

Pilonidal Sinus Management Using 980 nm Diode Laser

Muhammad A. Albahadili MBChB CABS HDLM^{1,2} Ammar W. Majeed MBChB DGS HDLM¹

¹Department of surgery, Aziziyah hospital, Aziziyah, Kut, Iraq

Abstract

Background: Pilonidal sinus is a chronic, debilitating disease of the natal cleft. It mainly involves the sacrococcygeal region and the presentation varies from asymptomatic pits to painful abscesses or sinuses. Treatment options vary from observation to wide excision. Unfortunately, surgical treatment may result in recurrence. Many conservative methods had being described for treatment of pilonidal sinus, photocoagulation using laser is one of them. **The aim of study:** To assess the efficacy of laser (diode) as a therapy to the pilonidal sinus. **Design:** A cohort of five patients with a provisional diagnosis of pilonidal sinus (unbranched) were treated by photocoagulation of sinus tract by diode laser 980 nm, between 17 and 25 year old (20.6±2.58), were diagnosed clinically and by sinogram to know the exact length of the tract and to exclude branching tract. The average length of the tracts were (5 cm) ranging (3-7) cm. Only one patient had recurrent sinus after surgical excision. **Result:** The mean operative time was (10.10) min. (range of 6.10-14.10 min.). All patient were seen the day after the procedure and then weekly, only one patient had pus discharge at day nine and was treated with ciprofloxacin and metronidazole for ten days and tract closed after 21 days of the procedure. The average time for closure was (10.4) day ranging (6-21). **conclusion:** Diode laser as a surgical tools in the treatment of pilonidal sinus offers the following benefits: Reducing hospital stay, minimizing tissue assault by avoiding unduly extensive procedures with the attendant complications, early resumption of work by the patient and preventing recurrence of the disease.

Keywords: pilonidal, diode 980nm, diode laser

1. Introduction

Pilonidal (nest of hair) sinus (PNS) is believed to arise from frictional impact on hair shafts in the intergluteal folds or sacrococcygeal cleft (figure 1).¹ It's acquired condition, usually seen in young adults, manifest by midline pits in the natal cleft and associated with hair.²

Usually affect young adults from puberty to early thirties & rare after 40 years. Male: Female ratio is 4:1 due to their more hirsute nature. Onset of disease is earlier in female, which may be due to earlier puberty in female⁽³⁾. The track is lined with granulation tissue (i.e. chronic inflammation) and contains hair. Commonly, it lies in the cleft between the buttocks, but may also be found elsewhere⁽⁴⁾. A deep abscess cavity with surrounding moist conditions and abundant bacteria, hair, debris and friction cause recurrent infection, associated with chronic pain and discharge⁽²⁾. Malignant change is a relatively rare complication of pilonidal disease, If it happens, squamous cell carcinoma is the most common presentation it carries bad prognosis⁽⁵⁾ PNS was first described by Hodges in 1880.⁽⁶⁾

Although pilonidal disease may be asymptomatic for sometime prior to presentation. Symptoms vary from a small dimple to a large painful mass. Often the area will drain fluid that may be clear, cloudy or bloody. With infection, the area becomes red, tender, and the drainage (pus) will have a foul odor. The infection may also cause fever, malaise, or nausea. PNS rarely develops⁽⁷⁾

For those patients who are asymptomatic, meticulous depilation and local hygiene are advised. It is not known what proportion of those who are asymptomatic go on to develop symptomatic disease. For the acute cellulitis that presents early, with pain that is tolerable and no evidence of abscess, broad spectrum antibiotics and depilation alone may be sufficient. Treatment of an acute exacerbation (abscess) if conservative treatment; baths, local antiseptic dressings and the administration of a broad-spectrum antibiotic fail to bring about resolution, the abscess should be drained through a small longitudinal incision made over the abscess and off the midline, with thorough curettage of granulation tissue and hair. This procedure may or may not be associated with complete resolution.^(8, 9) The standard treating pilonidal sinus (PNS) is surgical intervention with excision of sinus. Although surgical intervention is acutely effective, but the recurrence of pilonidal sinus is high.⁽¹⁰⁾ Laser hair depilation is a useful tool in treatment of PNS or prevent recurrence. More than one kind of laser used for PNS treatment.⁽¹¹⁻¹⁶⁾ Diode lasers provide great benefits over many other lasers because of its small size comparable to other types of laser. Diode laser also provides a wide range of spectrum that may be used in many medical fields. Another important privilege of Diode laser, that it is transmitted through fibro-optics so it can be used in different locations.⁽¹⁷⁾

