

Laser Usage in Sacrococcygeal Pilonidal Sinus Surgery

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Abstract:

Background: Sacrococcygeal pilonidal sinus disease is a common condition associated with recurrent infection, pain, discharge, delayed wound healing, and a negative impact on patients' quality of life. Conventional surgical treatment remains widely used, but it may be associated with postoperative pain, prolonged wound care, delayed return to daily activity, complications, and recurrence. Recently, there has been increasing interest in minimally invasive techniques for pilonidal sinus management. Laser ablation, particularly using a 1470-nm radial diode laser fiber, has emerged as a promising approach that destroys the sinus tract epithelium, promotes tract contraction, improves wound healing, and reduces tissue trauma. Published studies have reported favorable outcomes with laser treatment, including high healing rates, low postoperative pain, short hospital stay, rapid return to normal activity, fewer complications, and relatively low recurrence rates. However, long-term follow-up and further comparative studies are still required to confirm its efficacy and define its role as a standard treatment option for sacrococcygeal pilonidal sinus disease.

Keywords: Sacrococcygeal pilonidal sinus; Laser ablation; SiLaT; Minimally invasive surgery; Radial diode laser; Wound healing; Recurrence.

Introduction:

There is a strong worldwide trend toward the introduction of less invasive operations. Pit picking, which is a safe minimally invasive procedure, has long been used to treat pilonidal sinus disease. However, the recurrence rate may reach 13.2% after 5 years and 16.2% after 10 years (1).

Laser ablation using 1470-nm radial diode laser fiber was first proposed by Wilhelm, which was first used to treat anal fistula with a cure rate of 82%. The energy released by the annular laser at the end of the catheter makes the tissue in the fistula gasify and contract, closing the fistula. Laser ablation on PNS is a new method at which the sinus tract is ablated using radial laser. To prevent fluid accumulation and improve drainage, one, two, or three 1 cm incisions are performed. This method achieves rapid subsequent wound healing with at its lowest incidence of recurrence and minimal discomfort (2).

In 2016, Dessily et al. used this technique for the first time in the treatment of pilonidal sinuses, with a success rate of 87.5% and a recurrence rate of only 2.9%, with mild postoperative pain and minor wounds. Subsequent studies have reported similar results. Therefore, laser ablation closure may be the method of choice for the treatment of SPD (3).

Technique:

All patients were treated with sacrocaudal skin preparation before operation. They were placed in the lateral recumbent position for easy anesthesia; strong tape is placed on the buttock to increase exposure. Propofol medium/long-chain fat emulsion was injected to induce and maintain intra-venous anesthesia (propofol was infused by target-controlled infusion, taking into account the age, height, and weight of the patient). Anesthesia was induced by 3 µg/mL and maintained by 2 µg/mL propofol. Then, a probe was used to evaluate the length and

extent of the sinus from the pit (if there were multiple pits, the sinus tracts were evaluated separately). According to the size of the sinus infection area, a circular or oval incision was made to widen the existing sinus appropriately to ensure sufficient drainage (2).

Mosquito clamps were used from the incision to clean the hair in the sinus tract. Then, the sinus tract was cleaned with a curette. The optical fiber (Leonardo Dual 45 Laser 980 nm/1470 nm, CeramOptec GmbH of Biolitec AG, Bonn, Germany, single radial laser fiber) was probed from the small concave side, under the guidance of the indicator light, along the sinus tract to the end. The laser power was 10 W and the wavelength was 1470 nm. The parcel was ablated between the sinus and pit by pulling the optical fiber at 1 mm/s (2).



Figure 1: A The pits before the operation, B Biolitec device used for sinus laser treatment, C destruction of the tract with the laser, D after the operation, E successful healing at 1 year (2).

Outcome of Laser ablation:

During the last decade, many studies have aimed to evaluate minimally invasive techniques, like laser ablation in treatment of PNS since it is associated with less pain, faster wound healing. However, their results have been contradictory concerning the optimal surgical approach. (4)

In 2014, a study by Handmer demonstrated a minimally invasive sphincter preservation method for treating anal fistula. Suppose an annular laser with a wavelength of 1470 nm is used to treat anal fistula. In that case, the annular energy emitted by the laser catheter acts uniformly on the epithelial cells in the fistula, destroying the epithelial cells and causing the fistula to contract naturally (5).

Dessily et al. applied this technique to SPD. Good results were achieved, and it has been widely used in clinical settings, but no related research has been reported in China (3).

