

## Original Article

# Modified anal sphincter suspension improves anal function in patients with anal fistula

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Received April 13, 2024; Accepted August 22, 2024; Epub September 15, 2024; Published September 30, 2024

**Abstract:** Objective: To compare conventional thread-ligating therapy with the modified anal sphincter suspension procedure on the restoration of anal function in patients with anal fistula. Methods: This retrospective study included 120 consecutive patients with anal fistula treated at The First People's Hospital of Lin'an District, Hangzhou between January 2022 and December 2023. Patients were divided into an experimental group (n=66) who underwent the modified anal sphincter suspension procedure with preservation, and a control group (n=54) who received conventional thread-ligating therapy. Clinical data, including age, gender, duration of illness, BMI, medical history, anal function, pain score, quality of life score, overall efficacy assessment, and postoperative complications, were collected from the hospital's electronic medical records. Results: The cure rate was 90.91% in the experimental group and 92.59% in the control group ( $P>0.05$ ). Compared to the control group, the experimental group showed significantly higher scores in psychological function ( $89.65\pm 6.87$  vs.  $89.35\pm 7.67$ ,  $P=0.004$ ), material life ( $85.64\pm 6.87$  vs.  $68.64\pm 6.58$ ,  $P=0.002$ ), physical function ( $80.98\pm 5.98$  vs.  $70.85\pm 5.68$ ,  $P=0.003$ ), and social function ( $86.63\pm 5.97$  vs.  $74.65\pm 6.38$ ,  $P=0.009$ ) after surgery. Additionally, the Wexner scores, VAS scores, ARP, and RRP were significantly decreased in the experimental group postoperatively (all  $P<0.05$ ). Conclusions: The modified anal sphincter suspension procedure with preservation significantly reduces postoperative pain and improves anal function, thereby enhancing the quality of life in patients with anal fistula.

**Keywords:** Modified anal sphincter suspension procedure with preservation, anal function, anal fistula, postoperative pain

## Introduction

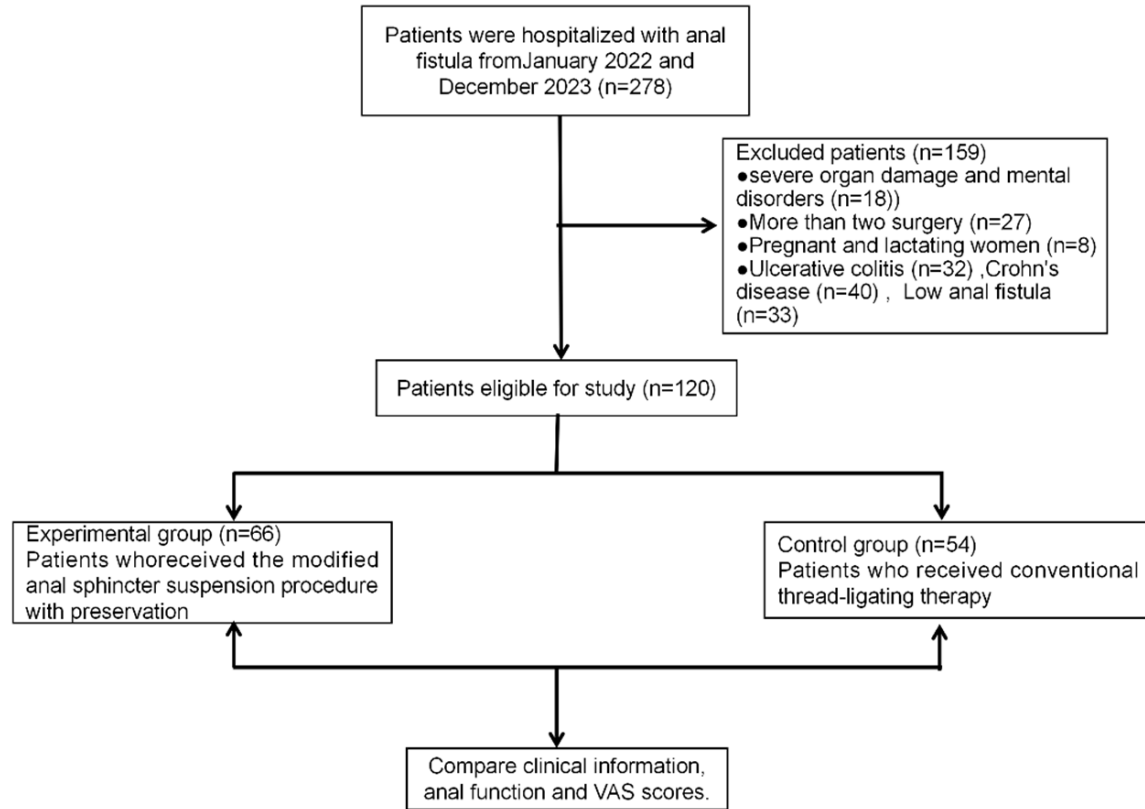
Anal fistulas are relatively common, with an estimated incidence of 1 in 10,000 individuals per year [1]. They can occur in individuals of any age but are most frequently seen in adults aged 30 to 60 years. There is no significant gender predilection, as anal fistulas affect both men and women [2]. The most common cause of anal fistulas is an infection or abscess in the anal glands, leading to the formation of a tract between the anal canal and the skin near the anus. Other causes include inflammatory bowel disease, trauma, and certain medical conditions [3-6]. Risk factors for developing anal fistulas include a history of anal abscesses, inflammatory bowel disease (such as Crohn's disease), chronic constipation, and previous anal surgeries [7-10]. If left untreated, anal fistulas can lead to recurrent infections, abscess formation, and chronic pain. In some cases,

