

# The Efficacy of Intradiscal Steroid Injections in Degenerative Lumbar Disc Disease

## Lomber Dejeneratif Disk Hastalığında İntradiskal Steroid Enjeksiyonun Etkinliği

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### Summary

**Objective:** We aimed to investigate the efficacy of intradiscal steroid injection in patients with chronic low back pain due to degenerative disc disease.

**Materials and Methods:** A total of 18 patients (9 female, 9 male) with chronic low back pain of discogenic origin were enrolled in the study. The intervertebral disc level which met the diagnostic criteria for provocative discography was defined as discogenic pain level. After identification of positive disc level, 1 cc betamethasone was injected into the disc. The outcome measures (visual analog pain scale and Quebec Back Pain Disability Scale scores, finger-tip-to-floor distance and duration of sitting without pain) were assessed before the treatment and at second week and third month post injection.

**Results:** The reduction in low back pain intensity between the baseline and second week, and between the baseline and third month was statistically significant ( $p=0.001$  and  $p=0.002$ ). Besides, statistically significant improvement was observed in Quebec Disability Scores between the baseline and second week, and between the baseline and third month ( $p=0.001$  and  $p=0.002$ ). The finger-tip-to-floor distance between the baseline and second week, and between the baseline and third month showed a statistically significant improvement ( $p=0.002$  and  $p=0.02$ ). The duration of sitting without pain between the baseline and second week, and between the baseline and third month showed a statistically significant increase ( $p=0.001$  and  $p=0.009$ ).

**Conclusion:** As a result, we suggest that intradiscal steroid injection may be effective in short-term and mid-term for reducing the intensity of spinal pain and the proportion of disability due to chronic discogenic low back pain in patients who do not respond to conservative treatment. *Turk J Phys Med Rehab 2012;58:88-92.*

**Key Words:** Degenerative disc disease, discogenic low back pain, discography, intradiscal injection, corticosteroid

### Özet

**Amaç:** İntradiskal steroid enjeksiyonlarının dejeneratif disk hastalığına bağlı kronik bel ağrısı olan hastalardaki etkinliğini değerlendirmektir.

**Gereç ve Yöntem:** Çalışmaya diskojenik kökenli kronik bel ağrısı olan 9'u kadın, 9'u erkek toplam 18 hasta dahil edildi. Provokatif diskografi kriterlerini karşılayan intervertebral disk, diskojenik ağrı seviyesi olarak belirlendi. Tespit edilen bu seviyeye 1 cc betametazon enjekte edildi. Hastalar tedavi öncesi, tedavi sonrası 2. hafta ve 3. ay spinal ağrı, Quebec Bel Ağrısı Özürlülük Skalası, el-parmak-zemin mesafesi ve ağrısız oturma süresi açısından değerlendirildiler.

**Bulgular:** Spinal ağrıda, Quebec skorlarında ve el-parmak-zemin mesafesinde başlangıç ile 2. hafta ve başlangıç ile 3. ay arasında istatistiksel olarak anlamlı azalma saptandı ( $p<0,05$ ). Ağrısız oturma süresinde başlangıç ile 2. hafta ve başlangıç ile 3. ay arasında istatistiksel olarak anlamlı artış saptandı ( $p=0,001$  ve  $p=0,009$ ).

**Sonuç:** Kronik diskojenik bel ağrısı yakınması olan ve konservatif tedaviye yanıt alınamayan iyi seçilmiş hasta grubunda, intradiskal steroid enjeksiyonunun spinal ağrı şiddeti ve bel ağrısına bağlı özürlülük oranını azaltmada kısa ve orta dönemde etkili olabileceğini düşünmekteyiz. *Türk Fiz Tıp Rehab Derg 2012;58:88-92.*

**Anahtar Kelimeler:** Dejeneratif disk hastalığı, diskojenik bel ağrısı, diskografi, intradiskal enjeksiyon, kortikosteroid

## Introduction

Discogenic low back pain (DLBP) is the most common type of chronic low back pain (CLBP), which accounts for 39% of all cases (1). Discogenic pain is defined as pain caused by a damaged intervertebral disc. When the degeneration starts in the intervertebral disc, it could become a source of mechanical low back pain (2). During this degenerative process, cells of the disc nucleus generate an inflammatory response, which leads to release of a large number of inflammatory factors or cytokines. This inflammatory response is the main pathophysiologic mechanism of DLBP (1).

