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Research Article

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Evaluation of 1470nm diode laser used in Haemorrhoidoplasty

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Abstract

Background: Hemorrhoids are a prevalent anorectal issue around the world, which can afflict a large number of people each year. Hemorrhoidal vein(s): When these veins become dilated and enlarged, they will turn into a morbid condition called hemorrhoidal disease. Lasers are mainly used to cut and or coagulate tissue. In this study, a 1470nm diode laser was used for the treatment of 10 cases with 2nd, 3rd, and 4th-degree hemorrhoids enrolled for hemorrhoido-plasty.

Aim of the study: Evaluation of the use of 1470nm-diode laser for treatment of second, third, and fourth-degree hemorrhoids by coagulative method and evaluate any possible complications.

Patients, Materials, and Methods: This is a prospective study with ten patients (all male). All patients were from the private clinic and were operated on using a 1470 nm diode laser for laser hemorrhoidoplasty between June 2022 and October 2022. All patients were surveyed and reported having one or more of the complications listed in the questionnaire paper (if any). Local anesthetic was used during the procedures.

Results: Patients experience mild pain during the administration of local anesthesia drugs. In the first postoperative week, mild pain in seven patients (70%) and moderate in three patients (30%). No patient experienced significant primary bleeding after the operation, and five patients (50%) had a seromucous discharge from the site of the operation that lasted for two to six days. No patient experienced infection. Urine retention was experienced in two patients (20%). With the exception of one patient who had minor skin prolapse, all patients saw improvements in their pre-operative symptoms and the disappearance of the hemorrhoid. During the follow-up period, none of them need to have a second laser treatment session. During the (four-week) follow-up period following the laser hemorrhoidoplasty, there was no recurrence observed or detected during the follow-up period, which was four weeks after the laser haemorrhoidoplasty. Every patient goes back to work within three to five days. All patients were satisfied with the outcome of the operation despite the minor complications that occurred post-operatively.

Conclusion: The clinical application of the 1470nm diode laser in surgical operations shows promise for routine use. It is a safe, acceptable, and remarkable substitute for traditional surgical treatment techniques and can be regarded as practical, effective, and easy to use

Keywords: 1470nm, diode laser, Hemorrhoids, haemorrhoidoplasty, treatment.

1. Introduction

Hemorrhoids may afflict over a million people annually; it is one of the most prevalent benign anorectal morbid disorders in the world [1]. The Hemorrhoids are defined as engorgement and distal displacement of typical anal cushions. One of the most important characteristics of hemorrhoids is the aberrant dilatation and distortion of the vascular channels, along with alterations in the breakdown of the connective tissue that supports the anal cushions. Hemorrhoidal venous cushions are normally found in structures of the ano-rectum and are always present unless an earlier intervention has been performed [2].

When the patient is in the lithotomy position, internal hemorrhoids, which are symptomatic anal cushions, typically lay at the 3, 7, and 11 o'clock positions. Furthermore, internal hemorrhoids at the secondary position are found in the space between the main site masses. External hemorrhoids are not actual hemorrhoids; instead, they are associated with venous channels of the inferior hemorrhoidal plexus, which are located deep in the skin around the anus. Typically, thrombosis, a painful acute condition, is the reason why external hemorrhoids are first identified [3].

Hemorrhoids are a type of disease that may cause patients symptoms and other complications. Bleeding, discharge, itching, pain, and symptomatic prolapse are the complaints [4].

Hemorrhoids incidence is as many as 36.4%. The human body normally has hemorrhoidal veins. Hemorrhoidal disease is a morbidly symptomatic disorder that develops as these veins enlarge and dilate. Straining will encourage vein congestion and hasten the development of hemorrhoids; it is common to see multiple cases in the same family and may have a significant genetic component. Vein dilatation is influenced by weightlifting, pregnancy, and any illness that raises intra-abdominal pressure. [5]

In general surgery, the primary uses of lasers are in tissue coagulation, vaporization, cutting, and excision. For most circumstances, "laser surgeries" essentially substitute the other devices used in conventional surgical (instruments) including electrocautery, cryosurgery, and scalpels. It was suggested that lasers will enable surgeons to perform more difficult procedures.[9](like fourth-degree hemorrhoids with no major wound, bleeding, or pain)

1.1 Study objectives

Assessment of the safety and effectiveness of the use of 1470nm-diode laser for treatment of second, third, and fourth-degree hemorrhoids by coagulative method and assessment of any possible complications and patients' satisfaction.

