Araştırma Makalesi (Research Article)

The Effect of Initial Visual Analog Scale Score on Results in Cervical Laser Discectomy

Servikal Lazer Diskektomide Başlangıç Görsel Analog Skala Skorunun Sonuçlara Etkisi

Kutsal Devrim SECINTI

Kahramanmaras Sutcu Imam University School of Medicine, Department of Neurosurgery, Kahramanmaras, Turkey

Özet

Amaç: Perkutan lazer disk dekompresyonu (PLDD), dejenere intervertebral diske perkutan olarak ulaşmayı ve disk materyalini ısı etkisi ile koagüle etmeyi amaçlayan bir cerrahi yöntemdir. Endikasyonları net olarak tanımlanmış gibi görünse de, vaka serileri arasındaki tutarsızlıklar hala ek endikasyonlara ihtiyaç duyulduğunun bir göstergesi olabilir. Bu çalışma, kabul anındaki görsel analog skala (VAS) skorunun servikal PLDD sonuçları üzerinde bir etkisinin olup olmadığını ve bunun hasta seçiminde dikkat edilmesi gereken bir veri olup olmadığını araştırmayı amaçlamaktadır.

Gereç ve Yöntemler: Servikal PLDD yapılan 67 hastanın verileri geriye dönük olarak incelendi, kriterlere uyan 48 hasta çalışmaya dahil edildi. Hastalar, kabul anındaki VAS skorlarına göre Grup-I (n=26) (VAS:3-5), Grup-IIa (n=17) (VAS:6-7) ve Grup-IIb (n=5) (VAS:8-9) olarak 3 gruba ayrıldı. Hastaların kabul anındaki VAS skorları 12 aylık takip süresince elde edilen VAS skorlarıyla karşılaştırıldı. Hasta memnuniyeti ise Odom kriterlerine göre değerlendirildi.

Bulgular: Tüm hastalar birlikte değerlendirildiğinde, hastaların %79.16'sı işlemden memnun olduğunu belirtti. Bununla birlikte, memnuniyet oranı Grup-I'de %96.15, Grup-IIa'da % 76.47 ve Grup-IIb'de %0.0 idi. İşlemden memnun olan hastaların ortalama başlangıç VAS skorları 5.08 iken memnun olmayanların 7.30'du. Etkilenen disk sayısı ve hasta yaşının sonuçlar üzerinde etkili olmadığı belirlendi (sırası ile p=0.701 ve p=0.883).

Sonuç: Kabul anındaki VAS skorları, hasta sonuçlarıyla doğrudan ilişkilidir. Başlangıç VAS skoru 5'ten daha yüksek olan hastalara servikal PLDD yapılmamalıdır.

Anahtar kelimeler: Görsel analog skala, Hasta seçimi, Perkütan lazer disk dekompresyonu, Servikal disk herniasyonu

Abstract

Objective: Percutaneous laser disc decompression (PLDD) is a surgical method that aims to reach the degenerated intervertebral disc percutaneously and coagulate the disc material with the effect of heat. Although the indications appear to be clearly defined, inconsistencies between case series may still indicate the need for additional indications. This study aims to investigate whether the visual analog scale (VAS) score at the time of admission has an effect on cervical PLDD results and whether this is a data that should be considered in patient selection.

Material and Methods: Data of 67 patients who underwent cervical PLDD were analyzed retrospectively, 48 patients who met the criteria were included in the study. Group-I (n=26) (VAS:3-5), Group-IIa (n=17) (VAS:6-7) and Group-IIb (n=5) (VAS: VAS:8-9) divided into 3 groups. The patients' VAS scores at the time of admission were compared with the VAS scores obtained during the 12-month follow-up. Patient satisfaction was evaluated according to the Odom criteria.

Results: When all patients were evaluated as a single group, 79.16% of the patients stated that they were satisfied with the procedure. However, when they were subdivided into groups, the satisfaction rate was 96.15% in Group-I, 76.47% in Group-IIa, and 0.0% in Group-IIb. The mean initial VAS score of patients who were satisfied with the procedure was 5.08, while those who were not satisfied were 7.30. Number of affected discs and patient age did not affect the results (p=0.701 and p=0.883, respectively).

Conclusion: VAS scores at the time of admission are directly related to patient outcomes. Cervical PLDD should not be performed in patients with a initial VAS score greater than 5.

