



COMPARISON OF LONG-TERM RESULTS OF ANTERIOR DISCECTOMY (ACD) VERSUS ANTERIOR DISCECTOMY WITH FUSION (ACDF) FOR TREATMENT OF CERVICAL DISCOPATHY

SERVİKAL DİSKOPATİ TEDAVİSİNDE ANTERİÖR DİSKEKTOMİ (ACD) İLE ANTERİÖR DİSKEKTOMİ VE FÜZYON (ACDF) TEDAVİLERİNİN UZUN DÖNEM SONUÇLARININ KARŞILAŞTIRILMASI

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SUMMARY

Purpose: To compare the clinical and radiological outcomes of two different surgical techniques that are used for cervical disc disease, anterior cervical discectomy (ACD) versus anterior cervical discectomy with fusion (ACDF).

Material and methods: Ninety-eight patients who underwent cervical spine surgery due to disc disease between 2009 and 2010 were included. 32 patients in the first group received ACD, and 66 patients in the second group received ACDF. 45 (46%) patients were male and 53 (54%) were female. In the ACD group, 28 patients had single-disc disease, and four patients had disease of two discs. In the ACDF group, 34 patients had single-disc disease and 32 patients had disease of two discs. Measurements of the lordosis angle, foraminal height, disc space height, and osteophytes were determined using X-rays for radiological evaluation. Odom's criteria were used for clinical evaluation.

Results: Odom's results of excellent and good were seen at rates of 22% and 62.5%, respectively, in the ACD group, and 30% excellent and 57.5% good were seen in the ACDF group, at the follow-up six months postoperatively. At the follow-up 24 months postoperatively, the Odom's results were 12.5% excellent and 68.7% good in the ACD group, and 26% excellent and 68% good in the ACDF group. Statistically, at the final follow-up the ACDF group had a higher disc space and foraminal height than the ACD group ($p<0.05$), but there were no differences in the lordosis angle measurement loosening between the two groups ($p>0.05$).

Conclusion: Patients who receive ACDF have better clinical and radiological results than those who receive ACD.

Key words: Cervical disc disease, cervical anterior fusion, cervical anterior instrumentation, Odom's criteria

Level of evidence: Retrospective clinical study, Level III

ÖZET

Amaç: Servikal disk hastalığı tedavisinde kullanılan anterior servikal diskektomi (ACD) ve anterior servikal diskektomi ve füzyon (ACDF) sonuçlarının klinik ve radyolojik olarak karşılaştırmak.

Hastalar ve yöntem: 2009-2010 yılları arasında servikal disk hastalığı nedeniyle ameliyat edilen 98 hasta çalışmaya alındı. Çalışmaya alınan hastaların 32'sine ACD, 66'sına ACDF uygulandı. Hastaların ortalama yaşları 47 (29-62) yıl idi. Hastaların 45'i (%46) erkek, 53'ü (%54) kadın idi. ACD grubunda 28 hasta tek mesafe, 4 hasta çift mesafe, ACDF grubunda ise 34 hasta tek mesafe, 32 hasta çift mesafe disk patolojisi nedeni ile ameliyat edildi. Hastaların radyolojik değerlendirmeleri standart olarak çekilen grafilerde lordoz kaybı, foramen yüksekliği, disk mesafesi yüksekliği ve osteofitlerin değerlendirilmesi ile yapıldı. Klinik değerlendirme Odom kriterleri kullanılarak yapıldı.