The patients' clinical history usually includes a deep and dull midline ache in the low back region. It may sometimes radiate beyond the gluteal area and rarely to the knees and legs. The pain worsens with prolonged sitting and axial loading. There is no accompanying sensory or motor loss (3). Discography is the gold standard for the diagnosis of DLBP. Treating DLBP continues to be a challenge for physicians. Recently, the efficacy of some interventional treatment methods of DLBP such as intradiscal steroid injections (ISI), epidural steroid injections (ESI), intradiscal radiofrequency (RF) thermocoagulation, and intradiscal electrothermal therapy (IDET) have been investigated in the literature (4).

In the literature, the efficacy of ISI is still controversial. In this study, we aimed to investigate the effect of ISI in patients with CLBP due to degenerative disc disease (DDD).

## Materials and Methods

### Patient Selection

This prospective single-arm study was carried out in the Interventional Pain Unit on an outpatient basis between September 2009 and May 2010. This study was approved by the local ethics committee and the patients gave their written informed consent to participate in the study. A total of 40 patients with chronic DLBP were eligible for the study. 18 out of 40 patients were dropped out of the study in the period before the provocative discography because of improvement in low back pain (LBP) or refusal of ISI treatment. 22 out of 40 patients underwent provocative discography and four patients, who did not meet criteria for the provocative discography, were excluded from the study. A total of 18 patients completed the study.

### Inclusion and Exclusion Criteria

The patients with chronic axial LBP, who fulfilled the following criteria, were included in the study: 1. No response to at least 3-months conservative treatment, 2. DDD findings on magnetic resonance imaging (MRI), 3. Positive response to a provocative discography. The patients, who were younger than 18 years or older than 60 years, who had undergone lumbar surgery, who had  $\geq 50\%$  height loss in the intervertebral disc distance on MRI, and who had sacroiliitis, infectious or neoplastic spinal disease, were excluded. The general contraindications for a fluoroscopy guided injection (e.g. pregnancy, contrast allergy, coagulopathy, etc.) also led to exclusion.

### Injection Procedure

Intradiscal injections were performed under fluoroscopic guidance and strict aseptic conditions. Whole procedure was performed by a physiatrists who had a considerable experience in spinal interventions. Cefazolin 1 g was administered intravenously 60 minutes before the injection procedure. The patients were not sedated during the procedure. Intervertebral disc level, which showed degenerative changes on MRI and which was concordant with LBP, was selected as the main target for provocative discography. The adjacent intervertebral disc level to the pathological level, which did not show degenerative changes on MRI, was selected as the control level for provocative discography. Thus, in each case, a minimum of two levels were selected.

The patient was positioned in a prone position. Each level was set up fluoroscopically, thus, the disc was parallel to the beam and obliqued, so that the superior articular process of the overlying facet joint was slightly posterior to the center of the endplate. Lidocaine was administered under the skin. Next, a 22-gauge 5-in. needle was advanced along the X-ray beam toward the disc. Meanwhile, during the procedure, the location of the needle in sagittal and coronal planes was assessed by fluoroscopic imaging. Needle-tip placement into the center of the disc was confirmed in the anteroposterior and lateral views before the intradiscal injection of 1-2 ml of iohexol 300 mg/ml (Figure 1A and 1B).

A provocative discogram was labelled positive when pain reproduction occurred with a pain of  $\geq 6/10$  in the pathological level and not in the control level. Contrast patterns were also recorded for each patient. After determination of the pathological disc level, 1 cc betamethasone was injected into the disc.

### Clinical Parameters Recorded

We recorded clinical parameters at baseline, at the second week and the third month after treatment. The following parameters were recorded: age, sex, duration of LBP, MRI findings, provoked disc level, discogram patterns, LBP intensity on a visual analog scale (VAS 100 mm), Quebec Back Pain Disability score (20 items, scored from 0, no disability, to 5, impossible to do; range of final scores 0-100), finger-tip-to-floor distance (cm), and duration of sitting without pain (min).