Key words: Cervical disc herniation, Percutaneous laser disc decompression, Patient selection, Visual analog scale

Yazışma Adresi: Kutsal Devrim SECINTI, Kahramanmaraş Sütçü İmam Üniversitesi Tıp Fakültesi Beyin Cerrahisi ABD, Kahramanmaraş, Türkiye

Telefon: 505 605 76 92, **Mail:** devrimsecinti@yahoo.com

ORCID No: 0000-0003-4345-0805

Geliş Tarihi: 19.03.2021

Kabul Tarihi: 04.05.2021

DOI: 10.17517/ksutfd.899891

INTRODUCTION

Performing thermal application by reaching through a percutaneous route with the help of a catheter in the pathological intervertebral disc results in a decrease in discogenic or radicular pain in many patients. This method is known as intradiscal electrotherapy (IDET), but it is called "percutaneous laser disc decompression" (PLDD) if the heat source is a laser device. The effectiveness of PLDD in patients with lumbar and cervical disc disease is controversial (1). There are studies claiming that the procedure is effective and ineffective (2-5). Although many studies have advocated that patient selection is the most important factor, the criteria and parameters of patient selection seems to be insufficient (6). The generally accepted approach for patient selection is that patients with sequestrated disc hernias, disc pathologies associated with spinal spondylosis, disc disorders accompanied by anulus tear or myelopathy, and patients with recurrent disc herniation will not benefit from PLDD (1-2,4-6). However, inconsistency in the results of studies excluding such patients also indicate that different additional criteria are still needed for patient selection (2-4,5,7,8).

The studies in the literature are mainly comparing the mean VAS (visual analog scale) scores at the time of admission (also called as "initial VAS scores") with the mean VAS scores detected during follow-up. If "initial VAS scores" affect patient outcomes, this data will be valuable to identify which group of patients should expect benefit from PLDD. But there is no study focuses on the relationship between "initial VAS scores" and patient outcomes.

In the present study, it was aimed to determine whether the VAS scores of the patient at the time of admission can be used as a selection criterion in the PLDD procedure.

MATERIALS AND METHODS

Patient Selection

After approval of University Ethic Committee (2020/11-09), datas of 67 patients who underwent cervical laser disc decompression between June 2010 and August 2019 were retrospectively reviewed. Forty-eight patients with complete follow-up results were included in the study. It was determined that in 29 patients PLDD was performed at one cervical level while two cervical levels for 15 patients, and three cervical levels for four patients **(Table 1)**.

Patients included in the study were selected from patients who had not responded to medical and conservative treatment for at least 6 weeks. Patients with more than three pathological discs, previous surgical history of the same site, annular fissure on MRI, sequestrated or fragmented discs, disc height less than 5 mm on X-ray, cervical spondylosis, older than 65 years and pregnants or suspected pregnants were excluded from the study. Forty three patients having criteria (initial VAS scores between 3-7) were included in the study (initial VAS scores were noted as "VAS-0"). Surgery was recommended primarily for patients with a VAS score of 8 or more. Five of these patients who did not accept surgical recommendation were included in the study. The VAS scores of all patients were recorded before the procedure.

Laser Device Parameters

A diode laser device (Yuancure Laser Corp. Beijing, China) with a wave length of 960 nm and a power of 10 watts were used. The device power was previously set to 5 Watt and T on: 500 ms, T off: 500 ms.

Surgical Procedure

On the day of the operation, patients were taken to the operating room under appropriate antibiotic prophylaxis. Following sedation, the level of the disc was determined by scopy when the patients were in the supine position and the head was in the neutral position. The surgical area was cleaned with antiseptic solution and covered with sterile drape. Following local anesthetic application, a 18 G needle was inserted to from the anterior aspect of disc under the guidance of scopy. Pain-provoked discs were detected by 0.50 ml of contrast agent injection (OmnipaqueTM (Iohexol), GE Healthcare, Cork, Ireland). Patients who were found to have leakage of the contrast agent from anulus fibrosus or patients without any pain-provoked discs were excluded from the study. A minimum of 150 joules and a maximum of 200 joules of energy were applied to each cervical disc via a 0.60 mm diameter fiberoptic cable passed through the needle. The application was continued as long as the patient was not disturbed by the pain caused by the heating of endplates. If the patient felt pain spreading at the application site or back, the procedure was continued by allowing 5-10 seconds for the endplate to cool and the pain resolve. In each painful condition, the procedure was interrupted in the same way for 5-10 seconds. The procedure was deemed unsuccessful in patients who could not reach 150 joules at the end of the procedure. At the end of the procedure, no additional injections such as local anesthetic or steroid were applied to the disc.