Bulgular: Odom kriterlerinin 6. ay değerlendirmelerinde ACD grubunda mükemmel sonuç oranı %22, iyi sonuç oranı %62,5 olarak ve ACDF grubunda ise mükemmel sonuç oranı %30, iyi sonuç oranı %57,5 olarak bulundu. Yirmidördüncü ay değerlendirmesinde ise ACD grubunda mükemmel sonuç oranı %12,5, iyi sonuç oranı %68,7 olarak, ACDF grubunda ise mükemmel sonuç oranı %26, iyi sonuç oranı %68 olarak bulundu. İstatistiksel olarak ACDF grubunda preop osteofit ve lordoz kaybı varlığı ACD grubuna göre anlamlı derecede yüksekti ($p<0,05$). On sekizinci ve yirmidördüncü ay ölçümlerinde ACD grubunda osteofit varlığı ACDF grubuna göre anlamlı derecede yüksekti ($p<0,05$) ve gruplar arasında lordoz kaybı varlığı bakımından anlamlı fark yoktu ($p>0,05$). ACDF grubunda ameliyat sonrası tüm ölçümlerde disk mesafesi yüksekliği ACD grubuna göre anlamlı derecede yüksekti ($p<0,05$). Buna paralel olarak ACDF grubunda foramen yüksekliği anlamlı derecede yüksekti ($p<0,05$).

Sonuç: ACDF uygulanan hastalarda radyolojik ve klinik olarak daha başarılı sonuçlar elde edilmektedir.

Anahtar Kelimeler: Servikal disk hastalığı, servikal anterior füzyon, servikal enstrümantasyon, Odom kriterleri

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III

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INTRODUCTION

Cervical disc hernias are often clinically specified as arm pain. The primary treatment method is conservative, although surgical treatment can be considered for cases with no response to conservative treatment^{8,16,19}. When health records in the USA are investigated, the number of patients who receive surgery due to cervical disc disorder is 50–60/100,000¹⁸.

The generally-accepted surgical approach is anterior cervical discectomy with or without fusion. Discectomy including intervertebral fusion was first described using an autograft taken from the iliac wing without the use of a microscope by Robinson and Smith^{1,6,15,20,21}. Discectomy applications gained a new dimension with the use of a microscope by Hankinson and Wilson⁶. Today, ACDF applications are accepted as a gold standard of surgical treatment, due to their high successes in the early period¹⁰. Although successful results have been shown with ACDF applications, there have also been articles reporting successful results with ACD^{2,4,6,7,12,15,17,22,26,27}.

The aim of this study is to evaluate the clinical and radiological results of the ACDF and ACD procedures in patients with cervical disc disease.

MATERIALS AND METHODS

In our study, 98 patients who were admitted to our clinic due to cervical disc disease between 2009 and 2010 were retrospectively evaluated. All patients received either ACD or ACDF surgery.

Patients who received surgery at more than two levels, had multi-level discopathy, had had previous operations, received a posterior

approach, developed stenosis after trauma, and had advanced instability, were excluded.

The preoperative, postoperative and long-term results of the patients were clinically and radiologically evaluated. Neurological examinations of the patients were performed by an independent neurology specialist.

After neurological examination, the patients were clinically divided into three groups: radiculopathy, myelopathy, and radiculomyelopathy. Patients with neurological signs at the root area, such as radicular pain, decrease in deep tendon reflexes (DTR), paresis, dermatoma sensory loss and atrophy were grouped as radiculopathy. Patients with spastic paresis, gait disorders, atrophy, bladder dysfunction, increase in DTR, pathological reflex and increase in tonus were grouped as myelopathy, and patients with problems belonging to both groups were grouped as radiculomyelopathy. The clinical results after surgery were evaluated as excellent, good, fair and bad according to Odom's criteria (Table-1)¹⁶.

Table-1. Odom's criteria used for clinical evaluation.

Rating	Odom's criteria
Excellent	No symptoms due to cervical disc disease
Good	No obstacle to doing business as intermittent symptoms associated with cervical disc disease are present
Fair	Subjective improvement but limited physical activity
Bad	Worse or no improvement according to preoperative situation

Four-way standard cervical anteroposterior, lateral, and both oblique radiographs were taken for radiological evaluation of the patients. In patients with suspected instability, hyperflexion and hyperextension X-rays were dynamically taken. MRI was performed for all patients. In the radiological evaluation, cervical lordosis, the

height of the disc space operated on, and the presence of osteophytes were examined in the standard cervical lateral X-ray, and the height of the foramen was investigated in oblique X-rays (Figure-1).