they may also be associated with fecal incontinence, impacting anal function [11].

Anal sphincter suspension is a surgical method for treating anal fistulas [12]. During the procedure, a thread is placed inside the fistula around the anus, connecting the fistula to the anal canal, allowing pus to drain smoothly and promoting fistula healing. This method can help reduce pain, decrease the risk of infection, and promote wound healing in patients with anal fistulas. The modified anal sphincter suspension procedure is a newer surgical method with the advantage of preserving anal function and reducing the risk of postoperative anal incontinence [13].

Durgun et al. reported that loose seton placement is a safe and effective method for treating abscesses [14]. However, another study found that patients with anal fistulas who underwent

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**Figure 1.** Flowchart of the study process.

seton drainage or cutting seton experienced fecal incontinence [15]. Some studies suggest that traditional suture techniques may cause further damage to the anal sphincter muscle, affecting the recovery of anal function [16]. On the other hand, new suture techniques, such as biological collagen filling or internal skin flap repair, may have better outcomes in restoring anal function and reducing the occurrence of complications. However, some research indicates that different suture techniques do not show significant differences in anal repair for anal fistula patients, as each technique has its own indications and limitations [17].

There is currently a lack of reports on the effects of the modified anal sphincter suspension procedure on postoperative pain and anal function in patients with anal fistula. Therefore, this study aimed to compare conventional thread-ligating therapy with the modified anal sphincter suspension procedure in terms of anal function and pain in patients with anal fistula, providing a basis for clinical diagnosis and treatment.

## Materials and methods

### Study population

In this retrospective study, data were collected from 120 consecutive patients with anal fistulas who underwent suture techniques at The First People's Hospital of Lin'an District, Hangzhou between January 2022 and December 2023. Patients were divided into two groups based on the surgical methods: a control group, which received conventional thread-ligating therapy (n=54), and the experimental group, which underwent the modified anal sphincter suspension procedure with preservation (n=66). The study process is illustrated in **Figure 1**. The study was approved by the Ethics Review Board of The First People's Hospital of Lin'an District, Hangzhou.

### Inclusion and exclusion criteria

Inclusion criteria: 1) patients diagnosed with anal fistula and who received the modified Parks loose suture; 2) age  $\geq 18$  years; 3) under-

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going first or second surgery; 4) no history of heart, liver, kidney, hematopoietic system disorders, or other functional impairments.