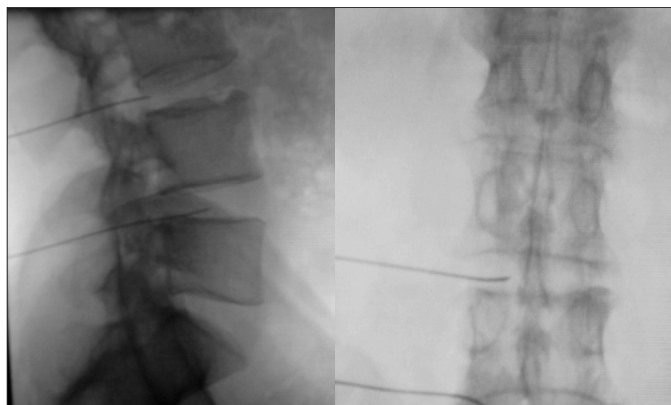


Figure 1. A) Lateral view, B) Antero-posterior view.

### Data Analysis

Statistical analyses were performed using SPSS 15.0 for Windows. Quantitative variables were described with means, standard deviations (SD), and ranges. Qualitative variables were described with proportions and percentages. The paired samples T-test of parametric test was used for evaluating the changes in pain and disability scores between time points. The changes in finger-tip-to-floor distance and duration of sitting without pain between time points were evaluated using the nonparametric Wilcoxon test. We compared the average change in pain and disability score in the sub-groups using the independent samples T-test and the average change in finger-tip-to-floor distance and duration of sitting without pain using the Mann-Whitney U test. A p value of less than 0.05 was considered statistically significant.

### Results

A total of 18 patients (9 men, 9 women; mean age: 43.7±12.7 years, range: 24-60 years) with CLBP due to DDD were included. The mean duration of LBP was 16.28±15.18 months. When the patients categorized their jobs according to difficulty level, 50% had mild, 44.4% had moderate, and 5.6% had heavy jobs.

We found the lumbar spine MRI findings as follows: 55% of patients had low signal intensity of the disc on sagittal T2W imaging, 30% had high-intensity zone (HIZ) on MRI and 15% had type 2 Modic changes on MRI. Type 1 and 3 Modic changes were not detected on MRI. We evaluated the provocative disc levels and Dallas discogram patterns. L4-L5 disc level was the most common provoked disc level, followed by L5-S1, L3-L4, T12-L1 and L1-L2. Only two patients had a positive discogram at more than one disc level, the others had a positive discogram at one disc level. Type-3 was the most common discogram pattern, followed by type-5, type-4 and type-2 (Table 1).

The mean LBP intensity (measured by VAS) of the patients before treatment was 66.39±13.69 mm. At the second week and third month after treatment, the mean LBP intensity was 37.50±17.08 mm and 39.17±19.64 mm, respectively. The reduction in LBP intensity was statistically significant between the baseline and second week, and between the baseline and third month (p=0.001 and p=0.002) (Table 2).

The mean Quebec Back Pain Disability score of the patients before treatment was 35.06±15.89. At the second week and third month after treatment, the mean Quebec Back Pain Disability score

was 23.67±14.48 and 24.44±13.78, respectively. The improvement in the Quebec Disability Scores between the baseline and second week, and between the baseline and third month was statistically significant (p=0.001 and p=0.002) (Table 2).

The mean finger-tip-to-floor distance of the patients before treatment was 11.61±7.74 cm. At the second week and third month after treatment, the mean finger-tip-to-floor distance was 6.22±6.62 cm and 7.33±7.38 cm, respectively. The finger-tip-to-floor distance improved significantly between the examinations at baseline and second week, and between the baseline and third month (p=0.002 and p=0.02) (Table 2).

The mean duration of sitting without pain before treatment was 33.33±26.84 min. At the second week and third month after treatment, the mean duration of sitting without pain was 64.17±38.08 min. and 56.11±39.83 min., respectively. The duration of sitting without pain showed a statistically significant increase between the baseline and second week, and between the baseline and third month (p=0.001 and p=0.009) (Table 2).

Levels of patient satisfaction about treatment were also recorded at the end of the study. 11.2% of patients rated their overall treatment experience as "no benefit", 27.8% "benefit", 44.4% "good benefit", and 16.6% as "very good benefit".

Table 1. MRI and discogram characteristics of patients.

