

# Effectiveness of laser hemorrhoidoplasty in the treatment of hemorrhoidal disease

## *Eficacia de la hemorroidoplastia láser en el tratamiento de la enfermedad hemorroidal*

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### Abstract

**Introduction.** Minimally invasive techniques still continue to maintain their popularity in hemorrhoidal disease. In this study, we aimed to present the symptomatic recovery and recurrence rates, post-operative pain levels, and complication rates of patients treated with the laser hemorrhoidoplasty (LHP) method in our clinic. **Methods.** The data of patients who underwent LHP due to Grades 2, 3, and 4 internal hemorrhoidal disease in our clinic were reviewed retrospectively. The patients enrolled in the study were followed for at least 6 months (6 months, 1 year, and 2 years) and their results were analyzed. **Results.** A total of 103 patients were included in the study. Seventy-five (72.8%) of them were male and the mean age was  $41.6 \pm 13.6$  years. The mean operation time was  $17.9 \pm 5.2$  min and minor complications developed in 3 (2.9%) patients postoperatively. Mean time to return to normal daily life was 2.17 (1-11) days. Recurrence developed in 16 (17.6%) patients with Grades 2 and 3 disease and in 6 (50%) of 12 patients with Grade 4 disease ( $p = 0.019$ ). **Conclusion.** LHP is a popular procedure which is effective in selected patient groups with acceptable recurrence rates.

**Keywords:** Laser hemorrhoidoplasty. Hemorrhoids. Hemorrhoidal disease. Proctology.

### Resumen

**Objetivo.** Presentar las tasas de recurrencia y recuperación sintomática, los niveles de dolor posoperatorio y las tasas de complicaciones de los pacientes tratados con hemorroidoplastia láser en nuestra clínica. **Método.** Los datos de los pacientes que se sometieron a hemorroidoplastia láser debido a enfermedad hemorroidal interna de grados 2, 3 y 4 en nuestra clínica se revisaron retrospectivamente. Los pacientes incluidos en el estudio fueron seguidos durante al menos 6 meses (6 meses, 1 año y 2 años) y se analizaron sus desenlaces. **Resultados.** Se incluyeron en el estudio 103 pacientes, de los cuales 75 (72.8%) eran de sexo masculino. La edad media fue de  $41.6 \pm 13.6$  años. El tiempo operatorio medio fue de  $17.9 \pm 5.2$  minutos. Se desarrollaron complicaciones menores en 3 (2.9%) pacientes en el posoperatorio. El tiempo medio de reincorporación a la vida diaria normal fue de 2.17 (1-11) días. La recurrencia se observó en 16 (17.6%) pacientes con enfermedad de grados 2 y 3, y en 6 (50%) de 12 pacientes con enfermedad de grado 4 ( $p = 0.019$ ). **Conclusiones.** La hemorroidoplastia láser es un procedimiento popular que es efectivo en grupos de pacientes seleccionados, con tasas de recurrencia aceptables.

**Palabras clave:** Hemorroidoplastia láser. Hemorroides. Enfermedad hemorroidal. Proctología.

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## Introduction

Hemorrhoidal disease is a very common pathology and significantly impairs quality of life in populations<sup>1</sup>. Since hemorrhoidal disease is very common in the population, and complications such as incontinence, bleeding, and anal stenosis that impair quality of life may occur after hemorrhoidectomy; minimally invasive techniques with less complications still continue to maintain their popularity. Although laser hemorrhoidoplasty (LHP) is the most up-to-date among these techniques, there are few studies on this method. The LHP is a safe, less painful, and minimally invasive surgical procedure. Therefore, it is defined as a suitable method for the treatment of hemorrhoidal disease<sup>2</sup>. There are also studies in the literature describing LHP with high short-term success rates in terms of downstaging and symptomatic improvement. Furthermore, the same studies add that this method is associated with a high risk of minor post-operative complications and long-term recurrence<sup>3</sup>.

In this study, we aimed to present the symptomatic recovery and recurrence rates, post-operative pain levels, and complication rates of patients treated with the LHP method in our clinic.

