



Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.elsevier.com/locate/ejogrb

Full length article

Comparison of preoperative and postoperative sexual function in patients with deeply infiltrating endometriosis with and without bowel resection



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ARTICLE INFO

Article history:

Received 4 November 2018

Received in revised form 20 March 2019

Accepted 9 May 2019

Keywords:

Deeply infiltrating endometriosis

Rectovaginal septum

Sexual function

Sexual satisfaction

Lubrication

Massachusetts General Hospital Sexual Functioning Questionnaire

ABSTRACT

Objective: To analyze preoperative and postoperative sexual function following surgery for deeply infiltrating endometriosis (DIE) with and without bowel involvement.

Study design: Patients with DIE who underwent surgery between 2001 and 2011 with segmental bowel resection (WB) or without segmental bowel resection (WOB) were surveyed using the German version of the Massachusetts General Hospital Sexual Functioning Questionnaire (KFSP). Responses were given on a six-point scale for the items sexual interest, sexual arousal, orgasm, lubrication, and general sexual satisfaction. As there are no cut-off values for the existence of sexual function disorders, a control group with no history of endometriosis was evaluated. Differences between the preoperative and postoperative results, as well as between WB, WOB, and a control group, were compared using the Wilcoxon test, Mann–Whitney *U* test, and Fisher's exact test.

Results: Eighty-nine patients without bowel resection (mean age 34.3 years; mean follow-up 63.2 months), 87 patients with bowel resection (mean age 37.7 years; mean follow-up 69.6 months), and 100 control patients aged 21–58 years (mean age 35.0 years) were evaluated. Preoperatively, both treatment groups had significantly poorer scores in all categories in comparison with the control group. The WOB group improved significantly in all categories postoperatively, with no further significant differences from the control group. No significant postoperative improvement was observed in the WB group, and the group had significantly poorer scores in comparison with the control group. The number of previous operations is associated with significantly poorer postoperative KFSP results. Sterility and age > 40 years are associated with significantly less improvement in the KFSP, although with lower initial values.

Conclusions: Patients with DIE with or without bowel involvement have significantly impaired sexual function preoperatively. Complete resection of endometriosis in the WOB group was able to improve sexual function, as the women had sexual scores similar to those in the healthy control group postoperatively. Possible explanations for the lack of postoperative improvement of sexual function after segmental bowel resection include the type of surgery carried out, or injury to the affected nerves resulting from the endometriosis.

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Introduction

Surgical treatment for deeply infiltrating endometriosis (DIE) requires complete resection of all of the affected organ structures in order to achieve an optimal outcome [1–3]. The vagina,

rectovaginal septum, and/or sacrouterine ligaments, bladder, and bowel are the structures most often affected [4], and the lesions are often associated with severe fibrosis and adhesions. When the rectum is involved, the surgeon may choose between anterior rectum resection and bowel-preserving techniques such as shaving and wedge resection [5]. The complication rates appear to be lower with the latter approach, but the success rate in relation to pain reduction also seems to be lower [6,7]. The data on this topic are as yet unclear.

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Due to the radical nature of complete resection of all endometriosis lesions, the patient needs to be informed about possible alternatives. Drug treatment is one alternative [8]. A less radical surgical procedure, leaving some endometriosis lesions in place, followed by drug treatment, may also be considered.

Whenever possible, the procedure should be performed laparoscopically [9] in a single session, with healthy margins. Due to the radical surgical approach that is needed, complications occur. A distinction is made in the literature between major and minor complications [10]. Major complications comprise conditions that require immediate intervention such as surgery or severe infections, hemorrhage requiring a blood transfusion, anastomotic insufficiencies after bowel resection, intestinal perforation, as well as rectovaginal fistulas [10]. Intraoperative injuries to organs and structures are also included. Major complication rates in the range of 2.9–8.4% have been reported for DIE without rectal resection [11,12]. In patients with DIE with rectal resection, the major complication rates reported range from 7.4%–25% [13,14].