The initial VAS scores of patients were recorded as VAS-0. The patients were discharged within 1 hour following the procedure by recording the change in VAS scores (VAS-I). The patients were advised that they should visit for the control at the 1st month, 3rd month, 6th month and 12th month after the procedure (the VAS scores were recorded as VAS-II, VAS-III, VAS-IV and VAS-V respectively). But in case of deterioration of their situation, they were informed about not have to wait for this period. The patients who reject to visit the hospital have been contacted by phone and asked on the basis of VAS score changings. The changes in VAS scores of all patients who visited to the hospital or were contacted by telephone was recorded. Patients who could not contacted even by phone were excluded from the study. Patients who were surgically operated (not benefited from PLDD) were also included in the study if they completed their pre- and postoperative follow-up periods. Study was completed with a

Table 1. Demographic datas of patients

Patient No	Initial VAS	1.day VAS	1.month VAS	3.month VAS	6.month VAS	12.month VAS	Odom Score	Gender	Age	NAD	Affected Disc Level
1	3	0	0	0	1	1	1	M	21	1	C5-6
2	4	1	1	1	2	2	2	M	35	1	C5-6
3	5	0	0	0	0	1	1	F	54	3	C3-4, C4-5, C5-6
4	3	0	0	0	0	0	1	F	39	2	C4-5, C5-6
5	4	1	1	1	0	0	1	F	22	2	C5-6, C6-7
6	4	0	0	1	0	0	1	M	63	1	C6-7
7	4	0	0	1	1	2	2	M	33	1	C5-6
8	5	2	2	1	1	1	1	F	51	1	C5-6
9	5	0	0	0	1	3	3	F	40	2	C5-6, C6-7
10	4	0	0	1	0	0	1	F	41	1	C3-4
11	4	0	0	0	0	0	1	K	29	1	C5-6
12	5	0	0	0	0	0	1	M	32	1	C4-5
13	5	1	1	1	2	2	1	M	43	2	C4-5, C5-6
14	4	0	1	1	1	1	1	F	34	1	C6-7
15	4	0	0	0	0	2	2	F	53	3	C3-4, C5-6, C6-7
16	3	0	0	0	0	1	2	F	49	2	C3-4, C6-7
17	5	5	5	7	7	*	4	F	53	3	C3-4, C5-6, C6-7
18	5	2	1	1	1	1	2	M	43	1	C5-6
19	4	0	0	0	0	0	1	M	36	1	C6-7
20	5	1	1	0	0	0	1	F	57	1	C6-7
21	5	1	1	1	1	1	2	F	61	2	C3-4, C6-7
22	5	0	1	1	1	0	1	F	31	1	C5-6
23	3	0	0	0	0	0	1	F	50	1	C5-6
24	5	0	1	1	1	1	1	M	51	1	C5-6
25	5	0	1	1	1	1	2	F	23	1	C6-7
26	4	3	4	4	4	4	4	M	47	1	C4-5
27	7	0	4	4	6	6	3	M	52	2	C4-5, C6-7
28	7	2	4	4	5	5	3	F	59	1	C6-7
29	6	0	0	0	0	0	1	F	32	2	C5-6,C6-7
30	7	1	7	7	7	*	4	F	40	1	C5-6
31	6	5	5	7	7	*	4	F	31	2	C4-5,C5-6
32	6	6	6	6	6	*	4	M	60	3	C4-5,C5-6, C6-7
33	8	5	5	5	5	*	4	M	44	2	C4-5,C6-7
34	7	0	1	1	2	2	3	F	25	1	C6-7
35	8	7	9	*	*	*	4	F	38	1	C5-6
36	7	0	0	0	1	1	2	F	27	1	C5-6
37	7	1	1	0	0	1	1	M	58	2	C5-6, C6-7
38	7	7	7	*	*	*	4	M	45	2	C3-4, C6-7
39	6	0	0	0	0	0	1	M	26	1	C5-6
40	9	6	9	*	*	*	4	F	25	2	C4-5, 5-6
41	8	2	8	8	*	*	4	F	30	1	C5-6
42	6	0	0	0	0	0	1	F	46	1	C5-6
43	6	0	0	0	0	0	1	M	52	1	C5-6
44	6	1	0	0	1	1	2	F	30	2	C4-5, C5-6
45	7	0	1	1	1	1	1	F	33	2	C4-5, C5-6
46	9	4	9	*	*	*	4	F	38	1	C5-6
47	7	0	0	0	0	0	1	F	42	1	C5-6
48	7	0	1	0	0	0	1	M	40	1	C6-7

VAS: visual analog scale, NAD: Number of affected disc(s), M:Male, F:Female

total of 48 patients who have complete recordings at the end of one year follow-up.

