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Original Research Article

A Novel Surgical Technique for Anal Fistula Surgery Designed to Preserve the Anal Sphincter Function and Anoderm

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Abstract

Objectives: We reviewed surgical outcomes after introducing a novel surgical technique for anal fistula surgery designed to preserve anal sphincter function and the anoderm.

Methods: We studied 200 male patients who underwent a functional preservative operative technique (FPOT group) for anal fistulas and 200 patients who underwent resection of trans-sphincteric anal fistulas (fistulectomy group) between February 2014 and September 2015. We compared complications, such as those affecting anal sphincter function, recurrence, and incontinence.

Results: Fistulas recurred in three (1.5%) patients in the FPOT group and two (1%) patients in the fistulectomy group. This difference was not significant. Other complications included gas leakage and other forms of incontinence in 1 (0.5%) and 14 (7%) patients in the FPOT and fistulectomy groups, respectively. Anal function assessment demonstrated that the FPOT was significantly better at preserving function than fistulectomy in all patients.

Conclusions: There were no significant differences between the FPOT and fistulectomy in terms of recurrence or complication rates. Also, because there was no decrease in postoperative anal function, we concluded that the FPOT is an effective preservative surgical technique for treating trans-sphincteric anal fistulas.

Keywords

FPOT, anal fistulas, fistulectomy, anal sphincter function

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Introduction

Many reports have discussed surgical techniques used for anal fistulas. Unlike hemorrhoid surgery, anal fistula surgery involves preserving the anal sphincter muscle, anoderm, and other aspects of anal function while simultaneously reducing recurrence[1-4]. In 2007, Rojanasakul et al.[5] reported ligating the intersphincteric fistula tract (LIFT), a surgical technique for anal fistulas that continues to gain recognition in the United States and Europe. But LIFT has problems, such as recurrence and remnant fistula[6,7].

Thus, to resect fistulas in a manner that causes the least damage to the anal sphincter and reduces recurrence, we performed a functional preservative operative technique (FPOT) for anal fistulas, which combines LIFT and SIFT, on 807 patients (688 men and 119 women) at our hospital between February 2014 and December 2016. We compared this novel technique to the standard technique (fistulectomy, e.g., fistulotomy and resection of the fistula tract wall) and reviewed the relevant literature.

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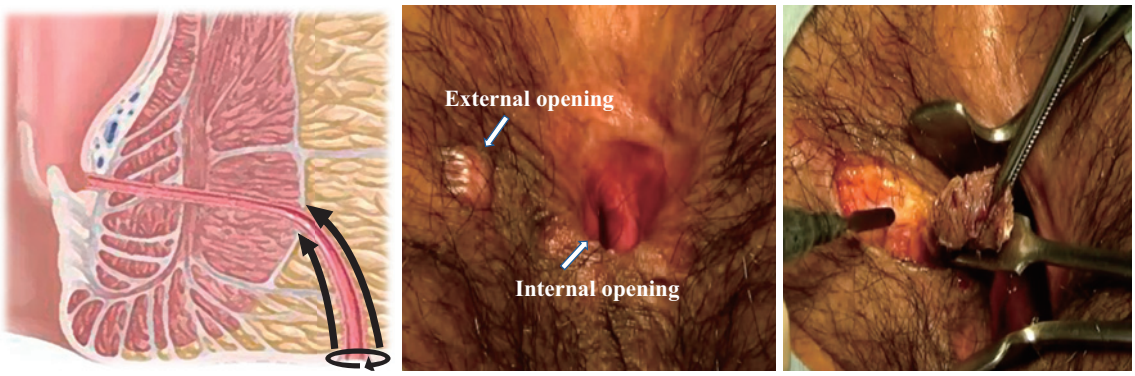

Figure 1. Identifying the course of the fistula tract and the internal opening. The incision around and dissection of the external opening.