		Number of discs (n)	Frequency (%)
Level of provoked discs	L5-S1	3	15%
	L4-5	13	65%
	L3-4	2	10%
	L1-2	1	5%
	T12-L1	1	5%
MRI findings	Black disc	11	55%
	Modic type 2	3	15%
	HIZ	6	30%
Discogram (Dallas)	Type 2	1	5%
	Type 3	14	70%
	Type 4	2	10%
	Type 5	3	15%

MRI: Magnetic Resonance Imaging, HIZ: High Intensity Zone

Table 2. The mean change of outcome measurements.

	Baseline	Second week	p*	Third month	p*
VAS spinal pain (mm)	66.39±13.69	37.50±17.08	0.001	39.17±19.64	0.002
Quebec disability scores	35.06±15.89	23.67±14.48	0.001	24.44±13.78	0.002
Finger-tip-to-foor distance (cm)	11.61±7.74	6.22±6.62	0.002	7.33±7.38	0.02
Duration of sitting without pain (min.)	33.33±26.84	64.17±38.08	0.001	56.11±39.83	0.014

VAS: Visueal Analog Scale

When we categorized the patients according to age (<35 years or >35 years), sex (male or female), duration of LBP (<3 months or >3 months) and difficulty of their job (mild-moderate-heavy worker), we did not find any significant difference between the sub-groups according to the average change in outcome measurements ( $p>0.05$ ).

## Discussion

MRI is the most commonly used method for the diagnosis of DLBP. Possible MRI findings are: 1. Low signal intensity of the disc on T2W, 2. HIZ at the rear of the disc, 3. End plate Modic changes. Many authors believe that, low-signal intensity of the disc does not reflect a clear change in the disc morphology and is only minimally associated with the amount of pain caused by DLBP. Low signal intensity of the disc has almost 100% sensitivity but a low specificity for DLBP. Therefore, it is not suitable as a diagnostic tool (5,6).

Although there is a controversy in literature about HIZ and pain, clinicians usually consider the presence of HIZ to be an indicator with a high sensitivity and lower specificity (1). A close association between HIZ and disc pain was observed in some studies with a sensitivity and specificity of >80% (1,7). However, Carragee et al. (8) found the occurrence rate of HIZ to be 59% in patients compared to 25% in asymptomatic volunteers, and they found no relationship between the presence of HIZ and DLBP.

Modic et al. (9) defined the altered signal intensity seen on MRIs in degenerative spinal disease as follows. Type 1: Inflammatory phase, type 2: Fat phase and type 3: Bone sclerosis. Modic types 1 and 2 were found to be highly prevalent in patients with DLBP (10,11). Generally, the Modic changes has a high sensitivity but slightly lower specificity as an indicator of DLBP (1,12).

In the present study, on sagittal T2W imaging, the frequency of low signal intensity was 55%, the frequency of HIZ was 30% and the frequency of Modic type 2 changes on MRI was 15%. Type 1 and 3 Modic changes were not seen in any patient. While all the disc levels, in which Modic type 2 changes and HIZ were determined, gave positive response to provocative discography, however, only 52% of the disc levels with a low signal intensity gave positive response. Our results are consistent with the prior studies' findings.

Provocative discography is usually accepted as a gold standart to determine the pain generator disc level. The most important and the general indication for a discography is to determine symptomatic disc level when multilevel disc degeneration is seen on MRI or CT (13). Many reports verified the clinical value of discography for the diagnosis of DLBP (14,15). However, Carragee et al. (16) found a false-positive rate as 25% during discography and they suggested that when strict inclusion criteria were applied, the rate of false-positive discography might be low in patients with DLBP. In the literature, some criteria were defined to reduce the possibility of false positive discography. These criteria are pressure of  $\leq 50$  psi above

opening pressure and pain intensity of  $\geq 6/10$  with a disc injection (17,18). Therefore, the most important factor is careful patient selection to bring the clinical benefit of discography to the highest level. In our study, we used a strict enrollment protocol with a pain of  $\geq 6/10$  during discography procedure. But we could not measure the intradiscal pressure during provocative discography.

