidus adalelerinin rekürren disk hernisi gelişimi üzerindeki etkisini araştırılmıştır.
Yöntem: Tekrarlayan lomber disk hernisi ameliyatı geçiren 59 hasta retrospektif olarak incelenmiştir. Primer lomber disk cerrahisi öncesi ve rekürren ameliyatı öncesi hastaların multifidus adale Kesit Alanı (CSA) ve Kas-Lamina Mesafesi (MLD) radyolojik olarak lomber MRG görüntüleri kullanılarak ölçümlendi. Bu ölçümler dahilinde lomber disk hernisi ameliyatları sonrasında multifidus adale geliştirici egzersiz programı uygulamasının rekürren disk gelişimi üzerindeki etkisi istatiksel olarak değerlendirildi.
Bulgular: Çalışmamızda primer lomber disk hernisi cerrahisi öncesinde yapılan multifidus kasının MLD ölçümü egzersiz alan ve almayan grup arasında istatiksel olarak anlamlı değil iken, lomber rekürren disk cerrahisi öncesi multifidus kasının patolojik disk tarafındaki MLD ölçümü (p= 0.017) egzersiz alan ve almayan grup arasında istatistiksel olarak anlamlıdır. Çalışmamızda ölçümler 2 ayrı radyolog tarafından ayrı zamanlarda yapılmıştır. Birinci gözlemcinin lomber rekürren disk hernisi cerrahisi öncesi yapılan ölçümlerinde egzersiz alan grupta multifidus adalesinin MLD ölçüm ortalaması 5.34 iken, egzersiz almayan grupta multifidus adalesinin MLD ölçüm ortalaması 6.83 olarak istatiksel anlamlı (p= 0.017) bulunmuştur. Ayrıca birinci gözlemcinin lomber rekürren disk hernisi cerrahisi öncesi patolojik disk üst mesafesinin ölçümü istatiksel olarak anlamlı sonuç

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çıkmıştır (p= 0.024). İkinci gözlemcinin yaptığı değerlendirmeye göre lomber rekürren disk hernisi cerrahisi öncesi multifidus adalesinin MLD ölçüm ortalaması egzersiz alan grupta 5.56 iken, egzersiz almayan grupta 6.81 ölçülmüş (p= 0.038) olup birinci gözlemciyle aynı sonucu vermektedir.
Sonuç: Çalışmamız bize egzersizin MLD mesafesini kısalttığını ve multifidus kasının atrofiye gitmesinin uygun bel egzersiz programı engellenebileceğini göstermektedir.

Anahtar Kelimeler: Lomber Disk Hernisi, Multifidus Kası, Kesit Alanı (CSA) ve Kas-Lamina Mesafesi (MLD), Egzersiz Programı.

INTRODUCTION

Low back pain is a significant problem affecting people at some point in their lives, affecting their quality of life and causing them to lose work power. The prevalence in society is 5%, but people suffer from low back pain at a certain point in their lives at a rate of approximately 80% (1). The increase in inactivity, in parallel with the development of technology, has significantly increased the incidence of lower back pain. Although low back pain is widespread, patients' complaints mainly improve without medical support. One of the most common causes is lumbar disc herniation. Low back and leg pain, posture disorder, and muscle spasms occur due to the pressure of the disc nucleus on the nerve root (2).

The lifetime probability of patients with low back pain having lumbar disc herniation is 2–5%, and the likelihood of radiculopathy is 1%. Since the lumbar vertebrae bear the most body weight, disc herniation is most commonly seen in the lumbar region. It is seen at the L4–5 and L5–S1 distances in more than 90%. Surgery is performed in 2% of lumbar disc herniation cases, but recurrence develops in 5–11%, and a second surgery is required (3). When we look at the literature, we see that the most common cause of long-term lower back pain after lumbar disc herniation surgery is recurrence. Paraspinal muscles are crucial for the protection of normal function and posture of the spine. The multifidus muscle, which is located in the most medial position and is one of the largest muscles, is essential for the normal function of the spine (4).