2.1 Patients

This is a prospective study with ten patients (all male). All patients were from the private clinic and were operated on using a 1470 nm diode laser for laser hemorrhoidoplasty between June 2022 and October 2022. Ten patients with symptomatic conditions of second, third, and fourth-degree hemorrhoids were included in this prospective study; all were male. The patients underwent laser hemorrhoidoplasty using a 1470nm diode laser at a private clinic under local anesthesia between June 20, 2022, and October 31, 2022. Patients' ages ranged from 32 to 65, with a mean age of 44.8 years, following a thorough description of the treatment and a discussion of its potential benefits and drawbacks as well as any anticipated complications. Preoperative evaluation: A case sheet was designed exclusively for the purpose of reviewing each patient's healthcare details and records. Age, symptoms (bleeding and discharge, nodule, itching, pain, and symptomatic prolapse), any prior surgeries, and past medical history are all considered a part of the patient's history.

A verbal agreement was obtained, a clinical evaluation of the patients and hematological investigations for virological infection, and complete blood count. Proctoscopy and digital rectal examination are part of the preoperative evaluation, which determines the degree of hemorrhoids, the number of piles, and any accompanying lesions or masses (if any).

A. Inclusion criteria

This study includes all patients who are older than 18 and have hemorrhoids of the second, third, or fourth degree.

B. Exclusion criteria

We excluded from our study patients with severe co-morbid illnesses, anal fissures, fistulas, and those who have first-degree hemorrhoids.

2.2 The Material

The medical laser system and accessories:

2.2.1. Laser system Specification

The laser system employed in this study was a class IV Medical laser system, a 1470nm diode laser that emits light at a wavelength in the near-infrared spectrum. The surgeon configured the laser aperture power output to vary between 0.5 and 15 Watts. Wuhan Dimed Laser Technology Co., Ltd. is the Chinese manufacturer of the diode laser (CHEYLAS-45JN) that is utilized, as shown in Figure 1.

Fig.1. laser device used.

2.2.2 Equipment

The following items are arranged on a tray with drapes, as shown in Figure 2. Allis tissue forceps, hypo-allergic surgical tape (4 inches), medical steel kidney dish, half-cut C-shaped proctoscopy, two syringes of 5 and 50 milliliters, Gauze swabs, Lidocaine solution 1% (50 milliliters), 100 milliliters of 0.9% isotonic normal saline, Lidocaine gel 5%, and a pair of gloves.
Also, doctor Google and completely shielded patient goggles are used during laser irradiation, as shown in Figures 3 and 4.

Fig.2. Equipment.

Fig.3. Doctor google.

Fig.4. Completely shielded patient google.

2.3 Procedure

With the patient in the lithotomy position and an antiseptic 10% povidone-iodine solution applied, No IV N.S.A.I.D. or sedation was used; instead, a 25 ml solution containing 1% lidocaine without epinephrine diluted by 25 ml normal saline (0.9%) (total 50 ml) was injected into the skin around the anus (4-5 ml) and deep in four quadrants around the anal canal (at 2-, 4-, 8-, and 10- o'clock) at a volume of roughly 10 ml each. Following the administration of local anesthesia, the c-shaped proctoscopy is inserted through the anus in order to identify the pile(s). Next, utilizing a laser handle with the bare optic fiber of 600µm diameter with an SMA905 connector, fixed 2-3mm beyond the edge of the terminal cannula, the laser energy is delivered at 8.0W power in pulsed mode, entering at the much-cutaneous junction at the base of the pile

and progressing to its pedicle. The pilot laser serves as a guide for the tip and depth of the laser optic fiber. Each pulse lasted 3 seconds (on) with a 0.6-second interval (off), (6.67Joules), using fan shape technique, the total amount of energy ranged from 150-200J per pile accordingly. A partial shrink of the pile volume serves as a sign to cease further radiation. To prevent overtreatment (overheating of the tissue), wet gauze with 0.9% normal saline was applied to a pile after each full set of pulses, with some pressure maintained for approximately thirty seconds. The skin opening kept open.