Methods

We studied 200 male patients who underwent an FPOT (FPOT group) for anal fistulas and 200 patients who underwent fistulectomy (fistulectomy group) for trans-sphincteric anal fistulas at our hospital between February 2014 and September 2015. There were 125 cases of posterior anal fistula (the internal opening was between the 5 and 7 o'clock positions around the anus) and 75 cases of anterior/lateral anal fistula by each operation within the study period. We explained the advantages and disadvantages of both fistulectomy and FPOT procedures to the patient for surgery, and selected the procedure with the patient's consent, based on the patient's wishes. Our fistulectomy is a surgical procedure in which we core out the fistula tract from the external opening to the outside of the external sphincter, opening the fistula tract from the internal opening to the internal sphincter. The values obtained for the following items for each technique were subjected to statistical analysis using the Mann-Whitney U test: surgical duration, blood loss, postoperative analgesic dose (loxoprofen: 60 mg), complications, healing duration, and pre- versus postoperative anal sphincter function test results. A p-value of <0.01 was considered statistically significant. The sphincter function was measured using a water perfusion catheter. The catheter used was the ASAHI BIOMED's eight-channel catheter (9043 H0131). The analysis was performed using a multi-parameter gastrointestinal motor function measurement system (POLYGRAF ID, 9043G0132).

FPOT

FPOT involves performing the LIFT and SIFT within the same surgical field. The patient is placed under lumbar anesthesia in the surgical jackknife position. The operative field is secured by pulling the buttocks left and right and deploying. A hydrogen peroxide solution and a probe are inserted into the secondary (external) opening of the fistula tract to identify the primary (internal) opening. The surgeon must take precautions to avoid creating an iatrogenic internal opening.

There have been reports on fistulizing by seton installation for 8-12 weeks as part of LIFT[8,9]. However, as a general rule, we do not use a seton while performing initial fistulous tract processing because, in many cases, it damages the anoderm.

Xylocaine, with 0.5% epinephrine, is then injected around the external opening into the subcutaneous intersphincteric groove along the fistula tract path. A skin incision is made around the external opening, and sharp and blunt dissection of the external fistula tract is performed to the outer margin of the external sphincter (Figure 1). A 2- to 3-cm arcuate incision is made into the skin surrounding the intersphincteric groove where the fistula tract is located.

Blunt and sharp subcutaneous dissection are performed; the internal and external sphincter muscles are identified, and the intersphincteric groove is dissected. The electrosurgical knife output should be set to low. The associated longitudinal muscle is splayed and resected; hemostasis is performed on blood vessels running longitudinally between the muscles using a coagulant, and they are then resected. The part of the external fistula tract between the internal and external sphincter muscles hardens into scar tissue. However, with careful resection, the damage to the internal and external sphincter muscles can be kept to a minimum.

Once the area around the external fistula tract has been fully resected, the external fistula tract is retracted externally, and the internal opening, which is a depression in the pectinate line of the anal canal, is identified. Mosquito forceps are used to grasp the external fistula tract within the resected intersphincteric region at the inner margin of the external sphincter and the outer margin of the internal sphincter (Figure 2). After partially resecting the external fistula tract, a 3-0 PDS® (ETHICON, INC, U.S.A) suture is inserted into the stumps, and the area is ligated. At this point, if the external fistula tract is thick, puncture ligation alone may not achieve adequate closure. Thus, additional suturing

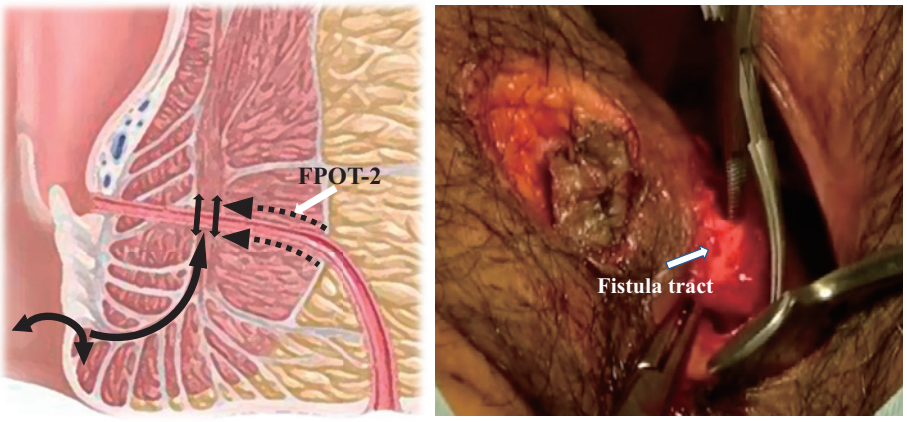

Figure 2. Incision into the skin of the intersphincteric groove and dissection of the internal and external sphincters and ligation of the fistula in the intersphincteric region.