The multifidus muscle is innervated by the medial branch of the posterior root of the segmental nerve and does not have collateral innervation. MRI measurements evaluate the multifidus muscle in the increasingly growing literature. Choi et al. (5) measured the CSA of the multifidus and psoas muscles using MRI and demonstrated that the CSA of the multifidus muscle decreased with the duration of symptoms. Danneels et al. (6) showed that CSA of the multifidus muscle is more significant in patients with chronic low back pain. Farshad et al. (7) measured the multifidus-lamina distance (MLD) with MRI and CSA. They revealed that the degree of nerve compression and symptom duration were insignificant for CSA and MLD. In addition, Zhao et al. (8) and Yoshihara et al. (9) examined the multifidus muscle histologically. They found that type 1 and type 2 fiber diameters were significantly reduced on the pathological side compared to the normal side.

Within the scope of this research, we aimed to elucidate bilateral measurements of CSA and MLD of the multifidus muscle at the pathological disc and the upper distance of the pathological disc using MRI before primary lumbar disc herniation surgery and bilateral measurements of CSA and MLD of the multifidus muscle at the pathological disc and the upper distance of the pathological disc using MRI before recurrent lumbar disc herniation surgery. In addition, CSA and MLD measurements were compared in the pathological disc and the upper distance of the pathological disc in the preoperative MRI of primary and recurrent disc herniation in the exercise and non-exercise patient groups.

METHOD

Fifty-nine patients who underwent recurrent lumbar disc herniation surgery at the Neurosurgery Clinic of Bursa Yüksek İhtisas Education and Research Hospital were retrospectively analyzed. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Our institution has granted ethics committee approval with protocol number 2011-KAEK-25-2019/06-23, and informed consent has been obtained from all participants.

Lumbar MRI images were obtained from our hospital PACS system. The patient's pathological disc and upper distance multifidus muscle MLD and CSA measurements were performed by two observers (radiologists) at different times. First, MRI T2 axial and sagittal images were used to determine the disc level and side. The severity of compression due to disc herniation was categorized according to Pfirrmann. Then, CSA and MLD measurements were performed bilaterally for the primary lumbar disc herniation distance and upper distance. Measurements were performed bilaterally for the recurrent lumbar disc herniation distance and upper distance.

Patients over the age of 70 and under the age of 18 who had previously undergone lumbar stabilization, listhesis, spondylodiscitis, spinal mass, and postoperative cerebrospinal fluid collection surgery were excluded from the study. In addition, 12 patients who did not follow the given exercise program were excluded from the study. Patient files, outpatient clinic records, and preoperative and postoperative MRI examinations using the hospital's PACS system were used for the patients included in the study.

Statistical Analysis

Patient data collected within the scope of the study were analyzed with the IBM Statistical Package for the Social Sciences (SPSS) for Windows 26.0 (IBM Corp., Armonk, NY) package program. Frequency and percentage for categorical data and mean and standard deviation for continuous data were given as descriptive values. For comparisons between groups, the "Independent Sample T-test" was used for two groups, and the "Pearson Chi-Square Test" was used to compare categorical variables. The results were considered statistically significant when the p-value was less than 0.05.

RESULTS

In the study, 3 (10.3%) of the cases who exercised were 18–30, 17 (58.6%) were 30–50, and 9 (31.0%) were over 50 years of age. Of the cases who did not exercise, 2 (6.7%) were 18–30, 20 (66.7%) were 30–50, and 8 (31.0%) were 50–70 years of age. No significant difference was found in age rates between the groups who did and did not exercise. Of the cases that exercised, 7 (24.1%) had a symptom duration of less than 3 months, 8 (27.6%) had a symptom duration of 3-6 months, and 14 (48.3%) had a symptom duration of more than 6 months. Of the cases that did not exercise, 8 (26.7%) had a symptom duration of less than 3 months, 8 (27.7%) had a symptom duration of 3–6 months, and 14 (48.7%) had a symptom duration of more than 6 months. The symptom duration rates were not statistically significantly different between the exercise and non-exercise groups.

The disc pfirrmann degrees of the cases in the exercise group were Grade II in 5 (17.2%) cases, Grade III in 15 (51.7%) cases, Grade IV in 6 (20.7%) cases, and Grade V in 3 (10.3%) cases. The disc pfirrmann degrees of the cases in the non-exercise group were found to be Grade II in 4 (13.3%) cases, Grade III in 15 (50.0%) cases, Grade IV in 10 (33.3%) cases and Grade V in 1 (3.3%) case with no significance.

