



LUMBAR DISCECTOMY WITH EPIDURAL FAT GRAFT AND ITS EFFECT ON CLINICAL OUTCOME AND SCAR FORMATION: A CASE CONTROL STUDY ON 104 PATIENTS

LOMBER DİSKEKTOMİDE, EPİDURAL YAĞ GREFTİNİN KLİNİK SONUÇLAR VE SKAR OLUŞUMU ÜZERİNDEKİ ETKİSİ: 104 HASTALIK BİR VAKA KONTROL ÇALIŞMASI

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SUMMARY

Background: Postoperative scar formation appears regularly after lumbar disc surgery, and is seen to be one possible reason for prolonged complaints after surgery. Therefore, several materials have been developed to decrease scarring in the spinal canal, although no significant clinical effects have been proven.

Materials and Methods: This retrospective analysis is designed as a case-control study examining the clinical outcome, measured with the Oswestry Disability Score, of 54 patients who received microdiscectomy with an epidural fat graft, compared with 52 patients who received microdiscectomy alone, with a minimum follow-up of one year. For radiological evaluation, the preoperative and one year postoperative MRIs were assessed by a radiologist who was blind to which treatment group the patient belonged.

Results: Whereas the requirement for postoperative analgesia was significantly lower in the fat graft group, the analysis showed no significant differences between the groups with regard to clinical outcome or scar formation by MRI one year after surgery. The fat graft was detectable in 65.8% patients on an MRI one year postoperatively.

Conclusion: This study confirms the already-known results that fat grafts, as well as other synthetic materials, do not significantly affect the clinical outcome after lumbar disc surgery, even though there is a tendency to detect reduced scar formation on MRI images one year after surgery.

Key words: Fat graft, lumbar disc surgery, scar formation

Level of evidence: Retrospective clinical study, Level III

ÖZET

Ameliyat sonrası skar oluşumu lomber disk ameliyatları sonrası sıklıkla görünür ve ameliyat sonrası uzun süreli şikayetler için olası bir nedendir. Bu nedenle önemli bir klinik etkisi kanıtlanmış olmasa da spinal kanalda skar oluşumunu azaltmak için çeşitli yöntemler geliştirilmiştir.

Gereç ve yöntem: Bu çalışmada retrospektif olarak tek mesafe mikrodikektomiye takiben epidural yağ grefti uygulanan 54 hasta ile fat grefti uygulanmayan 52 hasta 1 yıllık takip, MR görüntüleme ve Oswestry maluliyet skoru ile karşılaştırılmıştır. Radyolojik değerlendirme için ameliyat öncesi ve postoperatif 1 yıl sonrası sonrası MR ları bir radyolog tarafından değerlendirilmiştir.

Sonuçlar: Postoperatif olarak analjezi gereksinimi yağ grefti grubunda anlamlı derecede düşük iken, MR görüntüleme deki skar oluşumunda her iki grup arasında anlamlı bir farklılık gösterilememiştir. Yağ grefti 1 yıllık postoperatif MR'ların % 65.8 inde tespit edilmiştir.

Sonuç: Bu çalışmanın verilerine göre epidural yağ grefti ve diğer sentetik materyaller klinik sonuçlarda anlamlı bir etki yaratmadığı ileri sürülmüştür

Anahtar Sözcükler: Yağ grefti, epidural skar, disk cerrahisi

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III

INTRODUCTION:

Epidural scar formation appears regularly after lumbar disc surgery, and postoperative scarring seems to be one causative factor for unsuccessful lumbar disc surgery. Whereas nearly 80% of lumbar microdiscectomies show good or very good results, there is a constant number of approximately 16% of patients with persistent lower back pain, ending up with “failed back surgery syndrome”.

Several authors regard scar formation in the peridural space as one possible reason for post-discectomy syndrome^{15,26,28}. The three most important pathomechanisms of scar formation are destruction of the epidural lipid tissue, formation of epidural hematoma, and a penetration of the autochthon back muscles into the defect¹². For this reason, a variety of materials have been developed to reduce scarring in the spinal canal^{3,18,23,27,31}. Fat grafts brought into the epidural space had the best effects on reducing scarring after lumbar surgery²⁰⁻²². Langenskiöld and Kiviluoto were the first to describe the autologous implantation of subcutaneous fat grafts after discectomies of the lumbar spine in clinical practice, in 1976. Fat as a place-keeper in the epidural space is expected to reduce fibroblast migration, peridural scarring, compression of nerve roots, and postoperative pain, which should result in a better clinical outcome. However, the reported results are not consistent^{8,11,16,30}, and currently there are no studies showing a favorable influence on both scar formation and clinical outcome after the use of an epidural fat graft after lumbar discectomy.