In the latest meta-analysis of laser treatment of pilous sinus by Romic et al., a total of 971 patients were included, with a primary healing rate of 94.4%, a weighted average recurrence rate of 3.8%, and a weighted average complication rate of 10% ($P < 0.001$), all of which were mild complications. (6)

Since the introduction of laser technology in 2017, it has been mainly aimed at hemorrhoids and anal fistula with satisfactory results. Combined with the preliminary experience and existing experience, laser technology is effective in the treatment of Tibetan hair sinus, and the patients feel good after operation. As far as

we know, we are the first institution to carry out laser treatment of pilose sinuses in China. In the present study, we found that laser ablation using 1470-nm radial diode laser fiber was influential in the treatment of SPD. Among the 48 patients, all cases were successfully treated, the cure rate was 100%, and the recurrence rate was 2.1%. This may be related to the preoperative MRI or ultrasonic of all patients to identify the number and branches of sinuses and we exclude the patients in acute abscess stage. During the procedure, we should ensure sufficient drainage. After ablation, secretions or necrotic tissue can be discharged normally to prevent the accumulation of new infection lesions in the tube, improve the success rate of operation, and reduce the risk of recurrence (7).

One patient with recurrent seborrheic dermatitis had a history of seborrheic dermatitis, recurrent skin folliculitis on the shoulder, back, and buttocks, patchy old pigmentation, a long course of disease (2 years), recurrent swelling, and pus in the sacrococcyx. The patient relapsed 3 months after the first laser ablation procedure using 1470-nm radial diode laser fiber and was treated with the same process after the ineffective drug. The patient was followed up to observe wound healing and amalgamation. In addition, we evaluated the pain degree of the patients during dressing and found that the overall pain of the patients was mild. Patients did not take painkillers. The wounds were minor, and drainage was complete, reducing the stimulation of the postoperative wound inflammatory response and pain. In the present study, the 8 patients in the acute stage in the absence of abscess were not excluded. All patients were cured, indicating that this method is suitable for SPD patients in all stages except acute abscess. However, this conclusion needs to be confirmed in large cohorts (7).

Compared with other treatments of SPD, the limitation of laser ablation and closure is that it cannot be operated under direct vision, so there is the possibility of omission of sinus branches, incomplete cauterization of epithelial tissue and granulation tissue in the sinus, and incomplete hair cleaning, and these untreated sinus branches and hairs may cause disease recurrence. However, based on our experience, MRI examination before operation and adequate treatment of sinuses during operation can reduce its recurrence. Papagiannopoulos and Zarogoulidis proposed a new method: laser ablation of hair sinuses under the guidance of B-ultrasound during the operation. In their patient cohort, no apparent complications occurred.

But in terms of cost, laser technology requires more expensive materials. Nevertheless, the advantages of laser ablation closure are significant, including simple operation, less trauma, mild postoperative pain, and short hospital stay. It has lower requirements for postoperative wound care, fewer postoperative complications, and a lower recurrence rate than traditional surgery (8).

The most important advantage of this technique is that it can enable patients to return to routine work and life quickly, have little impact on employment and study, and improve postoperative satisfaction. Even if relapse occurs after operation, the success rate of reoperation using this technique is 75–78.3% (2)

Long-term follow-up of pilonidal sinus disease treated by radial laser surgery:

Pilonidal sinus disease (PSD) is a heterogeneous disease group with no consensus regarding its best treatment modality. It is a fairly common disease in which treatment failure and disease recurrences are frequent, leading to considerable morbidity in otherwise healthy patients. One meta-analysis analysing 740 studies and more than 80,000 patients on PSD surgery showed that recurrence in PSD is highly dependent on surgical procedure and by follow-up time. Recurrence of PSD may occur up to 20 years after surgery and follow-up of at least five years after PSD surgery is considered the gold standard. (9)

In recent years new minimally invasive techniques have become more popular for treating PSD, including pit-picking, treatment with phenol, with fibrin-glue, with endoscopy, as well as the Gips technique using trephines, and laser ablation. Minimally invasive techniques are generally considered to be associated with reduced postoperative morbidity and quicker return to normal daily activities than more conventional surgical methods (10).

Laser ablation is one of the newest and most advanced minimally invasive techniques. In a systematic review covering nine studies of laser treatment, Romic et al. showed that 94.4% of patients could achieve primary healing with a weighted mean complication rate of 10%; with a median follow-up of 12 months, their weighted mean recurrence rate was 3.8%. These results of high healing rate, low recurrence rate, and minor complications

were achieved with quite small sample sizes (ranging from 20 to 237) and relatively short follow-ups (median 12 months) **(6)**.