In the radiological measurements, changes in cervical lordosis were evaluated according to Martins' criteria¹². According to Martins' criteria, if there was normal lordosis after surgery, this was evaluated as excellent. If there was lordosis loss of less than 5°, this was evaluated as good. If the angle towards the front was 5–15°, this was evaluated as fair, and if the angle was more than 15°, this was evaluated as bad. Cases with fair and bad results were evaluated as lordosis loss.

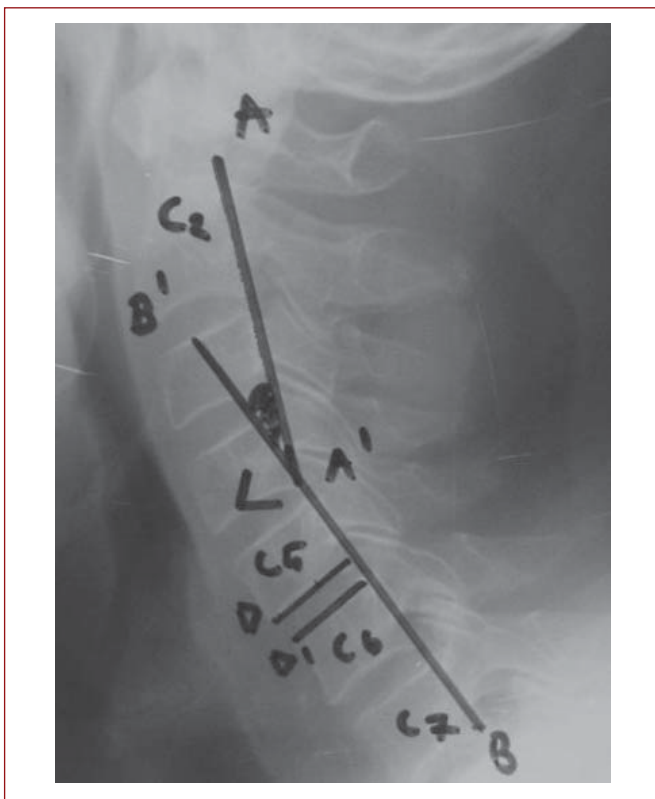


Figure-1. Measurement of the C2–7 angle of cervical lordosis in a lateral cervical X-ray in a neutral position is illustrated. The angle between the lines A–A' and B–B' consists of cervical lordosis. The area between the cervical vertebra end plates (D–D') was determined to be the disc height.

The anterior microdiscectomy surgical technique was applied to the patients, the presence of osteophytes was cleared, and the PLL was opened. In the ACDF group, titanium and peek cages were used for anterior fusion and DBM and spongius bone chips were used for bone fusion. Patients are encouraged to mobilize 24 hours after surgery and to use cervical collar for 4-6 weeks.

For statistical evaluation, the SPSS for Windows 16.0 statistical program was used. For the comparisons, the Student's t test, chi-square, Fisher Exact test and Paired t test were used. $p < 0.05$ was accepted as statistically significant.

RESULTS

The mean age of the patients was 47 (29–62) years. 45 of the patients (46%) were male and 53 (54%) were female. The mean age of the patients in the ACD group was 44 (29–62) years, and the mean age in the ACDF group was 48 (30–60) years.

Clinically, while 80 patients (82%) were admitted due to radiculopathy, three patients (3%) and 15 patients (15%) were admitted because of myelopathy and myeloradiculopathy, respectively (Table-2). In the first admission of the patients in both the ACD and ACDF groups, dermatome sensory changes were detected in 70 patients (71%), reflex changes were detected in 62 patients (63%) and various degrees of paresis were detected in 51 patients (52%).

Table-2. The distribution according to the clinical signs obtained from examination by a neurology specialist during clinical admission of the patients.