Exclusion criteria: 1) patients with severe organ damage or mental disorders; 2) patients with ulcerative colitis, Crohn's disease, or low anal fistula; 3) patients with a history of other perianal or vaginal surgeries; 4) pregnant or lactating women; 5) patients with other perianal diseases (e.g., hemorrhoids, vegetations); 6) patients with malignant tumors; 7) patients with severe immunodeficiency disease.

### *Surgical treatment*

The control group received conventional thread-ligating therapy. Sacral canal anesthesia was administered to numb the area around the anus. The surgeon identified the external opening of the fistula tract in the skin around the anus, then passed a seton (a thread or rubber band) through the fistula tract and tied it in place. This seton kept the tract open, allowing it to heal from the inside out by facilitating drainage of any infection or pus, thereby reducing the risk of abscess formation. Regular follow-up appointments were scheduled for dressing changes and to monitor the fistula healing process.

The experimental group underwent the modified anal sphincter suspension procedure with preservation treatment. Patients were also placed under sacral canal anesthesia to ensure comfort during the procedure. The surgeon examined the anal area to locate the internal opening of the fistula tract and assess its extent. A seton, made of surgical thread or a rubber band, was passed through the fistula tract and left in place to facilitate drainage and prevent premature closure of the tract. The seton was tied loosely to avoid cutting off the blood supply to surrounding tissues, thereby preserving the anal sphincter muscle and minimizing the risk of incontinence. The seton aided in proper drainage and allowed the fistula to heal from the inside out. Postoperatively, patients were advised on wound care, hygiene practices, and follow-up appointments to monitor healing and ensure proper resolution of the fistula.

### *Data collection and follow-up*

The primary outcomes included anal function and Visual Analog Scale (VAS) scores assessed

within a day before surgery and one week after surgery. Anal function was evaluated using the Wexner Continence Grading Scale (Wexner) [18] and anal pressure indicators. The Wexner score ranges from 0 to 20, with higher scores indicating more severe fecal incontinence. Anal pressure indicators included anal resting pressure (ARP), anal maximal squeezing pressure (AMSP), and rectal resting pressure (RRP), all measured using an anorectal manometry device (XDJ-S8G, Hefei Kelly Optoelectronic Technology Co., Ltd.). The Visual Analog Scale (VAS) [19] was used to assess pain levels, with higher scores indicating more severe pain.

The secondary outcomes included clinical information collected from the electronic medical records of each patient, including age, gender, duration of illness, BMI, medical history, quality of life score, overall efficacy assessment, and postoperative complications. The quality of life was assessed using the SF-36 scale [20], with higher scores indicating a higher quality of life.

### *Statistical analysis*

Data were analyzed using SPSS 23.0 (IBM Inc., IL, USA). Continuous data were expressed as mean  $\pm$  standard deviation (SD) and analyzed using the t-test. Categorical data were compared using the chi-square test, and ordinal data were compared using the Mann-Whitney U test. A *P*-value of less than 0.05 was considered statistically significant.

## **Results**

### *Comparison of baseline data between two groups*

In the experimental group, there were 37 males and 29 females, aged 20 to 53 years, with an average disease duration of  $5.03 \pm 6.36$  years. The control group consisted of 29 males and 25 females, aged 19 to 55 years, with an average disease duration of  $4.54 \pm 4.87$  years. There were no significant differences between the two groups in terms of age, gender, disease duration, BMI, disease type, or medical history (all  $P > 0.05$ ) (**Table 1**).

### *Comparison of surgical-related indicators between the two groups*

The differences in average incision length were statistically significant ( $P < 0.05$ ), with the experimental group showing better outcomes in

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**Table 1.** Comparison of baseline data between the two groups

Clinical indicators	Experimental group (n=66)	Control group (n=54)	t/ $\chi^2$	P
Age	35.36±15.68	37.65±17.98	1.564	0.324
Gender			0.987	0.416
Male	37 (56.06%)	29 (53.70%)		
Female	29 (43.94%)	25 (46.30%)		
Disease course (years)	5.03±6.36	4.54±4.87	1.297	0.339
Height	176.65±5.36	178.31±6.23	2.006	0.268
Weight	156.62±7.68	156.66±8.64	1.446	0.326
Body mass index	21.22±1.78	22.09±1.09	2.098	0.3254
Disease type			0.847	0.587
High complex anal fistula	38 (57.58%)	37 (68.52%)		
High perianal abscess	28 (42.42%)	17 (31.48%)		
Diabetes	38 (57.58%)	36 (66.7%)	1.095	0.439
Hypertension	29 (45.31%)	20 (37.03%)	1.143	0.546
Coronary heart disease	32 (48.48%)	20 (37.03%)	3.876	0.098
Chronic Kidney disease	12 (18.18%)	9 (16.67%)	1.766	0.657