Minor complications that occur include slight or moderate infections – for example, urinary tract infections. Other minor complications also involve short-term disturbances that are self-limiting and often need no further intervention, such as postoperative voiding dysfunctions, urinary obstructions, or peripheral sensory disturbances [10]. In DIE without or with segmental bowel resection, these occur in 0–14.7% of cases [11,15] and 0.6–57% of cases [16,17], respectively. However, a distinction between DIE with or without bowel involvement is only rarely made in the literature reports. Our research group has observed a major complication rate of 3.7% for patients with DIE without bowel resection, with a short-term minor complication rate of 12.7% [18]. In patients with DIE who undergo bowel resection, the major complication rate is 15.9% and the short-term minor complication rate 15% [19].

Major complications and short-term minor complications also need to be distinguished from long-term minor complications that involve persistent functional deficits in bladder, bowel, and sexual function. These occur due to the surgical procedure, which affects anatomic regions and structures such as the area of the rectovaginal septum and/or sacrouterine ligaments, which contain a considerable amount of nerve tissue, leading to impairments to the vascular and neural supply in the lesser pelvis [20]. Deep dyspareunia correlates with the extent of endometriotic lesions infiltrating the uterosacral ligaments [21,22].

There are few data available regarding long-term impairment or improvement of sexual function after surgery and drug treatment for deep endometriosis [23,24]. Due to the young age of the patients affected, this aspect requires further investigation. The radical surgical approach needed in the treatment of DIE carries a risk of long-term restriction of sexual function, but some authors have also reported postoperative improvement in sexual function in patients with DIE who undergo bowel resection [25–27].

The aim of the present study was to analyze sexual function after surgery for deeply infiltrating endometriosis with and without anterior rectal resection at the Department of Gynecology at Erlangen University Hospital/Friedrich Alexander University during the period from 2001 to 2011.

Materials and methods

The present study is methodologically based on a previous study carried out by our research group, investigating major and minor complications after resection for deeply infiltrating endometriosis with and without bowel resection [18,19]. In brief, the methods used were as follows.

Patients with ICD-10 diagnosis N80.8 (other endometriosis) and/or N80.5 (endometriosis of the intestine) and/or N80.4 (endometriosis of the rectovaginal septum and vagina) were included in the study. The authors evaluated the surgical reports between 2001 and 2011 for these patients. Authorization for the study was given by the Ethics Committee of Friedrich Alexander University, Erlangen (no. 307_12B).

Patients with deeply infiltrating endometriosis who were treated using resection with or without bowel resection and/or dissection of the vagina, sacrouterine ligaments, and/or rectovaginal septum were included in the study. Deeply infiltrating endometriosis was defined as having an infiltration depth greater than 5 mm; it includes Enzian classes A1–3 and/or Enzian B1–3 and/or Enzian C1–3 [28–32]. Patients who underwent wedge resection of the intestine and/or hysterectomy during the operation or previously were excluded.

Two patient groups were formed: patients who underwent surgery for DIE without segmental bowel resection (WOB) and those with segmental bowel resection (WB). The aim of this distinction was to assess the varying major and minor complication rates in these two groups, which are also discussed in the literature [18,19]. The patient data were obtained from their files, and the surgical reports were examined for data [18,19].

In this retrospective study, all of the patients received a questionnaire postoperatively at the time when the study was conducted. The questionnaires were sent by post, and if there was no response a reminder letter was sent and a phone call to the patient was made. The questionnaire comprised questions about the patient's sexual function before the operation and currently, as well as specific questions about her history, the postoperative course, and her state of health.

Preoperative and long-term sexual function and sexual pleasure were surveyed retrospectively by asking the patients to complete the German version of the Massachusetts General Hospital Sexual Functioning Questionnaire (*Kurzfragebogen Sexualität und Partnerschaft*, KFSP) (Table 1) [33–35]. The questions referred to the last 4 weeks before the questionnaire was completed and the 4 weeks before the operation. There are no cut-off values available for the existence of a sexual function disorder. A control group consisting of women of the same age group who did not have a history of endometriosis or hysterectomy was therefore also evaluated, using the same questionnaire.

The KFSP questionnaire is based on the Massachusetts General Hospital Sexual Function Questionnaire [34]. This standardized questionnaire consists of five questions. On a six-point scale (1, more than before; 2, normal; 3, minimally less than before; 4, less than before; 5, considerably less than before; 6, nonexistent), patients can record their level of sexual interest and their ability to reach sexual arousal, to experience an orgasm, to attain lubrication, and their general sexual satisfaction. The maximum score per question is 6 and the maximum overall score is 30, which is the

Table 1

Items included in the Sexuality and Partnership Questionnaire (34, 35) The patients respond using a six-point scale (1, more than before; 2, normal; 3, minimally less than before; 4, less than before; 5, considerably less than before; 6, nonexistent).