Nineteen (65.5%) of the participants in the exercise group used a corset in the postoperative period, while 11 (36.7%) of the participants in the non-exercising group did the same. According to the Chi-Square Analysis, the rates of postoperative corset use were statistically significantly different between the exercise and non-exercising groups (X2=4.91, p=0.027) (Table 1).

Table 1. Comparison of postoperative corset use rates between exercise and non-exercise groups

		EXERCISE					
		Yes		No		X2	P-value
		n	%	n	%		
POSTOPERATIVE CORSET USE	Yes	19	65.5	11	36.7	4.91	**0.027**
	No	10	34.5	19	63.3		

According to the Mann Whitney U test, it was found that the mean values of Recurrent disc distance mm MLD (Za=-2.38, p= 0.017) and Recurrent disc upper distance mm MLD (Za=-2.25, p= 0.024) were statistically significantly different between the exercise and non-exercise groups. In addition, it was found that the means of Recurrent disc distance mm CSA (Z=-0.50, p= 0.617), Recurrent disc distance versus mm CSA (Z=-0.44, p= 0.660), Recurrent disc upper distance mm CSA (Z=-0.41, p=0.682), Recurrent disc upper distance versus mm CSA (Z=-0.32, p= 0.750), Recurrent disc distance versus mm MLD (Z=0.44, p= 0.660), Recurrent disc upper distance versus mm mld (Z=-1.17, p= 0.243) were not statistically significantly different between the two groups (Table 2).

Table 2. Comparison of recurrent disc distance means between exercise and non-exercise groups (1st Reviewer)

	EXERCISE					
	Yes (n=29)		No (30)			
	Mean	Median	Mean	Median	Z	P-value
Recurrent disc distance mm csa	791.78	778.80	760.47	722.12	-0.50	0.617
Recurrent disc distance opposite mm csa	781.57	749.80	820.71	820.37	-0.44	0.660
Recurrent disc upper distance mm csa	685.21	694.00	698.84	688.36	-0.41	0.682
Recurrent disc upper distance opposite mm csa	672.67	701.36	681.56	637.94	-0.32	0.750
Recurrent disc distance mm mld	5.34	4.56	6.83	6.48	-2.38	**0.017**
Recurrent disc distance opposite mm mld	5.78	5.13	5.95	5.42	-0.44	0.660
Recurrent disc upper distance mm mld	3.10	2.94	4.22	4.14	-2.25	**0.024**
Recurrent disc upper distance opposite mm mld	4.06	4.11	3.68	3.53	-1.17	0.243

Z=Mann Whitney U test.

According to Multiple Linear Regression Analysis, 31% of the Recurrent Disc Distance mm mld values among all participants were explained by Gender, Age, Exercise, Symptom Duration, Interoperative Time, Level, Symptom Side, Disc Pfirrmann Degree, and Postoperative Brace Use; however, only exercise (p= 0.025, CI: 0.22, 3.16) and Disc Pfirrmann Degree (p= 0.029, CI: 0.11, 1.94) were effective factors in the model, and other variables were not statistically significant (Table 3).

Table 3. Results of Multiple Linear Regression Analysis associated with recurrent disc distance mm mld values (1st Reviewer)

	Unstandardized Coefficients		Standardized Coefficients	t	P-value	95% CI	
	B	SE	Beta			LL	UL
(Constant)	-1.65	3.46		-0.48	0.636	-8.60	5.30
Gender	1.62	0.75	0.28	2.16	0.036	0.11	3.13
Age	0.01	0.64	0.00	0.01	0.989	-1.28	1.29
Exercise	1.69	0.73	0.29	2.31	**0.025**	0.22	3.16
Symptom duration	-0.18	0.97	-0.05	-0.18	0.858	-2.13	1.78
Interoperative time	-0.25	1.48	-0.05	-0.16	0.869	-3.22	2.73
Level	0.94	0.60	0.20	1.57	0.122	-0.26	2.15
Symptom side	0.10	0.73	0.02	0.13	0.896	-1.37	1.57
Disc pfirrmann degree	1.02	0.45	0.28	2.25	**0.029**	0.11	1.94
Postoperative brace use	-0.06	0.73	-0.01	-0.08	0.937	-1.52	1.41

SE=Standard Error, LL=Lower Limit, UL=Upper Limit. R2=0.31, F=2.41, p=0.024.