2.4 post-operative treatments

For each patient, postoperative follow-ups were recorded. Fix a date for the next follow-up visit, giving him a prescription for antibiotics and analgesia as follows:

1- Injectable antibiotic for 2 days followed by oral one for another 5 days.
2- Single injectable analgesic on the first day (if needed), followed by oral analgesia for 3-5 days.
3- Use of sitz bath twice daily for 15 minutes each time for the first 5 days.

3. Result and discussion

3.1 Results

The results of this study are based on the clinical evaluation of every patient through examination, complaints made by the patient during the procedure, and post-operative and clinical follow-up. Under local anesthetic, the surgery was tolerated by all of the patients. Ten patients are male. According to the grade of the pile(s), they were divided into three grades: grade two, consisting of six patients; grade three, consisting of three patients; and grade four, consisting of one patient. As shown in Table 1.

Table 1. Grades of hemorrhoids in 10 patients.

Grade	No. of Patients	Percentage (%)
2nd degree	6	60%
3rd degree	3	30%
4th degree	1	10%
Total	10	100%

In terms of the number of piles, there are four patients with three piles: two with second-degree piles and two more with third-degree piles; four patients with two piles, three of them with second-degree piles and the last one fourth-degree; and two patients with one pile, one of which is second-degree and the other third-degree, as shown in Table 2.

Table 2. Number of piles in each patient.

Number of Piles	No. of Patients	Percentage (%)
3	(**2**pat.)with 2nd degree (**2**pat.)with 3rd degree **Total 4**	40%
2	(3pat.)with 2nd degree (1pat.)with 4th degree **Total 4**	40%
1	(1pat.)with 2nd degree (1pat.)with 3rd degree **Total 2**	20%
Total	**10**	100%

After a 30-day follow-up, the hemorrhoid disappeared in all (100%) of the patients, with the exception of some redundant skin in the fourth-degree one. None of them required another laser therapy session. None of the patients experienced any serious intraoperative or postoperative complications; therefore, there was no need for hospitalization. During the four-week follow-up period following the laser hemorrhoidoplasty, no recurrence was found.

3.2 Post-operative complications/follow-up

Patients were followed on the 1st, 2nd, and 4th Post-operative weeks.

1. *Pain was classified as mild*, moderate, and severe, as the patients described it, to simplify the patients' pain assessments. Seven patients (70%) had mild pain, including two with three (second-degree) piles, three with two (second-degree) piles, one with one (second-degree) pile, and the final patient with one third-degree pile; three patients (30%) had moderate symptoms, including one with two (fourth-degree) hemorrhoids and two more with three(third-degree) piles, as indicated in table (3-3); the first postoperative day's pain necessitated the use of an injectable NSAID analgesic (olfen ampoule) to manage the pain, and then the pain decrease in the following days.

2. *Bleeding and discharge:*
As indicated by Table (3-3), no patient experienced significant primary bleeding (spontaneous bleeding after surgery) or reactionary bleeding (post-defecatory bleeding). Five patients 50% experienced a sero-mucus discharge; one patient had two (fourth-degree) piles (10%), two (third-degree) piles (20%), and two (second-degree) piles (20%). Postoperative seromucus discharge is identified by simple underwear soiling that lasts for two to six days until it ceases on its own without medical intervention.