Groups

Inıtially, the patients were divided into two groups to determine whether the VAS score could be an effective parameter for the selection of patients to be expected to benefit from PLDD. Group 1 (n=26) was consisting of patients having a VAS score of 5 or lower and Group 2 (n=22) was consisting of patients with a VAS score of 6 or higher. In the postoperative period, patients were evaluated with VAS score in the first month, third month, 6th month and 12 months. Additionally, patients were also eveluated according to the Odom criteria at 12th month. When the pre-statistical datas were analyzed, it was found that the results of 22 patients in Group 2 were distinct in themselves. Therefore, it was decided to divide Group 2 into two separate subgroups. Thus, the patients were re-grouped as having a VAS score of 5 or less (Group 1, n=26), a VAS score of 6 or 7 (Group 2a, n=17) and a VAS score of 8 or 9 (Group 2b, n=5). Demographic datas of the patients are shown in **Table 1**.

Table is representing the demograpical datas of patients, initial and follow-up period's VAS scores, affected disc numbers and the levels of affected discs. (*) indicates that the patient went under surgery because of the ineffectiveness of the procedure and thats why the VAS follow-up could not be performed). (VAS: visual analog scale, NAD: Number of affected disc(s)).

Statistical Analysis

SPSS for Windows (Version 21) was used for statistical analysis. In the cases of Kolmogorov-Smirnov test was found to be non-normally distributed, nonparametric tests were performed. In the analysis of repeated measurements, Friedman Test was performed and then Bonferroni-corrected Wilcoxon test was used in paired comparisons (Bonferroni corrected p value ($p<0.008$) was considered as significant). Kruskal-Wallis test was used for the analysis of quantitative values if there is 3 groups to compare or more. But if there is 2 groups to compare, Mann Whitney U test was used. Chi-square test was used in the analysis of qualitative values. Spearsman's correlation test was used for correlation analysis. $p<0.05$ was considered as significant.

RESULTS

General Evaluation

Group I:

Of the 26 patients included in this group, Horner's syndrome was seen in 2 patients but resolved spontaneously within 6-8 hours. There was no complication in the other patients. Surgical discectomy was performed in one patient with an initial VAS score of 5 at the 10th month because the VAS score increased to 7 during follow-up (Table 1, patient no:17).

All other patients were generally satisfied with the procedure. There was a sudden decrease in VAS scores in the early period following the procedure. In the following period, a moderate increase was observed. It was found that the VAS score reached the plateau after 3 months postoperatively. In this group, pre-op, post-op 1st day, post-op 1st month, post-op 3rd month, post-op 6th month and post-op 12th month mean VAS scores were 4.30, 0.65, 0.80, 0.92, 0.96 and 0.96 respectively.

Patients were eveluated according to the Odom criteria at the end of 12th month by excluding one patient who underwent surgical discectomy. Only one patient whom VAS score was decreased to 3 from 5 was scored his final satisfaction as 3 points, but the rest were 1 or 2.

Group II:

When this group was examined before dividing in to subgroups, none of the 22 patients had complications. Nearly all patients were satisfied with the procedure in the first 2 weeks. Only 2 patients with initial VAS score of 8 and 9 were not benefit from the procedure. Surgical discectomy was offered but none of the patients accepted. Untill the 3th month some of the patients' condition begun to deteriorate during their follow-up. Eventually, 4 patients in the 4th month, 1 patient in the 7th month, 2 patients in the 10th month and 2 patients in the 11th month underwent anterior cervical discectomy (including the 2 non benefited patients in the begining). It was noticed that the patients with an initial VAS score of 8 or 9 deteriorated earlier than the others. Thus, dividing to subgroups of this group was decided. When Group II was re-grouped as Group IIa (VAS 6 or 7, n=17) and Group IIb (VAS 8 or 9, n=5), it was seen that only 4 of the 17 patients who constituted Group IIa needed surgery in 1 year follow-up. But all of five patients who constituted Group IIb were needed surgery at the end of the same period.

In Group II, the patients were eveluated according to Odom criteria at the end of 12th month by excluding 9 patients who underwent surgical discectomy. Three of 13 patients scored their final satisfaction as 3 points, 2 were scored as 2 points and 7 were scored as 1 point. Because of all patients in Group IIb went under surgery, Odom criteria was not applied to subgroups individually.

Statistical evaluation

Before grouping

The mean age of the patients was 40.92±11.50 (min:21, max:63). In general, before grouping the patients according to their initial VAS values, it was determined that the average of VAS scores of all patients (n=48) decreased from 5.54 to 1.08 at the end of 12 months. Repetitive VAS measurements were analyzed with the Friedman test and there was a significant difference between the measurements ($p<0.001$). The changes in the VAS scores of all patients for the follow-up periods before and after the procedure is summarized in **Table 2**.