**Table 2.** Comparison of surgical-related indicators between the two groups

Group	Average incision length (cm)	Wound area (cm <sup>2</sup> )	Surgical time (min)	Time for complete wound healing
Experimental group (n=66)	6.32±0.89	10.64±1.87	48.26±9.98	49.67±18.65
Control group (n=54)	6.32±0.87	15.64±1.89	55.98±9.56	62.67±15.06
T	0.864	8.029	6.784	12.265
P	0.465	0.004	0.025	0.001

**Table 3.** Comparison of clinical efficacy between the two groups

Group	Recovery	Healed	Recrudescence
Experimental group (n=66)	60 (90.91%)	6 (9.09%)	0 (0%)
Control group (n=54)	50 (92.59%)	4 (7.41%)	0 (0%)
$\chi^2$	2.93	3.39	-
P	0.74	0.33	-

wound area, surgical time, and time to complete wound healing (all  $P < 0.05$ ) compared to the control group (**Table 2**).

### *Comparison of clinical efficacy between the two groups*

The cure rate was 90.91% (60/66) in the experimental group and 92.59% (50/54) in the control group. There was no statistically significant difference in cure rates between the two groups ( $P > 0.05$ ) (**Table 3**).

### *Comparison of quality of life scores between the two groups*

SF-36 scores are shown in **Table 4**. Compared to the control group, the experimental group

had higher scores in psychological function (89.65±6.87 vs. 89.35±7.67,  $P = 0.004$ ), material life (85.64±6.87 vs. 68.64±6.58,  $P = 0.002$ ), physical function (80.98±5.98 vs. 70.85±5.68,  $P = 0.003$ ), and social function (86.63±5.97 vs. 74.65±6.38,  $P = 0.009$ ) after surgery.