3. *Retention of urine:*
This happens in two patients (20%), one of whom had three piles of third-degree hemorrhoids, and the last one had two piles of fourth-degree hemorrhoids and BPH. Both patients complained of burning during micturition and had minor difficulty urinating. The patients were treated conservatively with analgesics and encouragement to urinate; no additional intervention was required, as shown in Table 3.

4. *Infection According to Table 3*,
no patient (zero%) developed an infection during the postoperative period, and the postoperative period passed unnoticeably regarding the infection of the surgical site depending on the antibiotic regimen mentioned before.

5. *Return to work:*
Three patients (30%) return to work after five days, one with two (fourth-degree) hemorrhoids and two more with three (third-degree) hemorrhoids, because of pain, as mentioned before "three patients (30%) had moderate symptoms, including one with two (fourth-degree) hemorrhoids and two more with three(third-degree) piles". Whereas seven patients (70%) returned after three days, those with mild pain as mentioned before, "Seven patients (70%) had mild pain, including two with three (second-degree) piles, three with two (second-degree) piles, one with one (second-degree) pile, and the final patient with one third-degree pile" as shown in Table 3.

6. *Satisfaction:*
All patients (100%) are satisfied with the results of the operation and postoperative complaining, apart from the redundant skin of the one patient with 4th-degree piles who are reassured that this is not significant, as shown in Table 3. Yet they are completely satisfied with the result as no active bleeding, mass, itching, pain, symptomatic prolapse, or feeling of incomplete defecation.

7. *Recurrence:* As seen in Table 3, there was no recurrence during the follow-up period (0%) in this study.

Table 3. The results of the patients.

Post-operative complications / follow up	No. of Patients	Percentage (%)	Grade	No. of Piles
No pain	0	(0%)	/	/
Mild	7	(70%)	2nd and 3rd degree	Three, two, one piles
Moderate	3	(30%)	3rd and 4th degree	Three, two piles
Sever	0	0%	/	/
Bleeding & discharge Sero-mucous discharge	5	(50%)	2nd,3rd and 4th degree	-1 pat./2piles of 4th degree, -2 pat./3piles of 3rd degree, -2pat./3piles of 2nd degree
Retention of urine	2	(20%)	4th degree*1 and 3rd degree	two piles three piles
Need catheterization	0	0	0	0
Infection	0	0	0	0
Return to work	7 after three days 3 after five days	70% 30%	2nd and 3rd degree 4th and 3rd degree	Three, two, and one pile Three and two piles
Satisfaction	10	100%	2nd, 3rd and 4th*2 degree	Three, two, and one piles
Recurrence	0	0	0	0

*1 with BPH
*2 with redundant skin

3.3 Discussion

This study uses a diode laser operating at 1470 nm to treat hemorrhoids by minimally invasive laser-induced interstitial thermotherapy (coagulative effect, as mentioned before). The following characteristics were to be prospectively assessed in this study: pain, bleeding, retention of urine, surgical site infection, return to work, and overall patient satisfaction. Few cases in this study had post-procedural complications. Regarding postoperative pain, mild pain had occurred in (70%) of cases and moderate pain in (30%) of cases. This is in agreement with Brusciano et al. using Laser hemorrhoidoplasty (1470 nm); there were no major postoperative problems. Average level of pain after surgery: VAS (Visual Analog Scale) 2 (first 3 days)[6]. (Complication) Also in agreement with Paolo Giamundo Comparison: hemorrhoid laser operation (980 nm) versus band ligation Median post-operative pain VAS score 1.1 in laser hemorrhoid procedure [7]. Also, in agreement with Ferhatoglu et al. Hemorrhoidoplasty with laser (1470 nm) pain after 2 days of operation mean VAS score of 2.85 [8]. This is consistent with the hybrid digital guided HAL (hemorrhoidal artery ligation) with laser hemorrhoidoplasty scores of 2.82 and 1.28 on the third and seventh postoperative days, respectively, reported by De A et al. [9]

Regarding bleeding and discharge in this study, it is classified as:
1. Spontaneous bleeding post-operatively.
2. Post-defecation bleeding.
3. Sero-mucus discharge post-operatively.