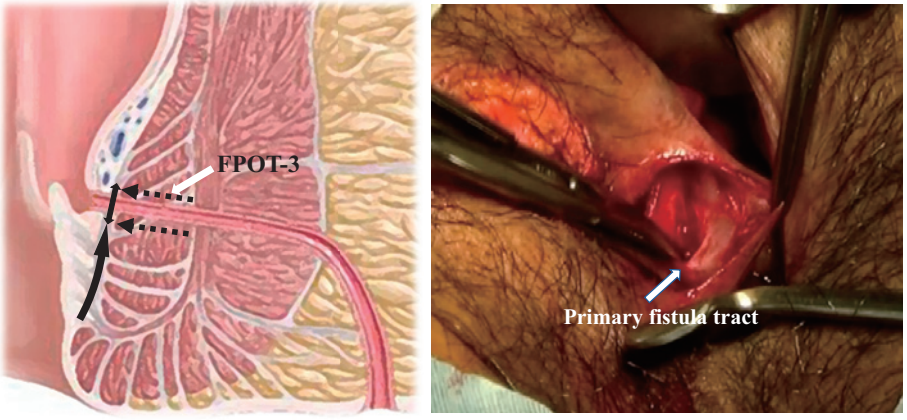

Figure 3. Dissection of the region between the anoderm and internal sphincter and resection of the internal fistula tract.

of the sphincter may be required, although this should be kept to the minimum extent required. Infected granulation tissue within the fistula tract can lead to delayed healing of the external opening; therefore, curettage with a sharp curette or a similar instrument is performed.

After processing the external fistula tract, the intersphincteric region is additionally resected on the proximal side for approximately 2 cm to identify and handle occasional multiple external fistula tracts or multiple anal fistulas in the same vicinity. After adequately resecting the intersphincteric region, palpation is performed to confirm that there is no remnant fistula tract. Then, the fistula tract dissected from the external opening is resected at the external margin of the external sphincter.

Next, from the same cutaneous incision, blunt and sharp dissection of the anoderm and medial side of the internal sphincter is performed. Because cutting into the cushion tissue can lead to bleeding, efforts must be made to limit the dissection to the inner margin of the internal sphincter. The funicular internal fistula tract, which enters the internal sphincter muscle fibers from the previously identified internal opening, can now be identified and is resected (Figure 3). Simultaneously, the neighboring inferior crypt is also dissected, which completes the processing of the internal fistula tract. The resection wound is approximately 2 cm proximal to the internal opening. Thus, the anoderm and rectal mucosa can be peeled back, and the cutaneous incision in the intersphincteric groove can be sutured. Suturing ensures that the internal opening and internal fistula tract are no longer aligned, preventing recurrence. Also, in cases where the internal fistula tract is wide open during surgery or when the anoderm is damaged during processing, only the anoderm is sutured closed using 3-0 Vicryl Rapide® (ETHICON, INC, U.S.A).

After all processes are completed, all dissection sites and wounds are irrigated with hydrogen peroxide and saline, and the intersphincteric groove incision wound is closed using 3-0 Vicryl Rapide®. Care should be taken not to close the

Table 1. Patient Background.

	Gender	Age	Preoperative MRP	Preoperative MSP
FPOT Posterior: 125 cases	Male	35.5 ± 11.3 years	83.8 ± 15.9 mmHg	179.5 ± 95.7 mmHg
FPOT Anterior/Lateral: 75 cases	Male		76.2 ± 32.0 mmHg	183.4 ± 93.4 mmHg
Fistulectomy Posterior: 125 cases	Male	40.3 ± 14.4 years	92.7 ± 14.8 mmHg	202.9 ± 94.2 mmHg
Fisturectomy Anterior/Lateral: 75 cases	Male		97.7 ± 44.6 mmHg	191.5 ± 74.7 mmHg

wound too tightly to ensure that the wound can drain. Although some believe that it is not necessary to close the wound when performing LIFT and SIFT, it is necessary to suture the wound closed at the completion of FPOT because it is important to ensure that the internal opening and internal fistula tract are no longer aligned when using FPOT.