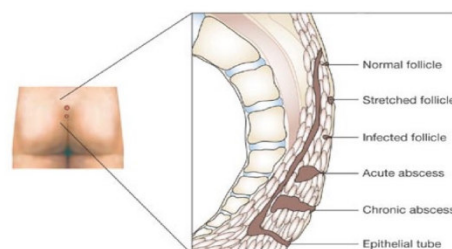


Figure 1. Pilonidal sinus tract

The aim of study: To assess the efficacy of laser (diode) as a therapy to the pilonidal sinus, taking in account the advantages & disadvantages of laser work, recurrence, hospital stay and resumption of work

2. Patients, Materials & Methods: In this study the used laser system was VELAS 6(table 1)

Table (1): Laser system technical data

Laser system	Wavelength	Laser power at tissue level	Pilot laser light	Laser beam delivery
GaAIAs laser (diode) VELAS 60	980 nm	1-60 W	Diode laser 650 nm	600 microm. Fiber with conical tip

A cohort of five patients with a provisional diagnosis of **pilonidal** sinus (unbranched) were treated by photocoagulation of sinus tract by diode laser (VELAS60) 980 nm, five patients included in this study were two male and three female, with age ranging (17-25) years (20.6 ± 2.58), were diagnosed clinically and by sinogram (fig. 2) to know the exact length of the tract and to exclude branching tract (branched tract excluded from the study). The average length of the tracts were (5 cm) ranging (3-7) cm. Only one patient had recurrent sinus after surgical excision.

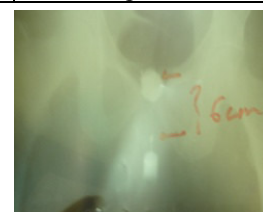


Figure 2. sinogram

2.1. Preliminary Study

An in vitro experiment was designed to pre fix parameters for interstitial coagulation of sinus tract, an excised pilonidal sinus were used, Interstitial coagulation of these tracts has been performed using different laser powers at different rates of retrograde application.

Each tract was laid open after the end of each application, and direct careful inspection of the treated tissue is performed. The aim of the experiment was to obtain a satisfactory coagulation of tissue without charring and carbonization. The indicator of a satisfactory interstitial coagulation was a change in the color of the tissue to yellow brown with minimum carbonization. The different parameters applied are illustrated in Table 2.

Table (2): Different laser parameters applied

Tract	Power density (w/cm^2)	Rate (cm/min)
1	1591.5	0.1
2	1591.5	0.5
3	1192	0.2
4	1192	0.5
5	994	0.1
6	994	0.5

2.2. Operative procedure:

Patient in prone position, after sterilization of the operative site with povidone iodine (10%), using local anesthesia with lidocaine (2%), the 600 um fiber optic introduced through the tract until reach the end of tract and then retrogradely pulled in a rate of 0.5 cm/min applying continuous power of (5 W), power density ($994 W/cm^2$), The procedure continued at this rate until the whole optical fiber was out of the fistula except for the Orb tip which was left for extra 10 seconds at the external opening prior to pulling it out terminating the procedure (Figs. 3,4,5).

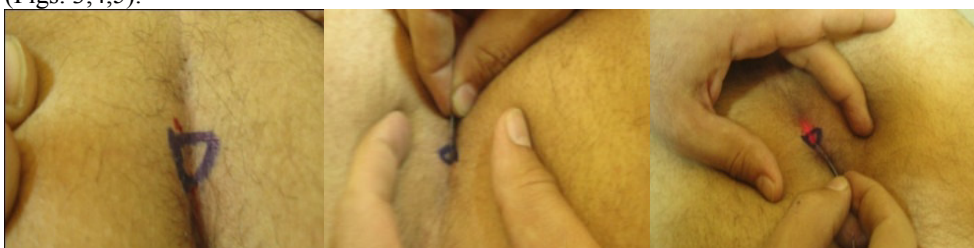


Figure 3

Figure 4

Figure 5

With the mentioned parameters, the total exposure time for each patient was entirely dependent on the length of the fistula treated (Table 3). The mean exposure time was 6.6 min.