## Materials and methods

The data of patients who underwent LHP surgery for Grades 2, 3, and 4 internal hemorrhoidal disease between January 1, 2018, and March 10, 2020, were analyzed retrospectively. Patients who underwent the LHP procedure, were older than 18 years of age, did not respond to medical treatments, had complete patient registration data, and had a follow-up period of at least 6 months were included in the study. Patients who did not complete the minimum 6-month follow-up period after the operation and whose contact and follow-up information were missing were excluded from the study. Patients with infective perianal pathologies such as acute thrombosed hemorrhoidal pouches, inflammatory bowel disease involving the anus or rectum, anal fistula, perianal abscess, and cellulitis were not operated.

## Parameters

Parameters were defined as patients' age, gender, American Society of Anesthesiology (ASA) score, whether they had undergone any procedure related to

hemorrhoidal disease in the past, presence of asthma/chronic obstructive pulmonary disease (COPD), post-operative follow-up times, number and grade of internal hemorrhoidal pouches, presence of complications, mean operation time, total hospital stay, symptomatic recovery, and recurrence rate. The presence of recurrence was recorded according to the examination and anamnesis findings of the patients at the 6<sup>th</sup> month, 1<sup>st</sup> year, and 2<sup>nd</sup> year period after the operation in the outpatient clinics. The visual analog scale (VAS) (0 points: no pain, 10 points: the most severe pain ever felt) scale was used to measure the pain score on the 1<sup>st</sup> day, 2<sup>nd</sup> day, and 1<sup>st</sup> month postoperatively. A satisfaction questionnaire with a Likert-type question (1: Not at all satisfied, 7: Very satisfied) was also administered to the patients. The patients were followed up at the 1<sup>st</sup> week, 1<sup>st</sup> month, 6<sup>th</sup> month, 1<sup>st</sup> year, and 2<sup>nd</sup> year after the operation. Patients who did not heal completely (100%) symptomatically were considered recurrence.

## Laser system

In the laser system, we use (Neov<sup>®</sup> Laser System), a diode laser with a wavelength of 1470 nm has a power of 6 watts. Each shot lasts 3 s and releases 18 Joules of energy. Each hemorrhoid pouch was shooted between 3 and 6 shots depending on its size and ablated with an energy ranging from 54 to 108 J per hemorrhoid pouch.

## Surgery technique

The operations were performed in the operating room under spinal anesthesia and in the lithotomy position. The surgeries were performed by the same surgical team and patients were hospitalized for one night after the operation.

## Statistical analysis

Statistical analyzes were performed using SPSS version 25.0 software. The conformity of the variables to the normal distribution was examined using Kolmogorov–Smirnov/Shapiro–Wilk tests. Descriptive analyzes were given using the mean  $\pm$  standard deviation for normally distributed variables, and the median (Q1-Q3) for non-normally distributed variables. Descriptive statistics were made by giving demographic characteristics, frequency, and percentage

values. To compare two groups for independent and continuous variables t-test was used in groups with normal distribution and Mann–Whitney U test was used in groups with non-normal distribution. The Kruskal–Wallis test was used to compare more than two groups. *Post hoc* Bonferroni test was used for pairwise comparisons in cases where there was a significant difference between the groups. Pearson's Chi-square or Fisher's Exact Chi-square test was used in the analysis of categorical variables;  $p < 0.05$  value was considered statistically significant.

## Results

A total of 103 patients were included in the study. Twelve patients who did not meet the inclusion criteria were excluded from the study. Seventy-five (72.8%) of the patients were male and the mean age was  $41.6 \pm 13.6$ . Ten of the patients (9.7%) were  $\geq 65$  years of age. According to Goligher classification, 37 (35.9%) patients had Grade 2, 54 (52.4%) patients had Grade 3, and 12 (11.7%) patients had Grade 4 internal hemorrhoidal disease. Bleeding (56.3%), palpable prolapsed pouches (48.5%), and pain in the perianal region (46.6%) were the most common pre-operative symptoms, respectively. The anesthesia scores of the patients were ASA 2 in 58 (56.3%) patients, ASA 1 in 37 (35.9%) patients, and ASA 3 in 8 (7.8%) patients. 12 (11.6%) patients had a history of previous surgery related to internal hemorrhoidal disease.