FPOT can be performed on many types of fistulas, but when the external fistula tract is thick, such as with transsphincteric and suprasphincteric fistulas, LIFT cannot ensure adequate processing of the fistula. As a result, after resecting the fistula tract in the intersphincteric region, the fistula tract is removed from the external opening up to the internal margin of the external sphincter. In such cases, either the first modified FPOT (FPOT-2) (Figure 2), which entails suturing closed the damaged portion of the sphincter to the internal margin of the external sphincter, or the second modified FPOT (FPOT-3) (Figure 3), which entails removing the internal fistula tract within the internal sphincter after dissecting the anoderm and suturing closed the external margin of the internal sphincter, can be selected following the fistula morphology.

The study on this surgical procedure was reviewed and approved by the Institutional Review Board (IRB) of Matsushima Hospital Colo-proctology Centre. (Approval Number: 2014-011).

This study consent has been obtained from all patients and relevant persons (such as the parent or legal guardian) to publish the information, including photographs.

Results

The mean age of the patients was 35.5 ± 11.3 years in the FPOT group and 40.3 ± 14.4 years in the fistulectomy group, indicating no significant difference (P = 0.03) (Table 1). The mean surgical duration was significantly longer in the FPOT group (22 ± 7 min) than in the fistulectomy group (13 ± 6 min) (P < 0.01). The intraoperative blood loss (9.7 ± 1 and 7.7 ± 7.7 g, respectively) (P = 0.1) and postoperative analgesia dose (391.8 ± 327.7 mg vs. 411.6 ± 337.9 mg, respectively) (P = 0.39) were not significantly different in the FPOT and fistulectomy groups. The duration of wound healing (42.9 ± 9.6 vs. 51.4 ± 16.2 days, respectively) (P = 0.009) was significantly shorter in the FPOT and fistulectomy groups.

Pre- versus postoperative sphincter function assessment

To remove the influence of changes in the maximum resting pressure (MRP), we compared the maximum squeezing pressure (MSP) that did not include MRP.

Posterior fistulas

The investigation of pre- versus postoperative changes in MRP indicated that although there was no significant difference in the FPOT group (from 83.8 ± 15.9 mmHg to 71.69 ± 13.5 mmHg), the postoperative value in the fistulectomy group showed a significant decline (from 92.7 ± 14.8 mmHg to 63.9 ± 16.2 mmHg) (Figure 4). Although a comparison of changes in MSP in the FPOT (from 179.5 ± 95.7 mmHg to 187.2 ± 85.4 mmHg) and fistulectomy groups (from 183.4 ± 93.4 mmHg to 185.1 ± 85.3 mmHg) showed no significant difference, both groups showed a tendency toward higher postoperative values (Figure 5). We also investigated the percent change in MRP and MSP. The rate of change was calculated as the value after surgery, assuming that the value before surgery was 100% (Postoperative MRP or MSP/Preoperative MRP or MSP X 100). The higher the number, the less the postoperative functional decline. The percent change in MRP was significantly greater in the FPOT group (91.16% ± 13.89%) than in the fistulectomy group (70.73% ± 19.67%). However, the percent change in the MSP was not significantly different (114.89% ± 37.46% vs. 103.09% ± 16.65%, respectively; Figure 6) between the FPOT and fistulectomy groups.

Anterior/lateral fistulas

Comparison of changes in MRP in both groups showed no significant difference, but the postoperative MRP tended to be higher in the FPOT group (76.2 ± 32.0 mmHg to 78.9 ± 20.7 mmHg) and lower in the fistulectomy group (97.7 ± 44.6 mmHg to 64.4 ± 19.6 mmHg) (Figure 7). The com-