According to Multiple Linear Regression Analysis, 26% of the Recurrent Disc Distance mm MLD values among all participants were explained by Gender, Age, Exercise, Symptom Duration, Interoperative Time, Level, Symptom Side, Disc Pfirrmann Degree and Postoperative Brace Use; however, it was found that only exercise (p= 0.003, CI: 0.47, 2.17) was an effective factor in the model, and other variables were not statistically significantly effective factors in the model (Table 4).

According to Multiple Linear Regression Analysis, 24% of the Recurrent Disc Distance mm mld values among all participants were explained by Gender, Age, Exercise, Symptom Duration, Interoperative Period, Level, Symptom Side, Disc Pfirrmann Degree and Postoperative Brace Use; however, it was found that only gender (p= 0.048, CI: 0.02, 3.22) was an effective factor in the model, and other variables were not statistically significantly effective factors in the model (Table 5).

Table 4. Multiple Linear Regression Analysis Results associated with recurrent upper disc distance mm mld values (2nd Reviewer)

	Unstandardized Coefficients		Standardized Coefficients	t	P-value LL	95% CI	
	B	SH	Beta			AL	ÜL
(Constant)	-0.19	2.01		-0.09	0.926	-4.22	3.84
Gender	0.32	0.44	0.10	0.74	0.464	-0.55	1.20
Age	0.25	0.37	0.09	0.69	0.501	-0.49	1.00
Exercise	1.32	0.43	0.41	3.11	**0.003**	0.47	2.17
Symptom duration	0.18	0.57	0.09	0.32	0.748	-0.95	1.32
Interoperative time	-0.66	0.86	-0.22	-0.77	0.443	-2.39	1.06
Level	0.53	0.35	0.20	1.52	0.136	-0.17	1.23
Symptom side	0.49	0.42	0.15	1.16	0.253	-0.36	1.34
Disc pfirrmann degree	0.32	0.26	0.16	1.21	0.232	-0.21	0.85
Postoperative brace use	-0.34	0.42	-0.11	-0.81	0.423	-1.19	0.51

SE=Standard Error, LL=Lower Limit, UL=Upper Limit. R2=0.26, F=1.96, p=0.065.

Table 5: Multiple Linear Regression Analysis Results associated with recurrent disc distance mm mld values (2nd Reviewer)

	Unstandardized Coefficients		Standardized Coefficients	t	P-value LL	95% CI	
	B	SH	Beta			AL	ÜL
(Constant)	-0.53	3.67		-0.14	0.886	-7.90	6.84
Gender	1.62	0.80	0.27	2.03	**0.048**	0.02	3.22
Age	0.14	0.68	0.03	0.21	0.832	-1.22	1.51
Exercise	1.38	0.78	0.24	1.78	0.082	-0.18	2.94
Symptom duration	-0.17	1.03	-0.05	-0.17	0.867	-2.25	1.90
Interoperative time	-0.21	1.57	-0.04	-0.13	0.894	-3.36	2.94
Level	0.92	0.64	0.20	1.45	0.154	-0.36	2.20
Symptom side	-0.10	0.78	-0.02	-0.13	0.898	-1.66	1.46
Disc pfirrmann degree	0.79	0.48	0.22	1.64	0.107	-0.18	1.76
Postoperative brace use	0.06	0.77	0.01	0.08	0.939	-1.50	1.62

SE=Standard Error, LL=Lower Limit, UL=Upper Limit. R2=0.24, F=1.73, p=0.107.

DISCUSSION

Low back pain is a common health problem and the second most common health problem for which people seek help. The prevalence in society is 5%, and its lifetime prevalence is 80%. It is the most essential reason for activity restriction in people under 45. No diagnosis can be made in 85% of low back pain cases (1–3). A detailed history and physical examination should be performed to evaluate patients with low back pain. While analgesic drugs are the best way to treat complaints, a 4-day activity restriction is also beneficial in most cases. However, complaints increase in rests lasting more than 4 days. Therefore, we recommend that patients return to their daily activities immediately. However, even if none of the patients with low back pain receive treatment, 85–90% recover within 1 month (2).