There was no post-operative spontaneous bleeding or post-defecatory bleeding. In five cases (50%), there was a small amount of post-operative sero-mucus discharge, which lasted for two to six days after surgery before stopping on its own without the need for further treatment and bothered the patients because it was a hygienic concern.

In the study of Cantarella Francesco et al., in 15.4% of cases, seromucous discharge from the small incisions was observed in the first few weeks after therapy. There were no occurrences of postoperative bleeding. [10]. In a study of Hassan et al., Two cases (10%) out of 20 cases in the open hemorrhoidectomy group had bleeding, whereas one case (5% of the cases) in the laser hemorrhoidoplasty group had bleeding (the patient was taking aspirin) [11]. Regarding infection and abscess formation, no patient in this study suffers from infection. In the study of Cantarella Francesco et al., One out of 25 cases, or 4 percent, had an abscess [10]. In the study of Hassan et al., In the group that underwent laser hemorrhoidoplasty, one case—or roughly 5% of the total—had an abscess. [11]

Two individuals (20%) experience burning sensations during micturition with minor difficulty in urinating. These patients are treated conservatively with analgesics and encouraged urination; further intervention is not necessary. One patient had two fourth-degree piles and BPH; both conditions are attributed to his post-operative symptoms related to this problem; the second patient had three third-degree piles. In a study by Cantarella Francesco et al., Three out of 25 patients, or 12% of the total, experienced acute urine retention; this was most likely brought on by the spinal anesthetic rather than the surgery. [10] In studies by De A et al., Hassan et al., and Sabanci et al., Urine retention is not listed in their studies as a postoperative complication [9, 11, 12]. During the four-week follow-up phase, there is no recurrence rate in this study. In a study by Cantarella Francesco et al., Two out of twenty-five cases (8%) had the recurrence of recurrent post-operative bleeding, which happens three to six months after the treatment[10]. In the De A et al. study, Four patients experienced an occasional bleeding recurrence, and two out of 42 patients reported an incomplete prolapse cure after an average follow-up of sixteen months [9]. In a study by A.N.M. Jane Alam et al., The recurrence rate of hemorrhoids at a one-year follow-up was 5% [13]. In terms of satisfaction and return to work, all cases (100%) do so within three to five days after the procedure, and most patients are pleased with the way the pre-operative symptoms have resolved. This concurs with De A et al. In an average of 5.8 days following surgery, all patients resumed their regular activities [9].

3.4 Limitations of the Study

In this study, there are some limitations:
1. Small sample size.
2. Short follow-up period.
3. No comparative group.
4. All patients were male, no results and complications comparisons with female patients.

4. Conclusions

Diode 1470nm laser hemorrhoid-plastic is a safe and effective procedure associated with a low incidence of postoperative complications, despite the limitations of this study, which primarily focused on the feasibility, safety, and short-term outcome of the procedure. However, it does require the availability of instruments (Diode laser system) and a skilled, well-trained surgeon. For the treatment of hemorrhoids, these are superior tools to traditional surgical methods, as the hemorrhoidectomy is considered as the gold standard regardless of its surgical technique, as it resects the diseased tissue at once. Yet, it may cause pain, mucosal stenosis or anal stenosis, prolonged healing time, and bleeding postoperatively (early and delayed).

For all that many patients refuse operative management, laser hemorrhoidoplasty is a minimally invasive procedure that is considered an alternative that resolves all the above concerns, so it is superior from this point of view.

By employing laser interstitial thermotherapy, tissue coagulation can be accomplished with lower power densities than with tissue cutting. The benefits of using a laser include its ability to stop bleeding from severed vessels (haemostasis), its tolerance by patients under local anesthesia, and its decreased risk of complications during or even after the operation. So, 1470nm laser hemorrhoido-plasty is:

1. Safe.
2. Effective procedure.
3. Low incidence of post-operative complications.
4. Post-operative pain is more with increased no. of piles and their degree.
5. Sero-mucous discharge again is more with increased no. of piles and their degree.
6. Retention of urine is more with those who had BPH, 4th-degree hemorrhoid, and more no. of piles. (more pain).
7. Return to work lasts longer in those with more pain and thence larger piles or more no. of haemorrhoids, faster than respective procedures.
8. Redundant skin is seen in 4th degree pile(s), although it is not significant but bother the patient and may consider the operation is poor, under treatment or recurrence.