Table 2. Statistical summary of the study with confidence interval and p values

	N	Mean	95%CI	Median	Std dev.	Min.	Max.	p value for test of normality
Pre PLDD VAS	48	5.54	5.08/6.00	5.00	1.584	3	9	0.001
Post PLDD VAS	48	1.33	0.72/1.95	0.00	2.107	0	7	<0.001
1.month VAS	48	2.04	1.21/2.87	1.00	2.851	0	9	<0.001
3.month VAS	44	1.52	0.82/2.23	1.00	2.328	0	8	<0.001
6.month VAS	43	1.53	0.85/2.22	1.00	2.229	0	7	<0.001
12.month VAS	38	1.08	0.61/1.55	1.00	1.421	0	6	<0.001

VAS: visual analog scale, CI: confidence interval, p<0.05 was considered as significant

Table 3. Bipartid comparisons of VAS measurements at different time inervals

Compared VAS scores	Post PLDD VAS	1. month VAS	3.month VAS	6.month VAS	12. month VAS
Pre PLDD VAS (VAS-0)	Z: -5.867 p< 0.001	Z: -5.535 p< 0.001	Z: -5.508 p< 0.001	Z: -5.461 p=0.000	Z: -5.330 p< 0.001
Post PLDD VAS (VAS-I)		Z: -3.176 p=0.001	Z: -2.744 p=0.006	Z: -2.973 p=0.003	Z: -3.035 p=0.002
Post PLDD VAS (VAS-II)	Z: -3.176 p=0.001		Z: -.812 p=0.417	Z:-1.978 p=0.048	Z: -2.214 p=0.027
Post PLDD VAS (VAS-III)	Z: -2.744 p=0.006	Z: -.812 p=0.417		Z: -1.807 p=0.071	Z: -2.502 p=0.012
Post PLDD VAS (VAS-IV)	Z: -2.973 p=0.003	Z:-1.978 p=0.048	Z: -1.807 p=0.071		Z:-1.933 p=0.053
Post PLDD VAS (VAS-V)	Z: -3.035 p=0.002	Z: -2.214 p=0.027	Z: -2.502 p=0.012	Z:-1.933 p=0.053	

PLDD: percutaneous laser disc decompression, VAS: visual analog scale, p<0.05 was considered as significant

The table shows that the N values (number of patients) of the measurements in different time periods gradually decrease. This is due to the fact that anterior cervical discectomy is performed in some of the patients who did not benefit from the procedure and therefore VAS score evaluation could not be performed in the following period. When all patients are evaluated together, it will be seen that 10 of 48 patients underwent surgical discectomy at the end of 12 months. In the first 3-month follow-up, it is seen in the table that the patients were generally satisfied with the procedure regardless of the initial VAS score, but after this date, some patients were dissatisfied and went under surgery. So that the N values were begun to decrease after the third month. This assessment, which is not made by dividing patients into groups according to their initial VAS scores, concludes that PLDD is an effective procedure with a satisfaction rate of 79.17% (or the unsucsess rate of %20.83). As can be seen, these results are nearly consistent with the whole literature. But, this is the common fault of many studies in the literature. This approach does not have the potential to relate patient results to initial VAS scores. Because, when patients divided into groups appropriately according their initial VAS scores, the success ratio would increase. If not, ratio would decrease (also see in Table 4). (a: lower bound/upper bound; b: Kolmogorov-Smirnov; N: number of patients, CI: confidence interval, %95 CI Lb/Ub: represents that confidence interval of lower bound and upper bound is %95).

Bonferroni-corrected Wilcoxon test was performed to compare VAS averages which are measured on different time periods (bipartid comparisons). Bonferroni corrected p<0.008 was considered significant **(Table 3)**. According to this assessment, the VAS scores of patients at all measurement times showed a statistically significant decrease compared to the initial VAS score. Post-op early VAS scores were also significantly lower than previous and subsequent measurements. However, there was no difference between the VAS scores in the post op 1st month and the 3rd month, 6th month and 12th month VAS values.

Bipartid comparisons of VAS measurements at different times with Wilcoxon Signed Ranks Test. It is seen that the VAS scores taken in the 3rd, 6th and 12th months are not statistically significant from the values taken in the 1st month. This situation was interpreted as "1 month followup is enough to decide the PLDD is effective or not" for each individual patient. (The table contains the datas before the patients were divided into groups as Group I, Group IIa and Group IIb).