The persistence of complaints after lumbar disc herniation surgery, failure to return to daily life, and continuation of back and leg pain as before surgery are defined as unsuccessful back surgery. The most common cause of unsuccessful back surgery is recurrent disc herniation. Lumbar disc herniation that develops at least 6 months after the patient's complaints have improved after lumbar disc surgery on the same level, on the same side, on the same level, on a different side, or at a different level is called recurrent disc herniation. However, the accepted definition in the literature is the development of a disc herniation that causes radicular pain on the same or opposite side, regardless of duration (10). Surgery is performed in 2% of lumbar disc herniation cases, but recurrence develops in 5–11%, and a second surgery is required (2, 4). When the risk factors for recurrent disc herniation are examined, it is seen that the most important factors are the wrong technique and the wrong indication. In addition, smoking and lifting heavy loads are among the risk factors for recurrent disc herniation (10). Different studies in the literature evaluate obesity as a risk factor. While Meredith et al. (11) revealed a strong relationship between obesity and recurrent lumbar disc herniation in their study on 75 patients (25 of whom were obese), Rhin et al. (12) could not establish a relationship between obesity and recurrent disc herniation in their prospective study. At the same time, biomechanical studies have shown that the position in which intradiscal pressure is highest is when the spine is in flexion. It has been demonstrated that disc height decreases in obese patients transitioning from supine to sitting or standing (13). When we look at the recurrence rates according to the discectomy technique, the recurrent disc herniation rate is 7–21% in patients who underwent limited discectomy, while this rate decreases to 3% in patients who underwent subtotal discectomy. However, it has also been reported that there is a parallelism between the extent of discectomy and instability (14). In their study, Kim et al. (15) showed that range of motion is also associated with recurrent lumbar disc herniation. While the rate of recurrent disc herniation was 26.5% in patients with more than 10 degrees of sagittal range of motion at the operated disc level, this rate was found to be 4.1% in patients with less than 10 degrees of sagittal range of motion. Modic changes were reported as another risk factor for recurrent disc herniation. Barth et al. (16) reported a relationship between Modic changes and recurrent disc herniation and that sequestrectomy reduced the rate of recurrent disc herniation. Chin et al. (17) reported that the prognosis of Modic type 1 and type 2 was worse. MRI is the gold standard diagnostic method for diagnosing recurrent disc herniation. Recurrent disc herniation has hypointense features in MRI T1 and T2 sequences. In contrast-enhanced lumbar MRI, epidural fibrosis is distinguished from recurrent lumbar disc herniation by retaining the contrast material. In addition, in lumbar MRI axial sections, while the dura is pushed due to the herniated disc in recurrent lumbar disc herniation, the dura is pulled toward the lesion in epidural fibrosis. In the treatment of recurrent lumbar disc herniation, a conservative approach, repeat discectomy, or fusion surgery with discectomy may be preferred (17).

Atrophy in the muscles may cause back pain. In the previous literature, many studies evaluated the atrophy of the paravertebral muscles. In particular, studies show that radiological CSA and MLD measurements of the paravertebral muscles are valuable in assessing lumbar paravertebral muscle atrophy. In addition, Yoshihara et al. (9) and Zhao et al. (8) evaluated the multifidus muscle histologically, took biopsies from the multifidus muscle from the side with lumbar disc herniation and the opposite side, and compared them. They revealed that the multifidus muscle's type 1 and type 2 fibers were significantly more atrophic on the side with lumbar disc herniation than on the normal side. Kim et al. (18) showed a significant difference in CSA of the multifidus muscle between the diseased and normal sides in the patient group with a symptom duration of 5.4±2.7 months in their study. In addition, in the survey conducted by Çolakoğlu et al. (19) on 90 patients, significant correlations were observed between symptom duration and the degree of fat content in the affected multifidus muscle. In contrast, Farshad et al. (7) showed that the asymmetry of the multifidus muscle is not related to the severity or duration of nerve root compression in the lumbar spine. Our study found no statistically significant relationship between the duration of symptoms and the CSA and MLD measurements of the multifidus muscle. In addition, we showed that the CSA and MLD measurements of the patients who received and did not receive exercise were not significantly related to gender, age, interoperative period, lumbar disc herniation level, symptom side, and Pfirrmann degree. In our study, it was revealed that 65.5% of the participants in the exercise group used a corset in the postoperative period, while 36.7% of the participants in the non-exercise group used a corset in the postoperative period and that the use of a corset after surgery was statistically significant.