Table (3): Laser exposure time for each sinus

Patient no.	Tract length (cm)	Exposure time (min)
1	6	12.10
2	4	8.10
3	5	10.10
4	7	14.10
5	3	6.10

3. Results:

The results of the preliminary work, to choose a suitable parameter for interstitial

Coagulation of sinus tract are presented in Table 4. At power of 4 W and rate of 0.1 cm/min only slight pale yellow changes noticed (minimal coagulation), accordingly, a power of 5 W applied in continuous mode and at a rate of 0.5cm/min was considered safe for purpose of coagulation of the sinus tract, that is why it had been chosen.

Table 4: Results of applying different laser parameters

Tract	Power (w)	Rate(cm/min)	Result
1	8	0.1	Sever charring and carbonization.
2	8	0.5	Moderate charring and carbonization.
3	6	0.2	Carbonization of tissue still noted.
4	6	0.5	Deep-brown color with multiple carbonization points.
5	5	0.1	Deep-brown color with scattered carbonization points.
6	5	0.5	Brown to deep yellow color with no carbonization effect.

The mean operative time was (10.10) min. (range of 6.10-14.10 min.). Evaluation of the postoperative pain was done in the follow up period, all patient have no pain during the procedure except at the external opening of tract all patient have pain which is moderate-sever pain, but during follow up there was no pain and so no need for any type of analgesia.

Follow up was conducted (table 5) to assess the time needed for healing and closure of the tract. The disappearance of the discharge and closure of the tract were considered as signs of

Table 5: Results of evaluation parameters in5 patients

Case no.	Tract length (cm)	Operative time(min)	Closure (day)	Post-operative pain	Post-operative infection	Follow up (week)
1	6	12.10	7	-	-	12
2	4	8.10	9	-	-	12
3	5	10.10	9	-	-	14
4	7	14.10	21	-	+	13
5	3	6.10	6	-	-	10

healing. All patient were seen the day after the procedure and then weekly, only one patient had pus discharge at day nine and was treated with ciprofloxacin and metronidazole for ten days and tract closed after 21 days of the procedure. The average time for closure was (10.4) day ranging (6-21).The procedure was done as a day case and no need for hospitalization and patient can resume his work next day.

4. Discussion

Pilonidal disease is a foreign body reaction accompanied by chronic inflammation that most commonly arises in the hair follicles of the natal cleft or other hair bearing areas. ⁽¹⁸⁾

With incidence of up to 26 cases per 100 thousand of general population each year, peaking between the 15th and 25th year of active life. ⁽¹⁹⁾ PNS is rare after 40th

It's acquired condition. ⁽²⁰⁾ Although the origin of the problem is unknown but the reports claim that genetic, hormonal stimulation of special sweat gland, obesity, personal hygiene and hirsutism are risk factors. ^(21,22) Treatment vary from meticulous depilation and local hygiene for truly asymptomatic to aggressive surgery in case chronic cases. The ideal therapy should be directed to treat the underlying etiological factor and would be a quick cure that allowed patients to return rapidly to normal activity, with minimal morbidity and a low risk of complications. Unfortunately, surgical treatment is an invasive method with a high failure rate and recurrence. ⁽²³⁾

Recurrence rate of PNS is very high whatever the sort of management. ⁽²⁴⁾

The hair is responsible as the most important etiological factor for this disease. With the development of laser epilation technology in recent years, some research has reported that relapse rates can be reduced by

removing the hair in combination with surgery. Relapse rates with surgical procedures have reported to be between 1 and 38 %.^(25,26)

The sinus coagulation technique by laser aims to destroy only the sinuses and the granulation tissues and thereby causing minimum damage to the surrounding healthy tissues. In our study we were used diode 980 nm in treatment of PNS, Diode laser 980nm that possesses a deeper power of penetration reaching about 1.5mm.⁽²⁷⁾ Application of diode 980 in 8w power in defocused continuous mode will rise temperature of affected tissues to above 50 degree and less than 100 degree; this temperature will cause protein denaturation.⁽²⁸⁾ The sign of protein denaturation is the blanching of the treated tissues as in our preliminary study.