After Grouping

Patients were grouped according to the initial VAS scores as Group I (initial VAS scores ≤5), Group IIa (initial VAS scores 6 or 7) and Group IIb (initial VAS scores 8 or 9). During the 12-month follow-up, there was a significant difference between these VAS groups in terms of surgical requirements (Pearson Chi-square: 23.624; p< 0.001). The relationship

between VAS scores at the time of admission and the surgical requirement rates are summarized in **Table 4**.

Table 4. Relationship between the initial VAS scores and surgical discectomy decisions (patient dissatisfactions)

Group	Description	N	Satisfied (%)	Went under surgery (%)
I	VAS ≤5	26	25 (%96.15)	1 (%3.86)
IIa	VAS 6 or 7	17	13 (%76.47)	4 (23.53)
IIb	VAS 8 or 9	5	0 (% 0.00)	5 (%100)
All patients	VAS 3 to 9	48	38 (79.17)	10 (% 20.83)

VAS: visual analog scale

The table is valuable in that it emphasizes the importance of subgrouping patients according to initial VAS scores in evaluating the success of PLDD. As can be seen, the success rate increases when applied to patients with a initial VAS score of 5 or less (first line), and decreases when this rule is not considered (last line).

Patients were further evaluated as those who did not need surgery (those who were satisfied with the procedure) and those who required surgery (those who were not satisfied with the procedure). It was seen that the average VAS scores at the time of admission of patients who are satisfied with the procedure was 5.08 and the VAS average of the dissatisfied patients was 7.30. The datas are presented in **Table 5.**

Comparison of VAS scores of patients who were satisfied (did not need surgery) after PLDD with those who needed surgery. Note that the mean initial VAS score of satisfied patients was 5.08 but 7.30 unstastisfied ones. (PLDD: percutaneus laser disc decompression, ACD: anterior cervical discectomy).

Odom criteria

Odom scores of patients with a VAS score of 5 and below (Group I) at the time of admission and those of 6 and above (Group II) were compared by performing the Mann-Whitney U test after excluding the operated ones (Z= -0.395, p=0.693). There was no difference between the groups. By applying Kruskal Wallis test, there was no difference when Odom scores were compared in terms of age (X2=0.657; p=0.883). There was no significant difference in Odom values compared to NAD (number of affected discs) (Pearson Chi-Square=2.559; p=0.701). When Odom scores and VAS scores at the time of patient admission were examined by using Spearsman correlation analysis, no correlation was detected (rho: 0.177; p=0.173). Spearsman correlation analysis revealed a positive correlation between Odom scores and 12th month VAS scores (rho: 0.787; p<0001). In addition, no significant correlation was found between the number of affected discs (NAD) and the VAS scores at the time of patient admission [by the Kruskal Wallis test (X2=1.526; p=0.466)]. There was no significant difference between the number of affected discs (NAD) between those who had surgery and those who did not (X2=2.417; p=0.146).

DISCUSSION

The concept of intra discal electrothermal therapy (IDET) is generally used to describe the methods used to achieve the thermal ablation of the intervertebral discs. This thermal ablation can be achieved with radiofrequency waves or laser energy (1,9). While naming the prosedure, the names "percutaneous disc coagulation" (PDC), "anuloplasty", and "nucleoplasty" are far from explaining what kind of energy ablation is used. But percutaneous laser disc decompression (PLDD) also includes the information that the type of energy used is laser energy (7,10,11). Despite the existence of many studies that argue that the method is effective, the question of how coagulating the nucleus pulposus relieves pain has not been clearly answered. Because, as far as is known, the nucleus pulposus does not have a nerve innervation. Therefore, to explain the mechanism of action, it has been proposed that the evaporation of a small part of the nucleus pulposus by thermal effect decreases the internal disc pressure and this also reduces pain (12). Thus, this hypothesis led to the idea that discs that were sequestered, migrated, or previously sur-

Table 5. Comparison of VAS scores according to success of PLDD

Operation		Pre PLDD VAS	Post PLDD VAS	1.month VAS	3.month VAS	6.month VAS	12.month VAS
PLDD	Mean	5.08	0.42	0.74	0.71	0.89	1.08
	N	38	38	38	38	38	38
	Std. Deviation	1.302	0.758	1.107	1.088	1.391	1.421
ACD	Mean	7.30	4.80	7.00	6.67	6.40	
	N	10	10	10	6	5	
	Std. Deviation	1.337	1.989	1.700	1.033	0.894	
Total	Mean	5.54	1.33	2.04	1.52	1.53	1.08
	N	48	48	48	44	43	38
	Std. Deviation	1.584	2.107	2.851	2.328	2.229	1.421

PLDD: percutaneous laser disc decompression, ACD: anterior cervical discectomy, VAS: visual analog scale.

gically operated should be rejected for PLDD. But was this oppinion true?