	ACD (n%)	ACDF (n%)	Total (n%)
Clinical sign			
Radiculopathy	30 (94%)	50 (76%)	80 (82%)
Myelopathy	0 (0%)	3 (4%)	3 (3%)
Myeloradiculopathy	2 (6%)	13 (20%)	15 (15%)
Total (n%)	32 (100%)	66 (100%)	98 (100%)

The mean baseline preoperative duration of symptoms was 10 months (20 days–30 months). The average preoperative duration of the disease in the ACD group was 12 months, and this was 14 months in the ACDF group. There were no statistically significant differences between them.

Thirty two of the 98 cases received ACD, and 66 patients received ACDF. In the ACDF group, a cervical plate was applied to 15 patients. In the ACD group, 28 patients had single-level and four patients had double-level discopathy, while in the ACDF group, 34 patients had single-level and 32 patients had double-level discopathy (Table-3). Six months after surgery, when the clinical results were evaluated according to Odom's criteria, the excellent and good result rates were 21.8% and 62.5%, respectively, in the ACD group, and 30.3% and 57.5%, respectively, in the ACDF group. At the 24 month follow-up, the excellent and good result rates were 12.5% and 68.7%, respectively, in the ACD group, and 25.7% and 68%, respectively, in the ACDF group.

Table-3. The distribution of disc levels and numbers of 98 patients receiving suitable ACD and ACDF techniques, according to group.

Operated disc level	ACD		ACDF		Total	
	n	%	n	%	n	%
Single level	28	88%	34	51%	62	62%
C3-4	0	0%	2	3%	2	3%
C4-5	4	13%	4	6%	8	8%
C5-6	13	41%	20	30%	33	34%
C6-7	11	34%	8	12%	19	19%
Double level	4	12%	32	49%	36	38%
C3-4/C5-6	0	0%	1	5%	1	2%
C3-4/C4-5	0	0%	2	3%	2	3%
C3-5/C5-6	1	3%	10	15%	11	11%
C5-6/C6-7	3	9%	19	29%	22	22%

Table-4. Evaluation of disc and foramen heights obtained after radiological measurements according to patient group, and statistical comparisons.

Radiological measurement	ACD		ACDF		p
	Average	SS	Average	SS	
Disc height					
Preop	6	1.13	5.9	1.3	0.001
Postop 1. day	5.4	0.9	9	0.7	0.001
Postop 18. Months	5.8	7.2	8.9	0.6	0.001
Postop 24. Months	4.4	0.65	8.8	0.6	0.001
Foramen height					
Preop	11.3	1.5	9.6	1.5	0.001
Postop 1. day	10.4	1.4	12.3	0.97	0.001
Postop 18. Months	9.2	1.2	12.2	0.9	0.001
Postop 24. Months	8.8	0.9	12.2	0.9	0.001

Table-5. Evaluation of lordosis loss and presence of osteophytes obtained after radiological measurements according to patients and statistical comparisons.

Radiological measurement	ACD		ACDF		p
	n	%	n	%	
Lordosis loss					
Preop	0	0%	56	85%	0.001
Postop 1. day	0	0%	13	20%	0.004
Postop 18. Months	2	6.2%	2	3%	0.4
Postop 24. Months	2	6.2%	2	3%	0.4
Presence of osteophyte					
Preop	19	59%	59	89%	0.001
Postop 1. day	0	0%	0	0%	
Postop 18. Months	5	16%	0	0%	0.003
Postop 24. Months	17	53%	10	15%	0.001

In cervical X-rays taken in the preoperative, postoperative and follow-up periods, the lordosis, disc space height, foramen height and osteophyte changes measured are shown in Tables 4 and 5. Statistically, the presence of preoperative osteophytes and lordosis loss was significantly higher in the ACDF group than in the ACD group ($p < 0.05$). At the 18 and 24 month measurements, the presence of

osteophytes in the ACD group was significantly higher than in the ACDF group ($p < 0.05$), and there were no significant differences between the groups in terms of lordosis loss ($p > 0.05$).