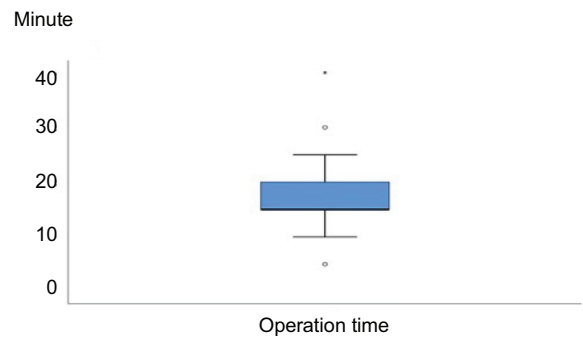
### Surgical outcomes

The mean number of pouches operated per patient was  $2.48 \pm 0.624$  and the mean operative time was  $17.9 \pm 5.2$  min. The operative time of the patients showed a homogeneous distribution (Fig. 1).

Eight of the patients underwent lateral internal sphincterotomy or skin tag excision in the same session after LHP due to symptomatic anal fissure or skin tag. LHP was not applied to patients with additional perianal fistula and other perianal region pathologies to hemorrhoids.

### Complications

There were no intraoperative complications in the patients. Post-operative complications were seen in 3 (2.9%) patients including; bleeding requiring hospitalization in one patient, bleeding and pain in one patient,



**Figure 1.** Distribution of operation times.

and headache due to spinal anesthesia in one patient. The patient with bleeding and pain was discharged after 10 days of clinic follow-up due to perianal pain (VAS pain score was 8 on the post-operative day 1). The bleeding seen in this patient spontaneously disappeared on the follow-up day 4. Age, gender, degree of hemorrhoid disease, presence of additional pathologies (fissure and skin tag), previous hemorrhoid surgery, second session, number of internal pouches, ASA score, and presence of asthma or COPD were not statistically significant factors for the occurrence of complications. None of the patients developed complications such as perianal sepsis, abscess, surgical site infection, submucosal fistula, or urinary retention. A second operation was not required due to complications and no mortality was observed. One hundred (98%) of the patients were discharged after one night follow-up. The mean time to return to normal daily activities was 2.17 (1-11) days.

### Pain analysis

When the post-operative pain scores were compared using the VAS, there was a statistically significant difference between the follow-up days ( $p < 0.001$ ). Paired comparisons of measurements at different times with the *post hoc* Bonferroni test (pair-wise comparisons; adj.sig. = p value) were also discussed and statistically significant differences were shown between each measures (Table 1).

The mean pain score of the patients on the 1<sup>st</sup> day after surgery was 3. There were four patients with a pain score of 5 and more. Three of these patients had a pain score of 5, while one had a score of 8. Three of the patients with a pain score of 5 on the 1<sup>st</sup> day were found to have a pain score below 5 on the 2<sup>nd</sup> day. Whereas the patient with a pain score of 8 had a pain score of 5 on the 2<sup>nd</sup> day (The only patient with a pain score of 5 or higher on the 2<sup>nd</sup> day).

**Table 1. Visual analog scale descriptive statistics analysis**

VAS/ time	n	Minimum	Maximum	Mean ± SD
VAS post-operative day 1	103	1	8	3.0 ± 0.9
VAS post-operative day 2	103	0	5	1.1 ± 0.7
VAS post-operative month 1	103	0	1	0.1 ± 0.3

VAS: visual analog scale.

**Table 2. Comparison of Grade 2 and 3 disease with Grade 4 in terms of recurrence**

Grade	Recurrence, count (%)		Total	p
	Yes	No		
Grade 2 and Grade 3	75 (82.4)	16 (17.6)	91 (100.0)	0.019*
Grade 4	6 (50.0)	6 (50.0)	12 (100.0)	

\*Fisher's exact test was used

## Recurrence

Recurrence was detected in 22 (21.4%) of 103 patients during the 6-24 month follow-up period. Recurrence was observed in 17.6% of patients operated for Grades 2 and 3 hemorrhoidal disease and 50% of patients operated for Grade 4 disease, and the difference was statistically significant ( $p = 0.019$ ) (Table 2). There was no statistically significant difference between Grades 2 and 3 internal hemorrhoidal diseases for recurrence.