The intention of our study was to retrospectively examine the morphological changes in the spinal canal and the clinical course after conventional nucleotomy, or nucleotomy with an epidural fat graft.

MATERIALS AND METHODS:

This study is a retrospective analysis of 106 patients who received their first surgery for a lumbar disc herniation by microdiscectomy with or without a fat graft, designed as a matched case-control study.

The case group consisted of 54 patients who received surgery with an epidural fat graft between 2002 and 2009 by the senior author (R.K.). The control group included 52 matched patients who received conventional lumbar discectomy from 2008 to 2009.

To analyze the clinical outcome, the Oswestry Low Back Pain Disability Index (ODI) was used⁴. For further evaluation, the gender, age at surgery, body mass index (BMI), duration of preoperative complaints in weeks, duration of hospital stay in days, type and amount of rehabilitation, amount of remedy and postoperative aid, use of postoperative analgesia, number of complications and wound infections, and time to re-entry into employment were also evaluated.

For radiological evaluations, preoperative magnetic resonance imaging (MRI) of the lumbar spine, as well as magnetic resonance images 12 months postoperatively, both with and without contrast enhancement, were studied. The assessment of postoperative intraspinal scarring was accomplished according to the grading system by Glickstein⁶ (Table-1).

Table-1. Grading of intraspinal scar according to Glickstein

Grade 0	No scar
Grade 1	< 25% of the thecal sac filled with scar
Grade 2	25–50% of the thecal sac filled with scar
Grade 3	> 50% of the thecal sac filled with scar

Table-2. Distribution of group characteristics

		Case group (fat graft)	Control group (without fat graft)	p-value
Gender	Male	29 (53.7%)	30 (57.7%)	0.7
	Female	25 (46.3%)	22 (42.3%)	
Mean age (years) ± SD		45.7 ± 5.1	50.3 ± 6.8	0.12
Body mass index (kg/m ²)		25.44 ± 4.6	26.3 ± 5.1	0.29
Duration of complaints before surgery (weeks) ± SD		13.9 ± 8.2	6.6 ± 5.9	0.26
Level of disc herniation	L2-3	2 (3.7%)	3 (5.8%)	0.26
	L3-4	3 (5.6%)	9 (17.3%)	
	L4-5	22 (40.7%)	14 (26.9%)	
	L5-S1	27 (50%)	25 (48.1%)	

Furthermore, the detectability of the fat graft was investigated. The evaluation of the MRIs was done by an experienced radiologist who was blind concerning the group affiliation.

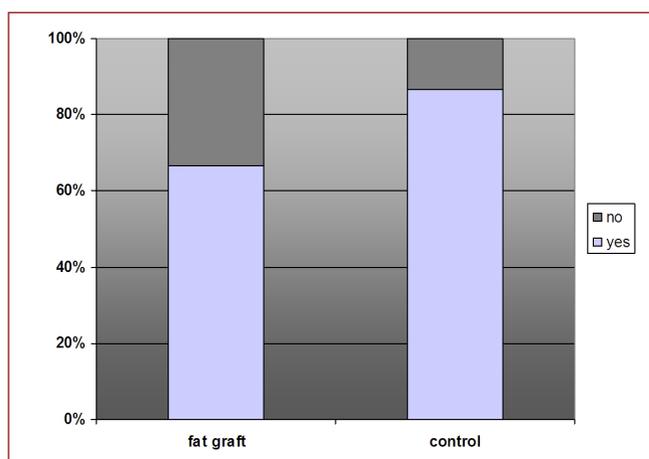
Statistics:

For statistical analysis, the Exact Fisher Test (Chi-square test after Pearson for low case numbers: exact significance two-pages) was utilized¹³. The Mann-Whitney U Test was used for the analysis of metric variables, with a significance level set at $p < 0.05$ ²⁵.