When this theory did not find much support, new devices have been developed which aiming to coagulate anulus fibrosus (AF) rather than nucleus pulposus, considering that the pain is actually due to degenerated AF. Thus, the systems that are contacting the inner surface of the AF by using guidable catheters and thus coagulating a larger AF region were developed (4,5,9). But in recent studies, contrary to the previously known, it has been shown that there are newly sprouted nerve endings into the degenerated nucleus pulposus (NP) due to degenerative processes, and these new nerve endings may be responsible for discogenic pain (13,14). Theoretically, thermal affect may denervates both the pain fibers of AF and nerve endings of NP which were newly sprouted. And as well, may cause some decrease in intradiscal pressure by evaporating some amount of NP. As is known, both can cause a decrease in discogenic pain. It is still unclear if decreasing the intradiscal pressure or the thermal denervation of pain fibers is more effective in the pain relief.

If recent findings (newly sprouted nerve fibers in to degenerated NP) is capable to explain the mechanism of action of PLDD, presence of contained discs or unruptured annulus fibrosuous is not necessary as it was considered before. Although it was not the aim of this study, newly established experimental set-ups that involves such patients will have potential to answer this paradigm. Probably, intra discal thermal applications reduces intradiscal pressure by evaporating some amount of NP. But if sequestrated discs or previouslu surgically operated discs are responding to PLDD, all the past knowledge will have to be re-organized. This knowledge would exclude the "decreasing of intradiscal pressure" theory but support the theory of "denervation of newly sprouted nerve fibers". If we focus at the literature that argue that PLDD is an effective method, Saal and Saal state that in their prospective studies of 25 patients, a decrease of VAS scores of 3.70 was achieved after 7 months of follow-up (5). In another study conducted by the same workers, 62 patients had a 3.20 point decrease in VAS after 28 months of follow-up (4).

Karasek and Bogduk conducted a study of 36 PLDD and 17 control patients. At the end of 12 months, they detected 3 point decrease in the VAS score in the PLDD group but it was not changed in control group (7). In their study, the success rate of PLDD was reported to be 20-60%. In another study, it was stated that the VAS scores decreased by 3.80 units in the 6-month follow-up of 79 patients who underwent PLDD, and the pain decreased by 50% in 48% of the patients (2). Lee et al. state that the patient satisfaction rate in their series is 63% (15).

On the other hand, there are also studies claiming that PLDD is ineffective. In the series of Davis et al. the rate of dissatisfied patients was 50%, the rate of satisfied patients was 37%, and the rate of those who could not decide was 13% (16). According to Freedman et al. the success rate of IDET was stated as 16%. In the same study, the rate of patients requiring surgery was reported as 23% since they did not benefit from PLDD (17). The surgical requirement rate after PLDD is 22.50% according to Webster et al. (18). Yektas evaluated the changes in the lower back and leg pain of the PLDD patients at the end of 24-month follow-up. While it did not detect a statistically significant decrease in the VAS value for low back pain, but stated that the decrease in the VAS scores for the leg pain was significant (19).

The inconsistency of the literature can be attributed to many reasons. Limited number of patients, inadequate follow-up time, inadequate patient acceptance and rejection criteria, surgical technique, surgical experience, device used, and parameters used (Watt, Joule etc.), number of affected discs may be some of these.

When the current literature is analyzed, it can be seen that the studies can be gathered under 3 main titles as those who are claiming that IDET is effective, who are claiming that it is ineffective and who are focusing on IDET's mechanism of action. It was noticed that the literature also needs the studies focusing on patient acceptance and rejection criteria. Therefore, in this study, it was examined whether the VAS scores at the time of admission had an effect on patient results, and whether those VAS scores could be accepted as a patient acceptance and rejection criterion.

Considering the results of the study, it can be seen that nearly all patients with a VAS score of 5 and below (Group I) satisfied from cervical PLDD. Some of the patients with a VAS score of 6 or 7 (Group IIa), and none of the patients with a VAS score of 8 or 9 (Group IIb) satisfied from the procedure. In summary, only one patient in Group I (n=26) was operated (anterior cervical discectomy) while 4 patients in Group IIa (n=17) and 5 patients in Group IIb (n=5) were operated.