It was previously reported that CSA measurements of the muscle are frequently performed to evaluate the atrophy of the multifidus muscle. In the study conducted by Keller et al. (20), they stated that the reliability of CT can be accepted for measuring the density and CSA of the paraspinal muscles. Hodges et al. (21) showed that the CSA of the multifidus muscle decreased in a study based on CSA measurement of the multifidus muscle performed by damaging the spinal root and disc of 21 pigs. In the survey conducted by Faur et al. (22), they measured the CSA of the multifidus muscle on MRI. They revealed that the percentage of multifidus muscle atrophy was higher at lower levels (L5/S1) and was related to the degree of disc degeneration. When Storheim et al. (23) and Huang et al. (24) compared the CSA of the paraspinal muscles of the patient groups that received and did not, they revealed an increase in paraspinal muscle CSA after exercise. In addition, Choi et al. (5) showed that lumbar extension muscle strengthening programs after lumbar disc herniation surgery can positively affect pain, recovery time, and paravertebral muscle strength. In our study, we revealed that there was no statistically significant difference in the CSA of the multifidus muscle in the exercise group and the non-exercise group.

Farshad et al. (7) calculated the CSA and MLD of the multifidus muscle on MRI in a retrospective study on 79 patients. They revealed that the asymmetry of the multifidus muscle was not related to the severity or duration of nerve root compression in the lumbar spine. Altınkaya et al. (25) reported that the MLD measurement in patients with lumbar disc herniation was significantly correlated with multifidus asymmetry. In our study, the MLD measurement of the multifidus muscle before primary lumbar disc herniation surgery was not statistically significant between the exercised and non-exercised groups. At the same time, the MLD measurement of the multifidus muscle on the pathological disc side before recurrent disc surgery (p= 0.017) was statistically significant between the exercised and non-exercised groups. In our study, the measurements were made by two different observers (radiologists) at various times. In the measurements taken by the first observer before recurrent disc surgery, the mean MLD measurement of the multifidus muscle was 5.34 in the exercise group. In contrast, the mean MLD measurement of the multifidus muscle in the no-exercise group was statistically significant at 6.83 (p= 0.017). In addition, the first observer's measurement of the upper pathological disc distance before recurrent disc surgery was also statistically significant (p= 0.024). According to the evaluation made by the second observer, the mean MLD measurement of the multifidus muscle before recurrent disc surgery was 5.56 in the exercise group. At the same time, it was measured at 6.81 in the no-exercise group (p= 0.038), which is the same as the first observer. This result shows us that exercise shortens the MLD distance and that an appropriate low-back exercise program can prevent atrophy of the multifidus muscle.

CONCLUSION

This research revealed no significant relationship between CSA and MLD measurements of patients who received and did not receive exercise and gender, age, the interval between surgeries, lumbar disc herniation level, symptom side, and pfirrmann degree. It was indicated that using a corset after surgery was an effective parameter for measuring patients who received and did not receive exercise. Exercise shortens the MLD distance, and an appropriate waist exercise program can prevent atrophy of the multifidus muscle.

DESCRIPTIONS

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AI Statement

The authors used AI and AI-assisted Technologies (Grammarly and MS Word Editor) in the writing process. These technologies improved the readability and language of the work. Still, they did not replace key authoring tasks such as producing scientific or medical insights, drawing scientific conclusions, or providing clinical recommendations. The authors are ultimately responsible and accountable for the contents of the whole work.

Competing interests

The authors declare that they have no competing interests.

Consent for Publication

The original article is not under consideration by another publication, and its substance, tables, or figures have not been published previously and will only be published elsewhere.

Data Availability

The data supporting this study's findings are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Ethical Declaration

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Our institution has granted ethics committee approval. As this was retrospective research, no informed consent was obtained from participants.

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