RESULTS:

The characteristics of each group with regard to gender, age, body mass index, duration of complaints before surgery and level of disc herniation, are shown in Table-2. In terms of the duration of hospital stay, type and amount of rehabilitation and postoperative aid, as well as the number of complications and wound infections, the groups did not differ significantly. Postoperative administration of basic analgesia was necessary for 36 patients (66.7%) in the fat graft group, and for 45 patients (86.5%) in the control group (Figure-1).

This difference was shown to be statistically significant using the Fisher's Exact Test ($p = 0.022$). The mean value of the Oswestry Low Back Pain Disability Index one year after surgery was 3.31 for the fat graft group and 4.67 for the control group (Figure-2).

**Figure-1.** Was basic analgesia necessary postoperatively?

The lower score for the fat graft group, by a distinction of 1.36, missed significance ($p = 0.132$) using the Mann-Whitney U Test.

In the fat graft group, 51 patients (94.44%) were able to re-enter their occupation one year after surgery, for two patients (3.7%) this was unclear, and one patient (1.85%) was unable to work in their original occupation again.

In the control group, for 44 patients (84.62%) re-entry into their occupation was possible, for six (11.54%) this was unclear, and two patients (3.85%) were unable to work in their initial occupation again after lumbar disc surgery (Figure-3).

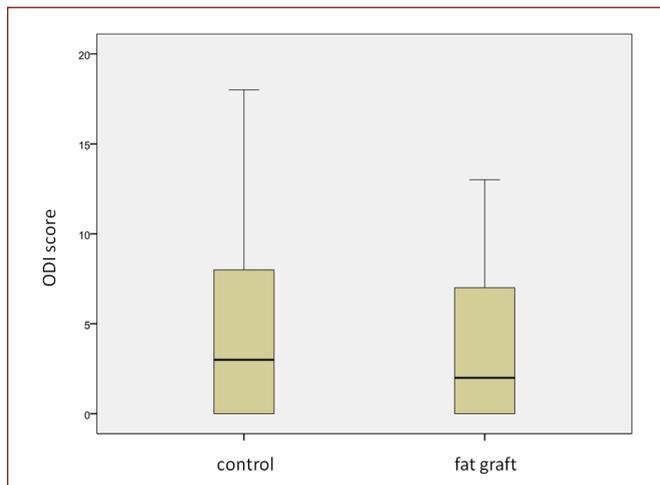


Figure-2. Box plots showing the distribution of the ODI values for the control group (median = 3; min = 0; max = 18) and the fat graft group (median = 2; min = 0; max = 13)

This difference showed no significance with the Fisher's Exact Test ($p=0.120$). The general outcome assessment, demonstrating a non-significant difference between the groups, is shown in Table-3.

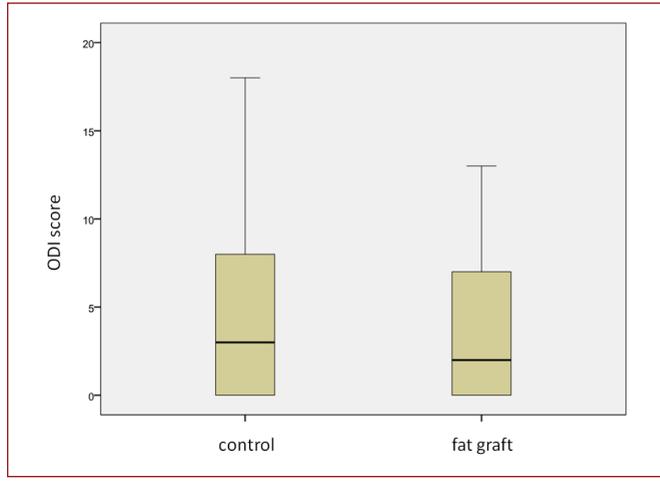


Figure-3. Re-entry into employment one year after surgery for both groups

Table-3. General outcome assessment

Outcome	Case group (fat graft)	Control group (without fat graft)	p-value
excellent	23 (42.6%)	15 (28.9%)	0.48
satisfactory	15 (27.8%)	15 (28.9%)	
acceptable	8 (14.8%)	11 (21.2%)	
unchanged	8 (14.8%)	11 (21.2%)	
aggravated	-	-	

The evaluation of the MRIs was done by an external radiologist who was blind to the group affiliation. There was no patient with degree 0 scar formation in either the fat graft group or the control group. 44.7%¹⁷ of patients in the fat graft group and 37.5%¹⁸ of patients in the control group had degree 1 scar formation, 52.6%²⁰ of patients with a fat graft and 56.3%²⁷ of patients after conventional nucleotomy showed degree 2 scar formation, and 2.6%¹ of patients in the fat graft group and 6.3%³ of patients in the control group had severe degree 3 scar formation (Figure-4).