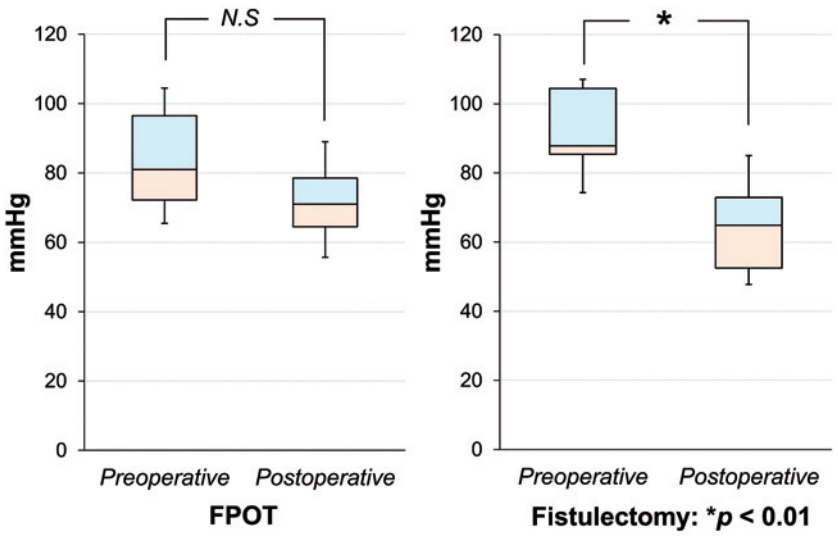

Figure 4. The investigation of pre- versus postoperative changes in the maximum resting pressure (MRP) of posterior fistulas.

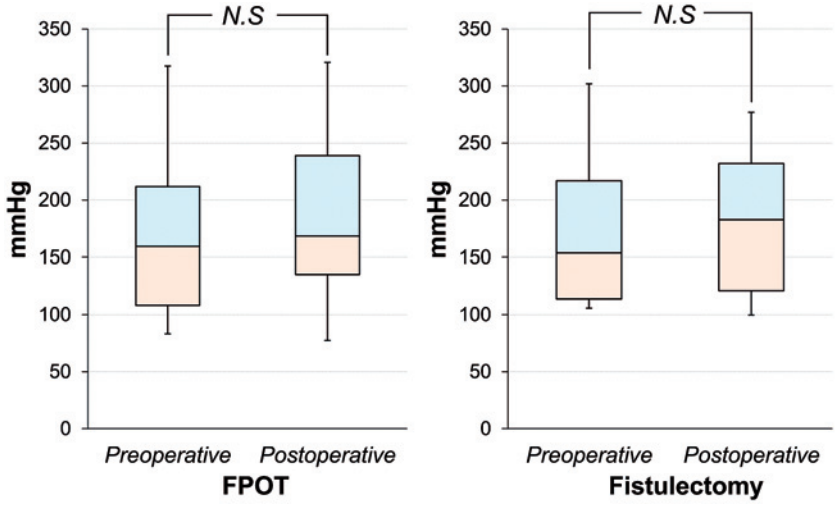

Figure 5. The investigation of pre- versus postoperative changes in the maximum squeezing pressure (MSP) of posterior fistulas.

parison of changes in MSP in both groups showed no significant difference (FPOT group: 202.9 ± 94.2 mmHg to 180.2 ± 98.4 mmHg, fistulectomy group: 191.5 ± 74.7 mmHg to 199.0 ± 121.0 mmHg), but the postoperative MSP in both groups tended to be higher (Figure 8). As with posterior fistulas, the percent change in MRP was greater in the FPOT group (116.5% ± 28.62%) than in the fistulectomy group (68.1% ± 13.97%), whereas the percent change in MSP was not significantly different (88.45% ± 23.47% vs. 101.47 ± 48.12; Figure 9) between the FPOT and fistulectomy groups.

Complications

The mean observation period was 1582 ± 159 days in the FPOT group and 1614 ± 183 days in the fistulectomy group. As shown in Table 1, postoperative bleeding was observed in 2 patients (1%) and 1 patient (0.5%), wound infection in 0 (0%) and 2 (1%), delayed wound dealing in 7 (3.5%) and 8 (4%), and recurrence in 3 (1.5%) and 2 (1%) in the FPOT and fistulectomy groups, respectively. These differences were not significant. However, there were significantly fewer patients with postoperative incontinence (gas and feces) in the FPOT (1 patient, 0.5%) than in the fistulectomy (14 patients, 7%) groups (Table 2).