Subgroups of different parameters that may affect relapse were examined. Except for the grade of hemorrhoidal disease, no significant correlation was found between the subgroups for recurrence (Table 3).

Considering the follow-up period of the patients, recurrence was detected 14 (13.6%) of 103 patients who completed the 6-month follow-up, 18 (21.2%) of the 85 patients who completed the 12-month follow-up, and 4 (25%) of the 16 patients who completed the 24-month follow-up period. We observed that the recurrence rate increased proportionally as the follow-up period increased. However, this proportional increase was not statistically significant. Median recurrence time was 6 months (min-max: 3-15 month). Recurrence developed in 2 (25%) of 8 patients who underwent LIS and skin tag excision due to anal fissure. The proportional increase compared to total recurrence was not statistically significant. Twelve patients had a previous hemorrhoids surgery history before the LHP (conventional hemorrhoidectomy

**Table 3. Analysis of parameters for recurrence**

Parameters	Subgroups	Recurrence		p	$\chi^2$
		No, n (%)	Yes, n (%)		
Age (years)	≥ 65	8 (9.9)	2 (9.1)	0.912	0.012
	< 65	73 (90.1)	20 (90.9)		
Sex	Female	23 (28.4)	5 (22.7)	0.596	0.281
	Male	58 (71.6)	17 (77.3)		
Additional surgical procedure	Yes	6 (7.4)	2 (9.1)	0.678	0.068
	No	75 (92.6)	20 (90.9)		
Grade	2	30 (37.0)	7 (31.8)	0.035	6.699
	3	45 (55.6)	9 (40.9)		
	4	6 (7.4)	6 (27.3)		
Complication	No	79 (97.5)	21 (95.5)	0.518	0.264
	Yes	2 (2.5)	1 (4.5)		
Second LHP	No	74 (91.4)	18 (81.8)	0.242	1.651
	Yes	7 (8.6)	4 (18.2)		
History of previous hemorrhoid surgery	No	69 (85.2)	22 (100)	0.065	3.689
	Yes	12 (14.8)	0		
Internal Pouch Count	1	6 (7.4)	1 (4.5)	0.733	0.622
	2	30 (37.0)	10 (45.5)		
	3	45 (55.6)	11 (50.0)		
ASA score	1	30 (37.0)	7 (31.8)	0.680	0.772
	2	44 (54.3)	14 (63.6)		
	3	7 (8.6)	1 (4.5)		
Asthma/COPD	No	77 (96.3)	21 (95.5)	1.000	0.029
	Yes	12 (3.8)	1 (4.5)		

$p < 0.05$  was considered statistically significant. Pearson's or Fisher's Kesin Ki kare tests were used. LHP: laser hemorrhoidoplasty; ASA: American Society of Anesthesiologists; COPD: chronic obstructive pulmonary disease

surgery in 10 patients, band ligation (LBL) in one patient, stapled hemorrhoidopexy in one patient). No recurrence was detected in any of these 12 patients.

Specifically, a 59-year-old male patient, who underwent low anterior resection for rectal cancer 8 years ago and had disease-free survival after oncological treatment, underwent the LHP procedure for symptomatic Grade 3 internal hemorrhoidal disease which is resistant to medical treatment. No recurrence was observed in this patient's 9-month follow-up.

Second session LHP was performed 11 patients due to the persistence of symptoms after the first surgery.

Symptomatic complete recovery was achieved in 7 (63.6%) of 11 patients and recurrence occurred in 4 patients (36.4%) during their follow-up. The median application time of the second session to the patients was the 2<sup>nd</sup> month after the first surgery (min: 1<sup>st</sup> month, max: 13<sup>th</sup> month). The follow-up times of the patients who underwent the second session were evaluated according to the date of the second surgery.