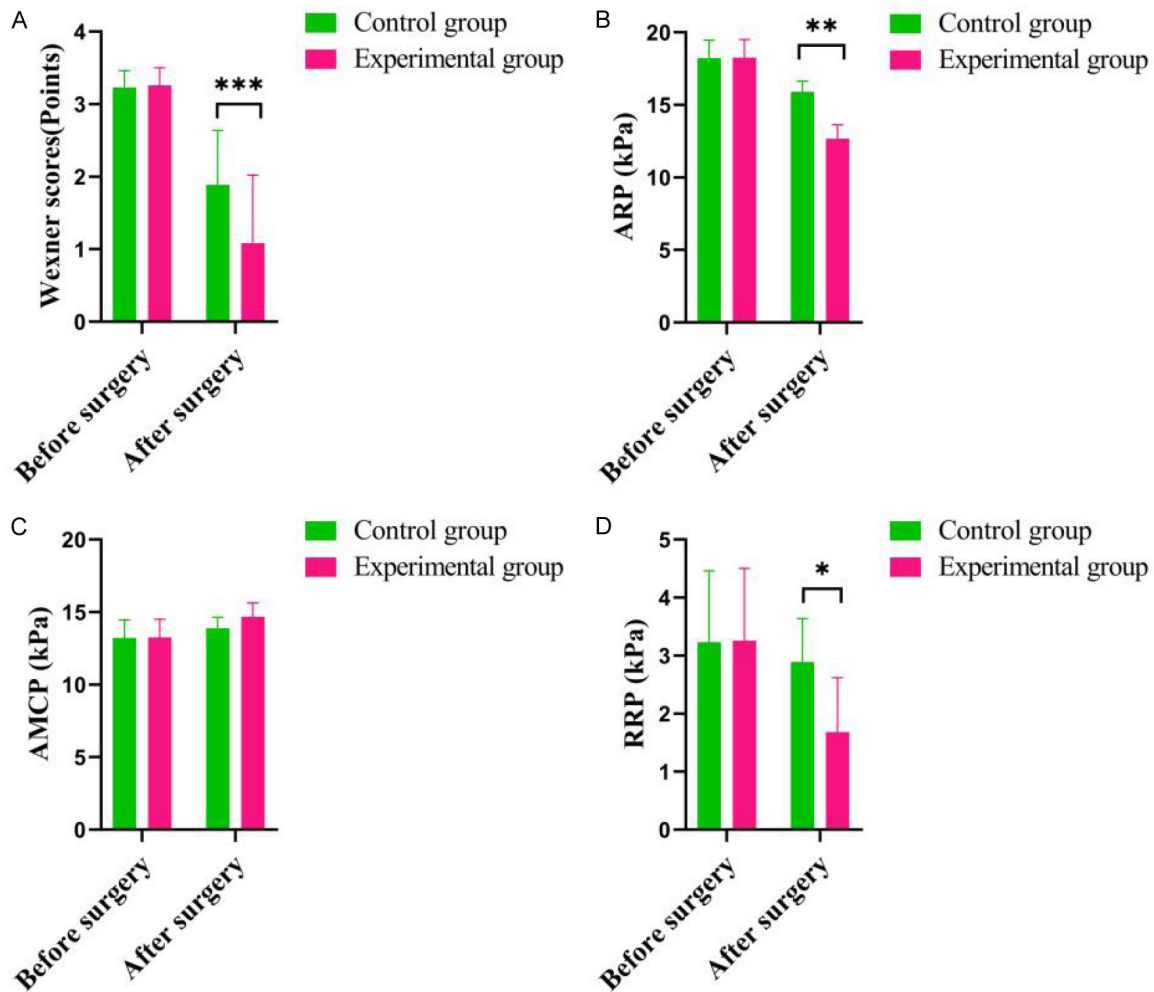
### *Comparison of anal function between the two groups*

There was no statistically significant difference in Wexner scores between the two groups on the day before surgery (3.14±0.32 vs. 3.16±0.37,  $P > 0.05$ ). However, both groups showed reduced Wexner scores one week after surgery (1.98±1.32 vs. 1.12±1.24,  $P < 0.05$ ), with the experimental group having significantly lower

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**Table 4.** Comparison of quality of life scores between the two groups

Group	Psychological function		Material life		Physical function		Social function	
	Before surgery	After surgery	Before surgery	After surgery	Before surgery	After surgery	Before surgery	After surgery
Experimental group (n=66)	66.52±7.35	89.65±6.87	64.98±7.68	85.64±6.87	62.51±5.92	80.98±5.98	69.69±6.23	86.63±5.97
Control group (n=54)	66.32±7.23	78.35±7.67	64.35±6.54	68.64±6.58	62.21±5.89	70.85±5.68	66.52±6.53	74.65±6.38
T	0.293	6.485	0.509	9.986	0.165	8.885	0.147	7.987
P	0.132	0.004	0.221	0.002	0.124	0.003	0.312	0.009



**Figure 2.** Comparison of anal function between the two groups. A: Wexner scores; B: ARP; C: AMCP; D: RRP. ARP: Anal pressure indicators include anal resting pressure; RRP: And rectal resting pressure; AMCP: Anal Squeezing Pressure Recovered. \* $P < 0.05$ , \*\* $P < 0.01$ , and \*\*\* $P < 0.001$ , compared to the control group.

scores than the control group ( $P < 0.05$ ) (Figure 2A).