Discussion

The fundamental principle of surgery for anal fistulas

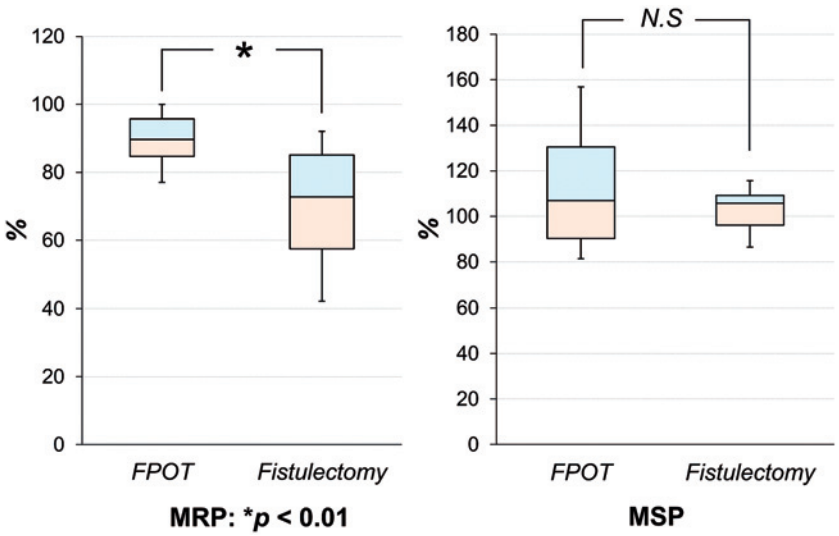

Figure 6. The investigated the percent change in the maximum resting pressure (MRP) and maximum squeezing pressure (MSP) of posterior fistulas.

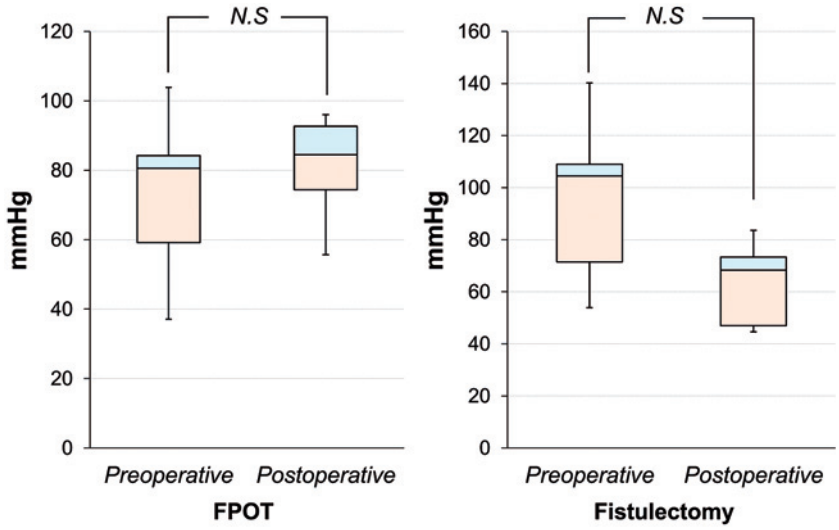

Figure 7. The investigation of pre- versus postoperative changes in the maximum resting pressure (MRP) of anterior/lateral fistulas.

calls for appropriate processing of the internal opening (internal fistula tract), primary lesion, and external opening (external fistula tract) and preservation of the sphincter and anoderm[10].

Previously, fistulotomy and fistulectomy were recommended for posterior intersphincteric and trans-sphincteric fistulas, and muscle-preserving surgical techniques were recommended for cases of anterior and lateral fistulas. However, our results indicated that, when fistulectomy of a posterior fistula was performed, sphincter function declined. Reports have also indicated that, in cases of damage to the sphincter owing to childbirth or other trauma, 50% patients experienced a return to the preoperative functional decline 5 years postoperatively[11,12]. These data suggest that when either fistulectomy or fistulotomy is performed for fistulas at any location, the anal functional decline may occur during the long-term postoperative observation period. In contrast, FPOT did not lead to pre- versus postoperative changes in MRP when performed for fistulas at any location, and when performed for anterior and lateral fistulas, in particular, the postoperative MRP increased. Thus, we believe that FPOT is useful as a sphincter-preserving surgical procedure for trans-sphincteric fistulas. Also, FPOT was not inferior to fistulectomy in terms of intraoperative bleeding, postoperative pain, postoperative bleeding, or recurrence, all of which have been reported to be low for fistulectomy[13]. Thus, we believe