No.	Item
1	What was your level of interest in sex during the last month?
2	How able were you to achieve sexual arousal during the last month?
3	How able were you to achieve orgasm during the last month?
4	(Only for women) How was your lubrication during the last month? (Only for men) How able were you to achieve an erection during the last month?
5	How would you grade your general level of sexual satisfaction during the last month?

poorest score that can be obtained. The question about erectile dysfunction was omitted, since only female patients were included.

The KFSP questionnaire does not have a cut-off value for the presence of a sexual functioning disturbance. A control group was therefore formed. The questionnaire was sent to volunteers aged 18–58 among contacts of the hospital staff and doctoral students (acquaintances, friends, and other students). Previous hysterectomy and/or a medical history including past or current endometriosis were exclusion criteria. This means that the members of the control group were not permitted to have undergone any diagnostic examinations (examination, ultrasound, or surgery) or treatment due to suspected endometriosis. It was ensured that the age distribution was similar; family planning, infertility, and parity did not have any influence on inclusion in the control group.

Intragroup comparisons were performed using the Wilcoxon test, and intergroup comparisons were done with the Kruskal–Wallis test, the Mann–Whitney *U* test, and Fisher’s exact test. The significance level using the Benjamini–Hochberg procedure was $p < 0.029$.

A multiple regression model was used to take into account the influencing factors of numbers of previous operations, sterility as a reason for surgery, and age, in addition to the influence of group membership on the total postoperative score. The variables PreOP and Age were defined to allow nonlinear associations to be investigated. Numbers of previous operations were classified as “0,” “1,” and “2 or more,” and the patient’s age at the time of responding to the questionnaire was classified as “up to 30,” “31–65,” “36–40,” and “41 or more.” The variable of group membership (WB or WOB) was also investigated.

A similar model with the same independent variables was also calculated for improvements in the total score as the target variable. The level of significance for the linear models was set at $p < 0.05$.

Results

Between 2001 and 2011, a total of 683 patients received diagnoses of ICD-10 N80.4 and/or N80.5 and/or N80.8. The surgical reports for these patients were reviewed. A total of 134 patients who underwent resection of deeply infiltrating endometriosis in the rectovaginal septum and/or sacrouterine ligaments without bowel resection (WOB) and 113 patients with anterior rectal resection (WB) were included in the study.

In the WOB group, the questionnaire response rate was 66.4% (89 patients) and the mean follow-up period was 63.2 months (SD 31.4 months); the patients’ mean age was 34.3 years (SD 6.0 years) and their mean body mass index (BMI) was 22.6 (SD 3.7). In the WB group, 87 of the 113 women returned the questionnaire (77.0%) and the mean follow-up period was 69.6 months (SD 26.3 months); the patients’ mean age was 37.7 years (SD 6.0) and their mean BMI was

23.4 (SD 4.4). The control group consisted of 100 patients aged 21–58 years, with a mean age of 35.0 (SD 8.7 years).

Thirty patients (33.7%) in the WOB group and 37 patients (42.5%) in the WB group had one prior operation for endometriosis; 23 (25.8%, WOB group) and 30 (34.5%, WB group) had two or more previous operations. The patients in the WB group had undergone significantly more previous operations for endometriosis ($p = 0.0022$).

In the WB group ($n = 86$), the reasons for surgery were reported to be dysmenorrhea in 70.9% of the patients ($n = 61$), dyspareunia in 41.9% ($n = 36$), dysuria in 25.6% ($n = 22$), dyschezia in 57% ($n = 49$), and sterility in 64% ($n = 55$). In the WOB group ($n = 89$), the reasons for surgery were reported to be dysmenorrhea in 65.2% ($n = 58$), dyspareunia in 50.6% ($n = 45$), dysuria in 12.4% ($n = 11$), dyschezia in 33.7% ($n = 30$), and sterility in 36% ($n = 32$). Dyschezia ($p = 0.0024$) and sterility ($p = 0.0003$) occurred significantly more often in the WB group.