### **Patient satisfaction**

In the satisfaction evaluation, 83 (80.6%) of 103 patients at the end of 6-month follow-up, 61 (81.3%) of 75 patients at the end of 12-month follow-up, and 12 (80%) of 15 patients at the end of 24-month follow-up stated that they were very satisfied/satisfied with LHP in terms of symptomatic recovery after surgery. No statistically significant difference was observed in terms of satisfaction during the follow-up periods.

### **Discussion**

The first use of diode lasers was in 2005<sup>4</sup>. Ablation with laser devices was presented by Karahaloğlu under the name of "LHP procedure"<sup>5,6</sup>. The procedure can be performed under local or regional anesthesia. Karahaloğlu performed the procedure in the lithotomy position<sup>5</sup>. Due to the sensitivity and short range of diode lasers, they are less likely to damage deep anatomical structures than other lasers<sup>7-9</sup>. Devices with a 980 nm wavelength were used in the beginning<sup>5,10,11</sup>. 1470 nm devices gained popularity due to less damage to surrounding tissues<sup>2,12,13</sup>. We performed all of our operations under spinal anesthesia in the lithotomy position with a 1470 nm wavelength diode laser.

In the literature, different recurrence rates, different follow-up periods, and different disease characteristics have been described. Different surgical techniques and different amounts of energy were applied in different studies. This makes comparison and standardization difficult. For example, Naderan et al. used a 980 nm laser device and did not include patients with Grade 4 disease and ASA 3 anesthesia score. In this study, they stated that there was no difference between Milligan-Morgan (MM) hemorrhoidectomy and laser application in terms of recurrence during the 12-month follow-up period<sup>10</sup>. Weyand et al. used a laser device with a wavelength of 1470 nm, added mucopexy when necessary, and followed 497 patients with grade 2-3-4 disease and ASA 1-2-3 anesthesia score for 6 months. They also treated proctological

diseases such as anal fissure and fistula in the same session and explained a recurrence rate of 8.8% in all patients<sup>2</sup>. Jahanshahi et al. reported no recurrence in any patient after 12 months of follow-up in their publication although they did not include additional proctologic diseases, did not apply mucopexy, and used a 980 nm diode laser device<sup>14</sup>. This is one of two publications describing a 0% recurrence rate<sup>14,15</sup>. Bruscianno et al. followed their patients for an average of 8.6 months, and excluded patients with an ASA score of 3 and undergone previous surgery for hemorrhoidal disease<sup>15</sup>.

Describing the results of the longest follow-up (5 years) in the literature, Faes et al. reported a high recurrence rate of 34%<sup>3</sup>. On the other hand Karahaloğlu published two studies in 2007 and 2010, and reported the recurrence rate decreased significantly from 31.2% to 5.8% with the addition of mucopexy to the procedure. Karahaloğlu was the first to mention the practice of repetitive sessions in LHP in the literature<sup>16</sup>. In our series, a total of 103 patients were followed for 6-24 months. All patients with anesthesia scores of ASA 1-2-3 were included in our study, and LHP was also applied to patients with Grade 4 disease. Patients who underwent additional procedures due to perianal fissure and skin tag were also included in the study. Our recurrence rates increased as the follow-up period increased, but this increase was not statistically significant. This result is thought to be due to the lower number of patients with a 2-year follow-up period. Our recurrence rates are significantly higher in Grade 4 disease than in Grades 2 and 3 diseases. We did not apply the second session to all recurrences due to limited data in the literature. Additional mucopexy was not applied in our operations. Mucopexy application may reduce our recurrence rates when the results of the studies are evaluated.

The biggest advantage of LHP is that it provides a quick return to work because it is less painful. Post-LHP pain score was found to be significantly lower than conventional methods<sup>7,10,11</sup>. In a publication evaluating 341 patients, it was stated that the pain score was low and the time to return to work was short after LHP<sup>14</sup>. There was a significant decrease in pain measurement on the 2<sup>nd</sup> day compared to the 1<sup>st</sup> day in our study. This decrease in pain scores in a short time is also one of the most important reasons for the short return times to work. In a study conducted in Italy, it was reported that 20 patients (40%) returned to their normal daily activities on the 1<sup>st</sup> day, and all patients (100%) on the 2<sup>nd</sup> day



after surgery<sup>15</sup>. In our study, the mean time for patients to return to normal daily life was 2.17 (1-11) days.