Denaturation of protein at the affected area means destruction of the diseased epithelium with its surface antigen. In addition, all the immune reaction components present in the range of diode laser treatment, as antigen antibodies, cytotoxic proteins and subepithelial lymphocytes, are all denaturated due to its deeper penetration.⁽²⁹⁾ Diode laser showed better bactericidal effects in long term.⁽³⁰⁾

All of the patients operated with laser coagulation technique procedure were discharged within few hours of the procedure. The patients were found comfortable with the bodily movements like sitting, walking and attending the nature's call. In comparison, the average duration of stay in the hospital was more in case of patients who were operated by marsupialization. The patients operated by laser technique were able to join their duties much earlier than the patients operated by marsupialization method. This was possible because of the reduced pain, and minimal discomfort in body movements. Some surgeons has described use of electrocauterisation in the treatment of pilonidal sinus. While the laser has a property to seal small blood vessels without creating any char if it used in the proper dose, the cautery or diathermy instruments create heat at the tip of the instruments to seal the affected portion with the help of transferred heat. This technique of sealing invariably results in damage to the adjacent healthy tissues further causing more pain and a delayed wound healing. Nd-YAG and Ruby lasers have been used in treating pilonidal disease and are reported to reduce pain, length of hospitalization and early return to work similar to the procedure conducted with the VELAS60 laser (diodes laser) device.⁽³¹⁾ The VELAS60 laser instrument has almost all the advantages of other lasers without the attending disadvantages like the price of the device, the easily transferring of the beam by optic fibers, the portability of the device and simplicity of its use. When we study the incision and lay open technique was longer compared to other techniques using partial or complete primary closure. But considering the complexity of these extensive procedures, period of hospital stay, consumption of inpatient hospital resources, need of antibiotics and the need to repeat procedure in case of wound dehiscence or complication.⁽³²⁾ Another advantage of laser surgery is that the same device could be used and could be selected to suit the exacting requirements of any surgical position and procedure. This is especially found of great help when working on a cavity of the pilonidal sinus with presence of offending tissues.⁽³³⁾ The recent literature consists of reports on the benefits of laser epilation in pilonidal sinus disease.

Benedetto and Lewis,⁽³⁴⁾ reported two patients with recalcitrant pilonidal sinus disease treated with an 800-nm diode laser, resulting in long-term relief. Similarly, Lavelle and colleagues,⁽³⁵⁾ presented a case of pilonidal sinus disease. They treated the surgical scar site five times with ruby laser for epilation and did not observe recurrence in 6 months. Conroy and colleagues reviewed 14 patients who underwent laser hair removal after pilonidal sinus surgery none of the patients had developed recurrent disease at 1-year follow-up. They suggested that laser hair depilation and the personal hygiene of the patient were useful in preventing recurrent pilonidal sinus disease. Schulze and colleagues,⁽³⁶⁾ reported that 19 of 23 patients who had laser epilation after surgical interventions and remained in follow-up did not have recurrence or need further surgery. The inadequate follow-up period and small number of patients in these studies make it difficult to derive firm conclusions, but our results and the literature support the beneficial effect of laser epilation as primary treatment or as an adjunct to surgery, even with a small number of laser treatments. But Firat Demircan and colleagues,⁽³⁷⁾ were mention in their prospective randomized study, the relapse rates in the surgery-only group and the surgery + laser epilation group were 4% and 20%, respectively, So results of them completely dissimilar from our and those of all the retrospective studies concerning the relapse rates after laser epilation following pilonidal sinus surgery. The follow up period in this study can only assess the short-term results of this procedure. According to the criteria for "fistula closure" (Ratto et al., 2000),⁽³⁸⁾ there were no recurrences within the follow up period. To assess intermediate and long term recurrence, a longer follow up period (up to 2 years) is needed. Selection of the diode laser for this procedure was dependent on the availability, portability, and applicability of the optical fiber. The Orb tip optical fiber was useful since laser energy is displayed outwards from the forward curvature of the tip. The amount of laser energy deposited in the tissue was directly related to the length of the fistula tract treated. At the fixed rate of retrograde application and the fixed power chosen, the longer the fistula tract the more the exposure time and the more the laser energy deposited in the treatment site. An extra 10 sec of laser application to the external opening was necessary to coagulate the pouting granulation tissue, thus encouraged healing and closure of the external opening. It seems that at the parameters chosen, coagulation of a well-formed fistula tract is safe, with no apparent damage to the nearby tissues. Because of absence of gross changes in the area treated, it

seems that nothing precludes repeating the procedure or resorting to any of the conventional methods in case of failure and recurrence. The parameters mentioned in the study are definitely reproducible in any future study with or without modifications. Safety measures were applied easily and enough goggles were always available to the attendant during the procedure. No accident regarding laser safety was recorded.