At the end of 12 months, it will be seen that the average VAS score (VAS-V) in Group I is much lower than that of Group IIa, that is, there is a difference in the satisfaction levels of not operated patients. This situation is also affected the Odom criteria. Since all patients belonging to Group IIb are operated, Odom criteria are not available. In the light of the available datas, the comparison of the groups in terms of Odom criteria was made only among the non-operated patients of Group I and Group IIa. Although the Odom scores were higher in Group IIa, it was not statistically significant.

There was also a significant difference between the post-PLDD early VAS measurements (VAS-I) of patients who are satisfied and who are not satisfied with the procedure at the end of the twelve months (0.42 and 4.80, respectively). This may be a preliminary finding whether patients will benefit from the PLDD at the end of the follow-up period, and this appears to be also related to the VAS score at the time of patient admission.

The fact that the mean initial VAS score of the patients who satisfied from the PLDD was 5.08 but the mean initial VAS score of dissatisfied patients was 7.30 supports this idea.

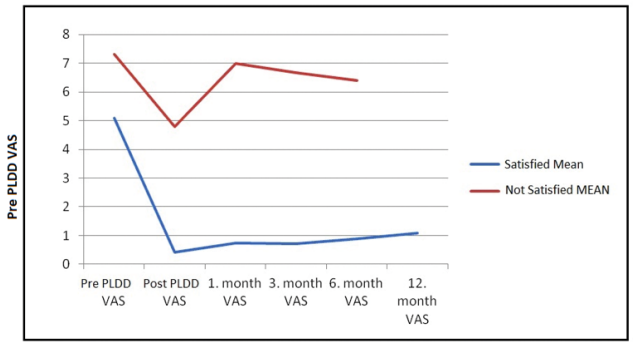

Figure 1. VAS score distribution of patients who were satisfied (not operated) and unsatisfied (operated) after PLDD by months. This graphic is also emphasizes the presence of a "threshold" for accepting or rejecting the PLDD patients.

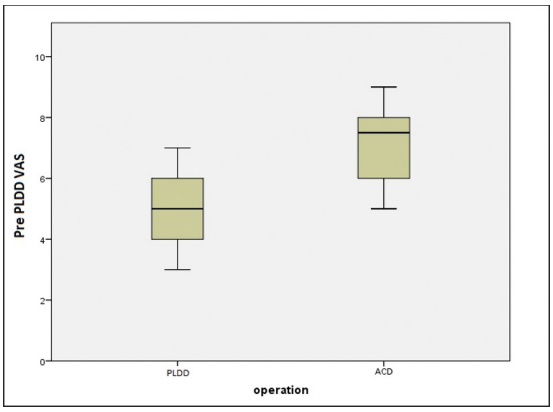

Figure 2. The box graphic of the patients said in Graphic 1. (PLDD: Percutaneous Laser Disc Decompression, ACD: Anterior Cervical Discectomy)

These results indicate that not every patient who is radiologically suitable may not actually be as it is thought for the IDET / PLDD procedure. It seems there is a threshold for the appropriate patient selection in terms of "initial VAS scores" **(Figure 1 and Figure 2)**.

The fact that the "initial VAS scores" are directly related to the need for surgery that occurs at the end of 12 months confirms the hypothesis that there is a "threshold value" for the appropriate patient selection. These datas are emphesising that an inital VAS score of lower than 5 must be a "patient acceptance criterion" or higher than 7 should be a "patient rejection criterion" for PLDD. According to the results of this study, the patients with an "initial VAS scores of 6" are still in grey area and the physician has to decide about the PLDD according to him/her clinical experience.

CONCLUSION

These results showed that the "initial VAS scores" in the cervical disc hernia can be a good "acceptance-rejection criterion" for PLDD. Patients with an "initial VAS score" of 5 (or 6) or less should be accepted but 7 or higher should be rejected.

In addition, although no significant difference was found between Group I and Group II in terms of Odom criteria, it was concluded that this situation should be taken into consideration by the surgeon. The preference should be used in favor of patients with a VAS score of 5 and below if possible. Becouse of the experimental set-up, Odom criteria did not applied to the surgically operated patients and it is obvious that this would be affect the Odom criteria.

Ower all, it was determined that the number of affected discs and patient age did not make a significant difference in terms of patient satisfaction, surgical discectomy rates, VAS and Odom scores. These criterions may be ignored while accepting the patients for PLDD.

Acknowledgment: We would like to thank to Dr. İlke Evrim Seçinti for her contribution to the statistical analysis of the study.

Conflict of Interest and Financial Status: Our study has not been financed by an institution and institution. In this study, there is no conflict of interest among the authors on any subject.

Ethical Approval: This study approved Kahramanmaras Sutcu Imam University Ethic Committee (2020/11-09)

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