Weyand et al. stated that after 6 months from the operation, 91% of the patients were very satisfied/satisfied with the surgery and suggested having the LHP surgery again<sup>2</sup>. In our satisfaction analyzes, 80.6% of the patients at the end of 6 months, 81.3% at the 12<sup>th</sup> month, and 80% at the 24<sup>th</sup> month stated that they were very satisfied/satisfied. Recurrences increased proportionally as the follow-up period increased, but the satisfaction rates of the patients were not change. This is a result of both the regression of the grades of the disease due to the shrinkage of the pouches, and the significant decrease in symptoms such as bleeding/prolapse due to fibrosis, although some patients' complaints continue after laser application. Because in our study, all patients who did not fully recover symptomatically were accepted as recurrence, but there are also patients whose pouches regressed significantly, although their symptoms continued.

Another advantage of LHP is low complication rates. Brusciano et al. did not report any complications other than edema and minor bleeding<sup>15</sup>. Karahaliloğlu et al. and Jahanshahi et al. reported an infection rate 0.6% and 0.58%, respectively<sup>5,14</sup>. Contrary to the literature, Faes et al. reported a high rate of minor complications due to the procedure as 18%. In our study, among 103 patients minor complications were observed in 3 (2.9%) patients. None of our patients required reoperation due to complications, and no subgroup was observed associated with the occurrence of complications. In another study, they stated that the number of pouches did not affect the complication rate whereas the amount of energy in joules applied per patient significantly affect postoperative complications<sup>2</sup>.

Considering the low rate of procedure-related complications, LHP can be used safely in risky patients with an ASA score of 3, with additional comorbidities and bleeding risk, using long-term anticoagulants and with diabetes. The short operation time is another factor that reduces the risk of anesthesia. The need for intensive care after LHP is also extremely low. In our study, only 1 (0.97%) patient was hospitalized in the intensive care unit for one night with the recommendation of the anesthesia unit due to the patient's risky chronic diseases.

One of the biggest limitations of using laser devices is their high cost<sup>3,5,9,10,17</sup>. Giamundo et al. calculated the cost of LHP to be over 15 times that of band ligation. However, they suggested that laser should be preferred over LBL technique due to its efficiency despite its high

cost<sup>9</sup>. LHP avoids the need for multiple dressings by a qualified nurse due to incisional discharge, which is common after MM surgery<sup>15</sup>. Short return time to daily activities also significantly reduces high cost<sup>5,15</sup>. Furthermore, the cost analysis of techniques using disposable advanced vessel sealing devices is similar<sup>15</sup>. Specially developed optical fiber is disposable but its cost is significantly less than the expensive stapler which is used in stapled hemorrhoidopexy<sup>5</sup>. Costs can be reduced by multiple use of these materials after proper sterilization<sup>16</sup>. In addition, LHP has a short learning curve of 3–5 cases for surgeons, and the use of laser devices is easy to teach surgery residents<sup>10</sup>. Surgery residents played an active role in our team.

### **Limitations**

The limitations of our study are its retrospective design, shorter follow-up of some patients, and the lack of a comparison group.

### **Conclusion**

LHP is a safe method in the treatment of Grade 2 and 3 disease whereas the recurrence rate is high in the treatment of Grade 4 disease. Recurrence rates can be reduced by adding mucopexy, optimizing the amount of energy applied to the tissue, the number of shots, and repeated sessions in appropriate patients. LHP is a popular procedure with acceptable recurrence rates and efficacy in selected patient groups, but needs standardization and improvement.

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### **Conflicts of interest**

The authors declare that they have no conflicts of interest.

### **Ethical disclosures**

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this study.

**Confidentiality of data.** The authors declare that no patient data appear in this article.

**Right to privacy and informed consent.** The authors declare that no patient data appear in this article.

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