5. Conclusions

It may be possible to heal a low pilonidal sinus tract by mere photocoagulation of the tract. Healing and closure of the fistula tract may be attributed to the coagulative destructive effect of the laser. Within the chosen parameters for application, there was no evidence of damage to the surrounding tissues. The procedure can be repeated in case of failure and its application does not preclude the application of any other conventional procedure.

This study carried out to evaluate Diode laser as a surgical tool in the treatment of pilonidal sinus. An ideal treatment of pilonidal sinus disease is one which aims at, reducing hospital stay, minimizing tissue assault by avoiding unduly extensive procedures with the attendant complications, early resumption of work by the patient and preventing recurrence of the disease.

Reference

1. Albahadili M. A. & Awazli L.G., Pilonidal Sinus Excision Using Carbon Dioxide Laser 10600 nm. *Iraqi J. Laser B.* 2015; 14: 33-40.
2. Khanna A, Rombeau JL. Pilonidal disease. *Clin Colon Rectal Surg.* 2011; Mar. 24 (1):46-53.
3. Bascom J, Bascom T. Utility of the cleft lift procedure in refractory pilonidal disease. *Am J Surg* 2007; 193:606-9.
4. Bendewald, Cima, pilonidal disease. *Clinics in colon and rectal surgery.* 2007;20(2): 86-95
5. Tirone A, Gaggelli I, Francioli N, Venezia D, Vuolo G. Malignant degeneration of chronic pilonidal cyst. Case report. *Ann Ital Chir.* 2009; 80(5):407-9.
6. Hodges RM. Pilonidal sinus. *Boston Med Surg J* 1880; 103: 485-586.
7. Cameron JL, et al., eds. The management of pilonidal disease. In: *Current Surgical Therapy.* 11th ed. Philadelphia, Pa.: Saunders Elsevier; 2014. <http://www.clinicalkey.com>. Accessed Aug. 15, 2015.
8. Steele et al: practice parameters for the management of pilonidal Disease of the Colon & Rectum, 2013;56:9
9. Humphries AE, Duncan JE, evaluation and management of pilonidal disease *Surg Clin North Am.* 2010 Feb;90(1):113-24,
10. Shah et al. Outcome of open versus closed surgical technique of treatment of chronic pilonidal sinus: A randomized controlled trial. *Khyber Med Univ J* 2013; 5(3): 146- 151.
11. Badawy EA, Kanawati MN. Effect of hair removal by Nd: YAG laser on the recurrence of pilonidal sinus. *J Eur Acad Dermatol Venereol.* 2009; 23(8): 883-6.
12. Conroy FJ, Kandamany N, Mahaffey PJ. Laser depilation and hygiene: preventing recurrent pilonidal sinus disease. *J Plast Reconstr Aesthet Surg.* 2008; 61(9): 1069-72.
13. Benedetto AV, Lewis AT. Pilonidal sinus disease treated by depilation using an 800 nm diode laser and review of the literature. *Dermatol Surg.* 2005; 31(5): 587-91.
14. Landa et al. Successful Treatment of Recurrent Pilonidal Sinus with Laser Epilation *Dermatologic Surgery,* 2005; 31(6):726–728.
15. Lindholt CS, Lindholt JS, Lindholt J. Treatment of pilonidal cyst with Nd-YAG laser. *Ugeskr Laeger.* 2008; 170(26-32): 2321-2.
16. Sadick NS, Yee-Levin J. Laser and light treatments for pilonidal cysts. *Cutis.* 2006; 78(2): 125-8.
17. Moritz, A., Gutknecht, N., Doertbudak, O.Goharkhay, K., Schoop, U., Schauer, P. and Sperr, W. Bacterial reduction in periodontal pockets through irradiation with diode laser, a pilot study. *J. Clin. Laser Med. Surg.* 1997; 15: 33-37.
18. Sondena K, Andersen E, Nesvik I, Soreide JA: Patient characteristics and symptoms in chronic pilonidal sinus disease. *Int J colorectal Dis* 1995; 10: 39–42.
19. Ghnam WM, Hafez DM. Laser hair removal as adjunct to surgery for pilonidal sinus: Our initial experience. *J Cutan Aesthet Surg.* 2011; 4:192–5.
20. Kosaka M, Kida M, Mori H, Kamiishi H. Pilonidal cyst of the scalp due to single minor trauma. *Dermatologic Surgery* 2007; 33(4): 505-7.
21. Benedetto AV, Lewis AT: Pilonidal sinus disease treated by depilation using an 800 nm diode laser and review of the literature. *Dermatol Surg* 2005; 31:587–591.
22. Odidi J, Gault D: laser depilation of the Natal cleft and aid to healing the pilonidal disease. *Annals J* 2002; 84: 29–32.
23. Shakoor siddiqui S, Ahmed Khan M: pilonidal sinus. *Pak J Med Sci* 2008; 24: 845–848.
24. Bascom J, Bascom B. Failed pilonidal surgery: new paradigm and new operation