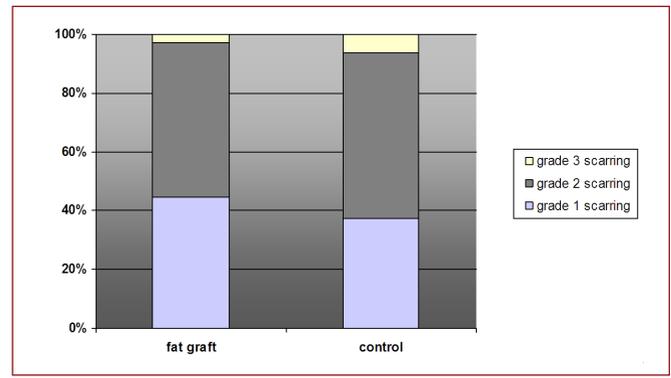


Figure-4. Distribution of scar formation in both groups,

Nevertheless, the differences between the groups were not significant ($p=0.658$). The fat graft could be detected by the radiologist in only 65.8% of patients in the fat graft group in postoperative MRIs.

DISCUSSION:

The group characteristics did not differ significantly, so the study shows good comparability between the groups. In terms of the clinical outcome, no significant distinctions between the fat graft group and the control group could be evaluated, which is consistent with previously-published results showing that fat grafts^{1,7,8,16}, as well as other synthetic materials^{9,14,24}, have no relevant influence on the clinical course after lumbar disc surgery. The Oswestry Low Back Pain Disability Index, a robust and widely-accepted tool, showed a slight tendency towards the fat graft group, nevertheless statistical significance was missing. The same applies to the general outcome assessment, which confirms the trend shown by other studies^{5,17,19}.

This study explicitly concentrated not only on outcome scores like ODI, but also on the analysis of softer evaluation criteria, such as the duration of hospital stay, type and amount of rehabilitation and postoperative aid, as well as the number of re-entries into employment. However, also with regard to these criteria, no statistically significant differences could be demonstrated. However, the high re-entry rate into occupation for both groups can be interpreted as a sign of satisfactory surgical results.

The only difference was merely the consumption of postoperative basic analgesics, which was significantly lower in the fat graft group when compared with the control group. Additionally, the results show no significant differences between the fat graft group and the control group with regard to postoperative scar formation in the spinal canal, in contrast-enhanced MRIs 12 months after surgery. This is in contradiction to previous studies carried out in dogs, showing a reduction of scarring with the help of a fat graft^{20,22}, although contrary reports have been published¹⁶.

In 1994, Pospiech et al.²⁰ provided evidence that epidural fat transfer can reduce scarring in the epidural space in nearly 70% of cases, in an experimental study on 30 beagle dogs. Quist et al.²² found a significant reduction of fibrous tissue by treatment with fat after laminectomy at the lumbar spine in 1998. Nevertheless, this experimentally-proven reduction of scarring could not be demonstrated to have a significant influence on the clinical outcome in several studies^{1,7-8}. On the other hand, the results of our study make clear that evidence of fat grafts in postoperative MRIs is possible 12 months after surgery. In nearly two thirds of the cases (65.8%), the fat tissue could be detected by MRI by a radiologist who was blind concerning the operation method and the patient's group affiliation. This supplies strong evidence that autologous fat grafts can survive vitally and be detected in the epidural space over a period of months or years after surgery, and underlines the findings of previous studies about the survival of transplanted fat^{10,29,30}. The fact that our study is a retrospective analysis, making it weaker in comparison to prospective randomized trials, is

partially compensated by establishing a matched control group. This study underlines the results of previous studies showing that there is only limited clinical use for autologous fat transplantation in the context of lumbar disc surgery.

CONCLUSION:

We conclude that there is no reason to prefer an autologous implant of subcutaneous fat grafts within the bounds of a disc prolapse at the lumbar spine to conventional nucleotomy.

Conflict of interest

The authors declare that they have no conflicts of interest.

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