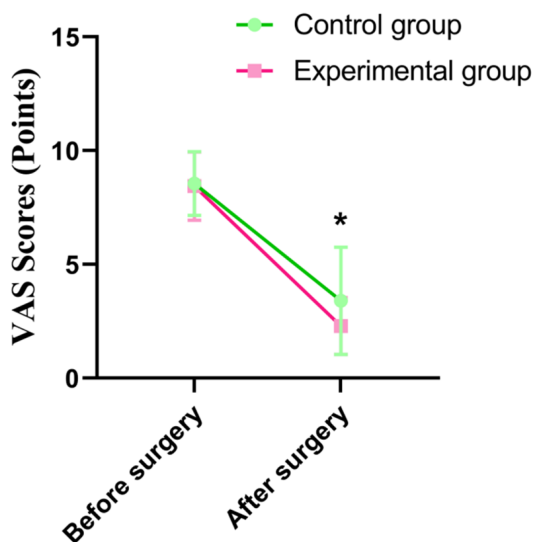
The ARP levels were not statistically different between the two groups on the day before surgery ( $18.14 \pm 0.22$  vs.  $19.16 \pm 0.27$ ,  $P > 0.05$ ), but both groups showed reduced ARP levels one week after surgery ( $16.18 \pm 0.12$  vs.  $13.12 \pm 0.24$ ,  $P < 0.05$ ), with the experimental group

having significantly lower ARP levels than the control group ( $P < 0.05$ ) (Figure 2B).

There were no statistically significant differences in AMSP levels between the two groups ( $P > 0.05$ ) (Figure 2C).

RRP levels were not statistically different between the two groups on the day before sur-

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**Figure 3.** Comparison of VAS scores between the two groups. \* $P < 0.05$ , compared to the control group. VAS: Visual Analog Scale.

gery ( $3.14 \pm 1.22$  vs.  $3.26 \pm 1.27$ ,  $P > 0.05$ ), but both groups showed reduced RRP levels one week after surgery ( $3.08 \pm 0.42$  vs.  $1.42 \pm 0.34$ ,  $P < 0.05$ ), with the experimental group having significantly lower RRP levels than the control group ( $P < 0.05$ ) (Figure 2D).

### Comparison of pain scores and incidence of postoperative complications between two groups

The results of the pain scores are shown in Figure 3. VAS scores did not differ significantly between the two groups on the day before surgery ( $8.14 \pm 0.22$  vs.  $8.16 \pm 0.27$ ,  $P > 0.05$ ). However, both groups showed a reduction in VAS scores one week after surgery ( $3.98 \pm 1.92$  vs.  $2.12 \pm 1.74$ ,  $P < 0.05$ ), with the experimental group exhibiting significantly lower scores than the control group ( $P < 0.05$ ). Additionally, there were no significant differences in the incidence of postoperative complications between the two groups (all  $P > 0.05$ , Table 5).

### Discussion

Anal fistula is a condition characterized by the development of a small tunnel between the skin near the anus and the inside of the anal canal [21]. It can cause pain, swelling, and pus discharge. The most common surgical treatment for anal fistula is fistulotomy, where the fistula tract is cut open, and the infected tissue

is removed [22, 23]. Another common surgical approach is seton placement, where a piece of material is inserted into the fistula tract to keep it open and allow it to heal from the inside out [24]. Postoperatively, patients may require a drainage tube or seton to remain in place for a period to ensure proper healing [25]. Surgical treatment for anal fistula can impact anal function, with some patients experiencing temporary or permanent changes in bowel movements, such as increased frequency or urgency [26, 27]. Additionally, some patients may experience fecal incontinence or difficulty controlling gas. Therefore, maximizing the preservation of anal function in patients with anal fistula has become a critical challenge.

The modified anal sphincter suspension procedure with preservation offers several advantages over conventional thread-ligating therapy. Firstly, it better preserves bowel control; the anal sphincter muscle is crucial in controlling bowel movements. By preserving this muscle during surgery, patients are less likely to experience postoperative issues with incontinence or loss of bowel control. Secondly, cutting or damaging the anal sphincter muscle during surgery can lead to complications such as infection, bleeding, or delayed healing [28]. By preserving the muscle, the risk of these complications is significantly reduced. Thirdly, preserving the anal sphincter muscle can lead to better long-term outcomes, including improved quality of life and overall patient satisfaction with the surgical procedure. Lastly, patients who undergo surgery with anal sphincter muscle preservation may experience a faster and smoother recovery compared to those who undergo traditional methods that involve cutting or damaging the muscle.