Although steroids have been used in spinal disorders for many years, their efficacy and mechanism of action have not always been proven. Theoretically, steroids have anti-inflammatory effect (19). When the symptom of pain is thought to result from inflammation, it is natural to think that an anti-inflammatory agent will be effective. However, the therapeutic use of steroids in the treatment of DDD is not proven sufficiently. Firstly, Feffer (19) used hydrocortisone injection into the disc space to reverse the degenerative process and to stimulate the healing process of disc. So, the symptoms of LBP would be reduced. On this theoretical basis, therapeutic intradiscal steroids have been used in the treatment of DLBP. At the end of the study, 46.7% of the patients showed significant improvement and 54.5% of those showed better pain relief in back pain while 45.6% of those showed better pain relief in radicular pain (19).

Simmons et al. (20) reported a prospective, randomized, double-blind study to evaluate the clinical efficacy of ISIs. A total of 25 patients were randomly assigned to group A (methylprednisolone) or group B (bupivacaine). The relative small size of the sample decreased the power of this study. The inclusion criteria were strict, but the follow-up period was limited to 2 weeks. 21% of patients (3 of 14) in the steroid group and 9% (1 of 11) in the anesthetic group showed improvement, with no statistical difference between the two groups. They concluded that there was no statistically significant benefit from ISI.

Khot et al. (21) reported a prospective randomized study of the therapeutic effect of ISI in 120 patients. A total of 120 patients were randomly assigned to group A (methylprednisolone; n: 60) or group B (normal saline; n: 60). They found that there was no significant difference in the VAS and Oswestry Disability Index (ODI) between the groups at 1-year follow-up. The authors concluded that ISI did not improve the clinical outcomes in patients with DLBP compared with placebo.

More recently, Buttermann (12) studied the effect of ISI in patients with DDD. In this study, patients with end-plate changes (n: 78) and those without changes (n: 93), who were considered candidates for lumbar fusion, underwent discography with or without intradiscal steroid in a randomized fashion. A visual analog scale and ODI were used to determine pain and function in the subjects before and after the injection for a 2-year follow-up period. The author found that patients with inflammatory end-plate changes had greater improvement in the ODI and pain diagram in the first 6 months compared to those without inflammatory end-plate changes. As a result, Buttermann (12) concluded that, ISI was more effective in patients with MRI findings of inflammatory end-plate changes.

Fayad et al. (22) sought to determine whether clinical outcome of patients with DLBP, who underwent ISI, could be predicted from MRI Modic changes. A total of 74 patients with LBP, who showed no response to 3-months conservative treatment, were enrolled in this study. The small sample size of the group with fatty end-plate changes, its retrospective design and the lack of control group were the limitations of this study. At 1 month, reduction in pain score was significantly higher in patients with inflammatory Modic changes than in patients with fatty end-plate changes. At 3 and 6 months, ISI tended to be more effective in patients with inflammatory Modic changes but not significantly. The authors concluded that ISI could be an effective short-term treatment for patients with DLBP and predominantly inflammatory endplate changes. These results are compatible with those of Butterman (12) who suggested that ISI was more effective in patients with MRI findings of discogenic inflammatory endplate changes. But this study's results were inconsistent with results of study conducted by Khot et al. (21). However, we did not get the inflammatory endplate changes as a selection criteria in our study, ISI was found effective in the clinical outcomes at 2 weeks and 3 months. When we categorized the patients according to MRI findings, no significant difference was found in the clinical outcomes between the groups ( $p>0.05$ ). In our study, none of the patients had inflammatory endplate changes on MRI, thus, we could not evaluate the effectiveness of ISI in patients with inflammatory endplate changes.

In the present study, we found that there were significant differences in VAS-spinal pain and Quebec Disability scores at the 2<sup>nd</sup> week and 3<sup>th</sup> month ( $p<0.05$ ). Our results were similar with those of Buttermann (12) and Fayad et al. (22). The small sample size, the lack of control group and the short follow-up period were the limitations of our study.

None of the above trials reported adverse events (such as discitis) following ISI. Also in our study, no complications, such as infection or hematoma were reported. However, some patients had an increase in their spinal pain scores after intradiscal injection. This condition was controlled with analgesic drugs, and disappeared within 48 hours.

## Conclusions

As a result we suggest that ISI may be effective in short-term and mid-term for reducing the intensity of spinal pain and disability due to chronic DLBP in patients who do not respond to a conservative treatment.

## Conflict of Interest:

Authors reported no conflicts of interest.

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