- leading to cures. *Arch Surg* 2002; 137: 1146–50.
25. Oram Y, Kahraman F, Karıncaoğlu Y, Koyuncu E. Evaluation of 60 patients with pilonidal sinus treated with laser epilation after surgery. *Dermatol Surg* 2010; 36: 88-91.
 26. Karydakís GE. Easy and successful treatment of pilonidal sinus after explanation of its causative process. *Aust NZ J Surg* 1992; 62: 385-9.
 27. Catone GA, Halusic E: Photobiology of lasers in oral maxillofacial surgery .In *Laser applications in oral and maxillofacial surgery*. Catone GA and Alling, C. Saunders company 1997; 29-38.
 28. L'Esperance, F.A.: *Ophthalmic lasers*. Third edition, chapter 1, pp. 1-10 .Churchill Livingstone, Edinburgh and London, 1989.
 29. Mona Soliman MD, Ahmed EL Kharbotly MD and Ali Saafan Ph.D, Management of oral lichen planus using diode laser (980nm). A clinical study, *Egyptian Dermatology Online Journal*. 2005;1(1): 3
 30. Reza Birang. et al. The Effects of Diode Laser (980 nm Wavelength) and Chlorhexidin Gel in the Treatment of Chronic Periodontitis *Journal of Lasers in Medical Sciences*. 2011; 2(4): 131-138
 31. Palesty JA, et al. Nd: YAG laser surgery for the excision of pilonidal cysts: a comparison with traditional techniques. *Lasers Surg Med*. 2000; 26(4):380-5.
 32. Georgiou GK, Outpatient Treatment of Pilonidal Disease with a 1470nm Diode Laser; Initial Experience. *Int J Surg Surgical Porced*. 2016; 1: 103. doi: <http://dx.doi.org/10.15344/ijssp/2016/103>
 33. Saidi MH, Setzler KR, Farhart SA, Akright BD. Comparison of office loop electrosurgical conization and cold knife conization. *J Am Asso Gynecol laparosc*. 1994; 1:135-139.
 34. Benedetto AV, Lewis AT. Pilonidal sinus disease treated by depilation using an 800 nm diode laser and review of the literature. *Dermatol Surg* 2005; 31:587–91.
 35. Lavelle M, Jafri Z, Town G. Recurrent pilonidal sinus treated with epilation using a ruby laser. *J Cosmet Laser Ther* 2002; 4:45–7.
 36. Schulze SM, Patel N, Hertzog D, Fares LG. Treatment of pilonidal disease with laser epilation. *Am Surg* 2006; 72:534–7.
 37. Firat Demircan et al. The effect of laser epilation on recurrence and satisfaction in patients with sacrococcygeal pilonidal disease: a prospective randomized controlled trial *Int J Clin Exp Med* 2015;8(2)
 38. Ratto C., Gentile E., Merico M. et al. How can the assessment of fistula in ano be improved? *Dis. Colon Rectum* 2000;43: 1375