Our research demonstrated that the modified anal sphincter suspension procedure with preservation treatment could improve anal function, as indicated by the significant reduction in Wexner scores, ARP, and RRP in the experimental group. Preserving anal sphincter function is crucial for patients with anal fistulas, as it directly impacts their quality of life and overall well-being. One of the surgical techniques employed to enhance anal function in these patients is the preservation of the anal sphincter muscle with a seton placement procedure. The anal sphincter muscle plays a vital role in controlling bowel movements and maintaining

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**Table 5.** Comparison of incidence of postoperative complications between the two groups

Group	Experimental group (n=66)	Control group (n=54)	$\chi^2$	P
Anal leakage	2 (3.03%)	3 (5.56%)	0.001	1.002
Anorectal deformation	0 (0.0%)	1 (1.85%)	0.000	0.987
Abnormal bowel function	1 (1.51%)	7 (12.96%)	3.982	0.065

continence. This technique precisely locates and manages the fistula tract, minimizing damage to the surrounding normal tissues. By carefully adjusting the tension and position of the seton, the procedure helps to gradually cut through the involved tissues while avoiding excessive damage to the anal sphincter complex. This is particularly important for patients with anal fistulas, as the presence of a fistula can disrupt the normal function of the anal sphincter muscle [29].

In this study, the results demonstrated that the modified anal sphincter suspension procedure with preservation treatment can effectively reduce pain in patients with anal fistula. Firstly, the modified thread-drawing technique allows for gradual and controlled cutting through the anal sphincter, avoiding sudden and excessive tension, which reduces the immediate sharp pain often caused by rapid tissue disruption. Secondly, by preserving the anal sphincter, this approach helps maintain the normal structure and function of the anal area, minimizing the impact on surrounding tissues and nerve endings, thereby alleviating pain. Additionally, this technique promotes better wound healing and reduces the occurrence of complications that might otherwise exacerbate pain. It also enhances blood circulation and tissue repair in the anal region, further contributing to pain relief and recovery. Overall, the combination of these techniques effectively manages the treatment process, leading to a significant reduction in pain for patients with anal fistula.

The study also showed that the modified anal sphincter suspension procedure with preservation treatment could decrease the incidence of postoperative complications. The modified technique is more precise and gentle, minimizing damage to surrounding tissues and structures, which helps reduce the risk of bleeding, infection, and other complications. By better preserving the anus, it maintains normal physiological function and integrity, which is beneficial for proper wound healing and reduces the

likelihood of complications such as anal stricture and fecal incontinence. Moreover, the combined approach allows for better control of the tension and cutting process, avoiding excessive stress on the anal sphincter and reducing the potential for related complications such as sphincter injury. Additionally, it promotes improved blood circulation and tissue repair in the treated area, facilitating recovery and minimizing adverse events. Overall, these measures effectively lower the incidence of postoperative complications in patients undergoing treatment for anal fistula.

Furthermore, the study found that the modified anal sphincter suspension procedure with preservation treatment could improve the quality of life for patients with anal fistulas. By preserving the integrity of the anal sphincter muscle, patients are less likely to experience fecal incontinence after surgery [30], leading to significant improvements in overall well-being and quality of life. The modified surgery also carries a lower risk of complications compared to traditional anal sphincterotomy [31]. This reduction in risk, combined with a decrease in psychological stress and anxiety, allows patients to avoid the persistent distress caused by their condition, positively impacting their mental and emotional well-being and further enhancing their overall quality of life. Consequently, patients are less likely to experience postoperative pain, infection, or other issues that could hinder their recovery and diminish their quality of life.

This study has a few limitations. Firstly, the study duration was limited, and the long-term efficacy of the treatment was not evaluated. Secondly, this study was a single-center, small-sample retrospective analysis, which may introduce selection bias. Additionally, the study only explored a limited range of intervention methods and did not compare multiple intervention strategies. Future research should consider expanding the sample size, extending the duration of longitudinal studies, and exploring the effects of the modified anal sphincter suspen-

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sion procedure with preservation on anal function in patients with anal fistulas.

In summary, compared to conventional thread-ligating therapy, the modified anal sphincter suspension procedure with preservation treatment for patients with anal fistula can relieve postoperative pain, improve anal function, and enhance the quality of life.

### Disclosure of conflict of interest

None.

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