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تقييم تأثير الدايود ليزر 1470 نانومتر في علاج البواسير الشرجية بطريقة تخثير الدم

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الخلاصة

الخلفية: البواسير هي مشكلة شرجية منتشرة في جميع أنحاء العالم، والتي يمكن أن تصيب عددًا كبيرًا من الأشخاص كل عام .الأوردة في البواسير عندما تتوسع وتتضخم فإنها ستتحول إلى حالة مرضية تسمى مرض البواسير .يستخدم الليزر بشكل رئيسي لقطع و/أو تخثر الأنسجة .في هذه الدراسة تم استخدام ليزر ديود 1470 نانومتر في 10 حالات مصابة ببواسير من الدرجة الثانية والثالثة والرابعة عن طريق عملية رأب البواسير.

الهدف من الدراسة: استخدام الدايود ليزر ذو الطول الموجي 1470 نانومتر في علاج الدرجة الثانية والثالثة والرابعة من البواسير الشرجية وتقييم الأضرار الجانبية لهذا الأستخدام او اي مضاعفات محتملة.

المرضى, المواد, الطريقة: هذه دراسة مراقبة مستقبلية بوجود عشرة مرضى (جميعهم من الذكور)؛ كان جميع المرضى من العيادة الخاصة وخضعوا لعملية جراحية باستخدام ليزر ديود 1470 نانومتر لرأب البواسير بالليزر في الفترة ما بين يونيو 2022 وأكتوبر 2022، وقد تم استطلاع رأي جميع المرضى وأفادوا بوجود واحد أو أكثر من المضاعفات المدرجة في ورقة الاستبيان (إن وجدت). تم استخدام المخدر الموضعي أثناء العملية.

النتائج: معظم المرضى لم يعانوا من أي ألم أثناء العملية عدا الم بسيط اثناء حقن المادة المخدرة موضعيا ، كان هناك ألم خفيف في سبعة مرضى (70٪) ومتوسط في ثلاثة مرضى (30٪) في الأسبوع الأول بعد العملية. بالنسبة للأفرازات المخاطية المصلية خمس مرضى (50٪) كان هناك إفرازات مخاطية مصلية من مكان العملية استمرت 2-6 أيام ، ولم يصاب أي مريض بنزيف أولي مهم بعد العملية. لم يصاب أي مريض بالعدوى او الأخماج. كان لدى مريضين احتباس بسيط للبول تم متابعته بشكل تحفظي دون اي تداخل قسطاري للمثانة (20٪). كل المرضى كان لديهم تحسن في الأعراض ما قبل العملية واختفاء البواسير باستثناء مريض واحد كان لديه بعض التدلي الجلدي الذي كان يعاني من باسورين من الدرجة الرابعة. لم يحتج اي من المرضى إلى جلسة ثانية من العلاج بالليزر خلال فترة المتابعة. لم يتم الكشف عن أي رجوع للبواسير خلال فترة المتابعة التي كانت اربع أسابيع من رأب البواسير بالليزر.

عاد جميع المرضى إلى العمل في غضون 3-5 أيام. كان جميع المرضى راضين عن نتائج العملية على الرغم من المضاعفات البسيطة التي حدثت بعد العملية.

الأستنتاج: إن الاستخدام السريري لليزر 1470 نانومتر في العمليات الجراحية أثبت أنه مفيد للعمليات اليومية ، ويمكن اعتباره عمليًا وفعالًا وسهل الاستخدام ويوفر بديلاً آمنًا ومقبولًا ومثيرًا للإهتمام بدل تقنيات العلاج الجراحي التقليدية في البواسير.