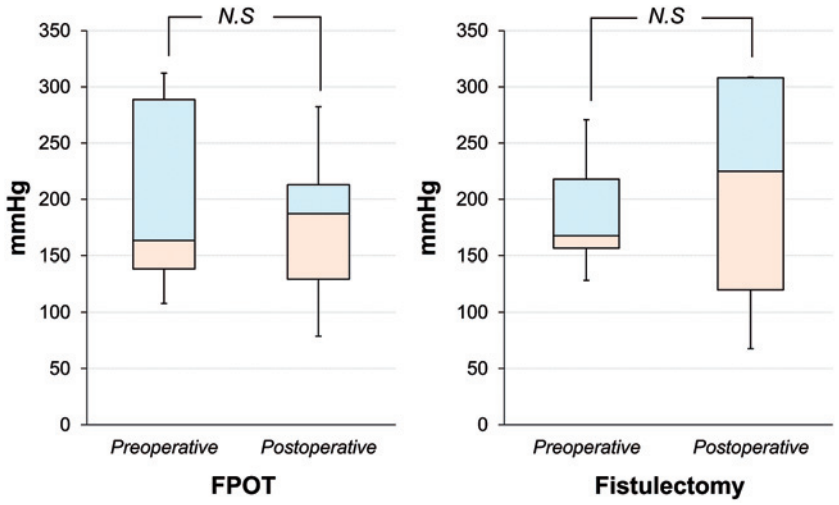

Figure 8. The investigation of pre- versus postoperative changes in the maximum squeezing pressure (MSP) of anterior/lateral fistulas.

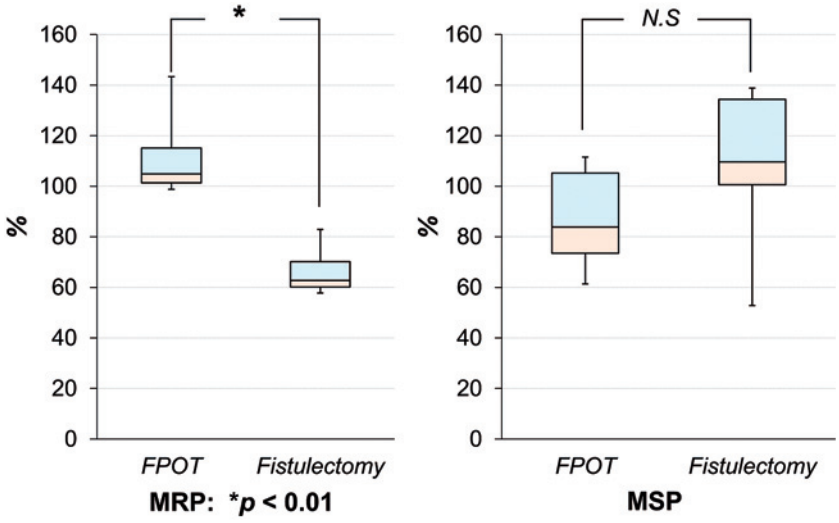

Figure 9. The investigated the percent change in the maximum resting pressure (MRP) and maximum squeezing pressure (MSP) of anterior/lateral fistulas.

Table 2. Complications.