Several short-term studies have compared laser treatment to other PSD surgery techniques. We could only find one prospective randomized study involving laser treatment, one combining laser treatment with pit excision (in 30 patients) and comparing it to the Karydakakis technique (in 28) **(11)**.

In addition to laser surgery with tract ablation, a laser can serve for hair depilation in the sacrococcygeal area before or after surgery. Studies related to the effect of laser depilation on PSD recurrence rate are heterogeneous, and according to the authors of systematic reviews hard to compare. Halleran et al., examining 35 studies on laser hair depilation, stated that PSD recurrence afterwards ranged from 0 to 28% during a follow-up from 6 months to 5 years **(12)**.

Pronk et al. studied 14 studies on hair removal after PSD surgery and found a recurrence rate of 9.3% after laser hair removal versus 23.4% after traditional hair removal methods (mean follow-up, 37 months) **(13)**.

One of the benefits of laser surgery is its simplicity: it is easily repeatable in cases with recurrence if considered reasonable based on PDS severity and patient characteristics. Two recent short-term follow-up studies with relatively large sample sizes of 226 and 311 patients have noted that, to achieve a sufficiently good healing rate, laser treatment should be repeated, several times if necessary. Sluckin et al. reported, with the 311 patients and a median follow-up of 10 months, an initial success rate of 66% after one laser procedure and 92% and 98% after two and three procedures **(14)**.

De Decker et al. showed, with 226 patients and a median follow-up of 129 months, a healing rate of 78.8% after one laser procedure, increasing to 85.4% after one or more procedures **(15)**.

No long-term follow-up results are available (with which to compare ours). The tendency of PSD to recur necessitates long-term follow-up studies. With regard to mini-invasive techniques, we only found long-term follow-up studies for pit-picking and endoscopic techniques. For these mini-invasive techniques, recurrences seem to be relatively more frequent in long-term than in short-term follow-up **(16)**.

The effect of the treatment of Sacrococcygeal pilonidal sinus disease (SPND) on the patient's psychology and quality of life imposes a significant burden on the physician to implement new methods to improve the disease's management. However, treating SPND using surgical techniques is still the standard of care. SiLaT is one of the promising techniques of the growing trend toward minimally invasive treatment of SPND, but it needs to be further investigated and validated, which is the main aim of the current study. The demographic characteristics of the patients were similar to those reported in the literature **(17)**.

The use of SiLaT is straightforward, with a short cutting time (10-15 minutes) and hospital stay. The hospital stay is non representative, as most of the patients were admitted four to six hours prior to surgery and discharged when it was appropriate, four to six hours after surgery, unless the patient was not from the town or their conditions necessitated their stay in the hospital for another day. The procedure can be performed for all types of SPND under locoregional anesthesia or local sedation. However, since the jackknife position in perianal cases is our preference, it was performed under general anesthesia **(3)**.

The mean duration for the resumption of regular activities following SiLaT in the current study was higher (18.4 days) than that reported in multiple studies in the literature. Moreover, the mean wound healing rate by secondary intention was low after SiLaT (6.5 days), which is better than the reported mean wound healing rate **(18)**.

The current study had a low percentage of postoperative complications (7.3%). It only involved wound infection compared to those reported from surgical intervention, which involved wound infection, dehiscence, and seroma. All the complications seen individually in three cases were treated conservatively and graded on Clavien-Dindo classification as grade II **(19)**.

At the same time, SiLaT studies by Abdelnaby et al. reported similar rates but different types of postoperative complications (wound infection only versus wound infection and hematoma, respectively) in comparison with the current study (18).

The worldwide recurrence rate of surgical management of SPND is varied and reported in some studies to be as low as 0.2%, with the best result achieved using modified Limberg flap (20).

While pain killer usage and visual analog scale are not the optimal methods to assess pain, they showed a slightly lower percentage of using pain medications with good pain scores in the perioperative period in comparison with other studies. Furthermore, patient satisfaction was comparable to other studies as most patients were very satisfied with the outcomes. The cornerstone in developing SPND is hair at the natal cleft area. Therefore, since there is good evidence of laser depilation, all patients were instructed to take laser depilation sessions postoperatively, and they were found to have 100% compliance (18).

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