The postoperative height of the disc space in the ACDF group was significantly higher than in the ACD group ($p < 0.05$). The height of the foramen in the ACDF group was also significantly higher ($p < 0.05$).

Two patients, in the ACD group had post operative pain for more than three months but pain resolved spontaneously after 1.5 years.

Temporary hoarseness was observed in ten patients (two patients in the ACD group and eight patients in the ACDF), and this recovered one month postoperatively. In two patients who received ACDF, a superficial wound infection developed, which was treated with basic antibiotic therapy.

DISCUSSION

In symptomatic cervical disc disorders, surgical treatment is performed for cases that do not respond to conservative treatment. The main aim of surgical treatment is to remove pressure on the spinal cord and nerve roots^{1,22,25}. An anterior approach for surgical treatment is less traumatic than a posterior approach and disrupts stabilization less. The advantages of an anterior approach are the relaxation of neurovascular structures directly, regression in osteophytes, protection of the disc space height, reduction in folding of the ligamentum flavum and the provision of expansion in the foramen. With a posterior approach, there are disadvantages, such as lack of removal of pressure developed from the anterior, postoperative kyphosis and swan neck deformity^{8,9}.

Performing discectomy at the problematic disc level with surgical treatments can remove pressure on the spinal cord and nerve root^{1,23,25}. Cervical discectomy was first defined by Robinson and Smith without the use of a microscope^{1,6,15,20,21}. Hankinson and Wilson subsequently reported successful results using a microscope in cervical discectomy⁶. While Robinson and Smith used an autograft from the iliac wing for fusion in

their studies, Hankinson and Wilson did not use a graft for fusion^{1,6,15,20,21}.

Today, ACDF is accepted as a standard treatment method, and previous studies have supported the suggestion that discectomy is sufficient^{2,7,12,15,17,22,23,26,27}.

There are studies comparing cases who received only discectomy with those who received discectomy with fusion. Barlocher and Savolainen did not detect any statistically significant differences in the evaluation of clinical results for both groups using Odom's criteria^{7,23}. In our study, while the excellent and good result rates in the ACD group were 12.5% and 68.7%, respectively, at the 24 month follow-up, these rates were 25.7% and 68.1%, respectively, in the ACDF group. Clinically, the rates of excellent and good results were higher in the ACDF group.

In the literature, it has been stated that the effects of segmental kyphosis that develops after ACD can be a problem at adjacent levels and the sagittal cervical axis^{1,3,5,11,14,24}. In a study performed by Savolainen, Xie, Barlocher, Hauerberg and Martin, they evaluated the postoperative cervical lordosis values in both groups who received surgery^{4,7,12,23,26} and showed that the lordosis loss after surgery was higher for the ACD group than for the group who received fusion. In the evaluation of postoperative cervical lordosis in our study, while the lordosis loss was lower in the ACDF group for the first eighteen months, there were no statistically significant differences between the two groups at the 24 month evaluation.

With anterior approaches applied to cervical disc disease, the need for fusion has been defended due to the development of foraminal stenosis

and root pressure depending on the collapse of the space after discectomy^{1,13,23,25}. Bohlman et al. detected that arm pain recovered in 95% of 162 cases, and neck pain in 69%³. In a clinical series that included 44 cases who received the Smith Robinson technique, Aronson et al. reported the superiority of an anterior approach and fusion for the removal of arm pain that developed due to soft disc herniation¹. In our study, a statistically greater successful gain of disc space and foramen height was seen in the ACDF group than in the ACD group. These results are similar to those found in the literature.

As in our cases, the most common symptom of cervical disc disease is neck and arm pain. In our cases, pain control was better for the group that received cervical discectomy and cage and plate with fusion than for the group that received anterior discectomy without fusion. When the preoperative and postoperative cervical roentgenographies were compared for the group of patients who received cervical microdiscectomy and cage and plate with fusion, it was observed that the height of the degenerated disc space increased, the height of the foramen accordingly increased, and the disrupted cervical lordotic angle was recovered. More successful results were obtained in the ACDF group, radiologically and clinically.

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