	FPOT	Fistulectomy
Postoperative bleeding	2/200: 1%	1/200: 0.5%
Postoperative infection	0/200: 0%	2/200: 1%
Delayed wound healing	7/200: 3.5%	8/200: 4%
Recurrence	3/200: 1.5%	2/200: 1%
Incontinence (gas, feces)	1/200: 0.5%	14/200: 7%

Mean observation period:
FPOT: 1582 ± 159 days
Fistulectomy: 1614 ± 183 days

that FPOT is useful from the perspective of a patient's quality of life (in terms of a shorter hospital stay and shorter recovery period) and from the perspective of medical economics. Although FPOT was slightly more complicated than fistulectomy and the surgery duration was significantly longer, the duration was still within tolerable levels. With increased practice on more patients, it may be possible to reduce further the surgical duration of FPOT (the surgical duration in 2016 was 15 ± 6 min, which indicated that there was no longer a difference between the surgical duration of FPOT and fistulectomy). In our study, FPOT had the same lower recurrence as fistulectomy than monotherapy with LIFT. However, because the postoperative observation period was short (maximum of 3.5 years), the recurrence may increase in the future because, naturally, the recurrence would increase as the observation period becomes longer. Therefore, we believe that further studies on the types of recurrence that occur during longer observation periods are important.

As FPOT is a sphincter-preserving and an anoderm-preserving procedure, it is not indicated in patients who require surgical relaxation of the internal sphincter owing to excessive tension of the internal sphincter before surgery, such as in patients with fistulas with anal fissures. FPOT is indicated in patients in whom preoperative sphincter function is normal or decreased.

We now discuss the often-debated topic of the risk of oncogenesis associated with a remnant fistula. Fistula cancer is diagnosed using the criteria developed by Rosser[14] and Skir[15]. However, there have been many previous reports on the causes of oncogenesis, including occurrence from the anal gland[16], from the fistula itself[17], from the rectal mucosa affected by the development of the internal opening[18], and from enteric duplication[19]. However, Iwadare reported that it is impossible to identify the cause of oncogenesis[20]. There is doubt regarding the issue of maintaining the anal gland morphology at the site of fistulization. When FPOT is used, the internal fistula tract is resected, which means that the effect on the rectal mucosa by the development of the internal opening is avoided, and additionally, the presence of enteric duplication can be ruled out before surgery by ultrasound. Among patients in whom a remnant fistula within the sphincter develops into cancer, many of them have high intersphincteric fistulas with circular fistula tracts that are not completely resected. Fistulas classified using Sumikoshi's method[21] as lying within the external sphincter would remain. When fistulotomy is performed, the opened fistula tract wall remains, but there are no reports of these surgical procedures leading to oncogenesis. Further, several patients do not undergo radical surgery after incisional drainage, and many of them likely do not suffer abscesses or inflammation even if a fistula tract has formed. Thus, considering the number of such patients that may exist, it seems unlikely that fistula cancer would develop owing to remnant fistulas alone. Nevertheless, it is necessary to keep the possibility of the oncogenesis of remnant fistulas in mind. Fistula cancer is defined as the presence of fistula symptoms for over 10 years; however, Samejima et al.[22] conducted a survey of the current state of fistula cancer in Japan and stated that patients in whom fistula cancer developed after having a fistula for a shorter duration than ≥10 years were considered to have fistula cancer. Thus, in the future, there is a need for further observational studies on changes in sphincter function and remnant fistula tracts over the long term and of further studies on other diseases and multiple fistulas.

To ensure that the recurrence of fistulas after surgery is reduced, the fistula tract must be completely resected. However, if surgeons aim to preserve sphincter function, at least some portion of the fistula tract should remain. Thus, the two goals are considered opposites. The novel surgical procedure that we developed completely preserves the sphincter and anoderm while allowing simultaneous surgical processing of the internal opening (internal fistula tract), primary lesion, and external opening (external fistula tract). Thus, FPOT abides by the fundamental principle of fistula surgery while simultaneously avoiding the problem of anal dysfunction. To conclude, we believe that FPOT is a useful sphincter-preserving technique.

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Conflicts of Interest

There are no conflicts of interest.

Author Contributions

All authors listed in the manuscript meet the ICMJE contribution criteria.

Ethical approval

The study on this surgical procedure was reviewed and approved by the Institutional Review Board of Matsushima Hospital Colo-proctology Centre (Approval Number: 2016-011).

Disclaimer

Kosuke Okamoto and Yasuhiro Shimojima are Associate Editors of Journal of the Anus, Rectum and Colon and on the journal's Editorial Board. They were not involved in the editorial evaluation or decision to accept this article for publication at all.

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