Table 2 provides details of the operations. Patients who had successful bowel resections underwent vaginal dissection significantly more often and unilateral dissection of the sacrouterine ligament significantly less often.

Analysis of the preoperative KFSP in both groups showed significantly poorer scores for all five subscores and for the overall score in comparison with the control group. There were no significant differences between the two treatment groups before surgery ($p = 0.53$). Details are shown in Table 3 and Fig. 1a.

WOB group

The WOB group showed significant improvement in all items surveyed, leading to a significant increase in the overall KFSP score in the preoperative/postoperative comparison. After surgery, the overall score and the items “sexual arousal,” “ability to achieve lubrication,” and “sexual satisfaction” differed significantly from the scores in the WB group. Due to this improvement after surgery, the WOB group no longer differed from the control group (Tables 3–5 and Fig. 1b,c).

Analysis and graphic depictions were carried out for all patients who responded to all of the questions both preoperatively and postoperatively. The numbers of patients with DIE without bowel resection who experienced improvement, no change, or deterioration on any subscore or the overall score are shown in Fig. 2.

After surgery, 38 patients experienced an improvement in their level of sexual interest, with a mean increase of 2.58 points; 17 saw a decrease (mean 2.29), and 19 remained the same (total, $n = 74$). Twenty-seven patients reported an improvement in their ability to have an orgasm (mean 3.00), 12 saw a decrease (mean 2.25), and 35 women stated that there was no change (total, $n = 74$). Lubrication improved in 25 women (mean 2.72), deteriorated in 10 (mean 2.30), and remained the same in 38 (total, $n = 73$). In 35 patients,

Table 2

Details of surgical treatment. Local R0 resection: no macroscopic residual lesion in the area of the deeply infiltrating endometriosis (DIE); complete R0 resection: no macroscopic residual lesion in any endometriotic lesions present (excluding adenomyosis). Significant differences were tested (p) using Fisher’s exact test; the significance level using the Benjamini–Hochberg procedure was $p < 0.029$.

	DIE without segmental bowel resection (WOB)			DIE with segmental bowel resection (WB)			<i>p</i>
	Total	<i>n</i>	%	Total	<i>n</i>	%	
Laparoscopic access route	89	88	98.9	87	83	95.4	0.208
Endometriosis excision							
Vagina	89	37	41.6	87	66	75.9	<0.001
Rectovaginal septum	89	80	89.9	87	76	87.4	0.641
Sacrouterine ligament, unilateral	89	43	48.3	87	7	8.0	<0.001
Sacrouterine ligament, bilateral	89	24	27.0	87	21	24.1	0.731
Other endometriotic lesions	89	67	75.3	87	63	72.4	0.733
Local R0 resection	89	86	96.6	87	86	98.9	0.621
Complete R0 resection	89	84	94.4	87	74	85.1	0.048

Table 3
Preoperative results with the Massachusetts General Hospital Sexual Functioning Questionnaire: short questionnaire on sexuality and partnership. Comparison of KFSP results between the group without bowel resection (WOB) and the group with bowel resection (WB), between each other and against the control group (CG). The data are presented as means with standard deviation (SD). Significant differences were tested (p) using the Mann–Whitney U test; the significance level using the Benjamini–Hochberg procedure was $p < 0.029$.

	WOB ($n = 74$) Mean (SD)	WB ($n = 77$) Mean (SD)	WOB vs. WB p	CG ($n = 100$) Mean (SD)	WOB vs. CG p	WB vs. CG p
Sexual interest	4.03 (1.68)	4.05 (1.65)	1	2.60 (1.19)	< 0.001	< 0.001
Sexual arousal	3.89 (1.71)	3.70 (1.58)	0.442	2.55 (1.17)	< 0.001	< 0.001
Ability to experience orgasm	3.85 (1.78)	3.62 (1.71)	0.413	2.65 (1.28)	< 0.001	< 0.001
Ability to achieve lubrication	3.49 (1.80)	3.21 (1.60)	0.366	2.52 (1.17)	< 0.001	0.003
Sexual satisfaction	4.00 (1.73)	3.94 (1.66)	0.732	2.61 (1.24)	< 0.001	< 0.001
Overall score	19.3 (8.00)	18.2 (7.30)	0.53	12.9 (5.00)	< 0.001	< 0.001

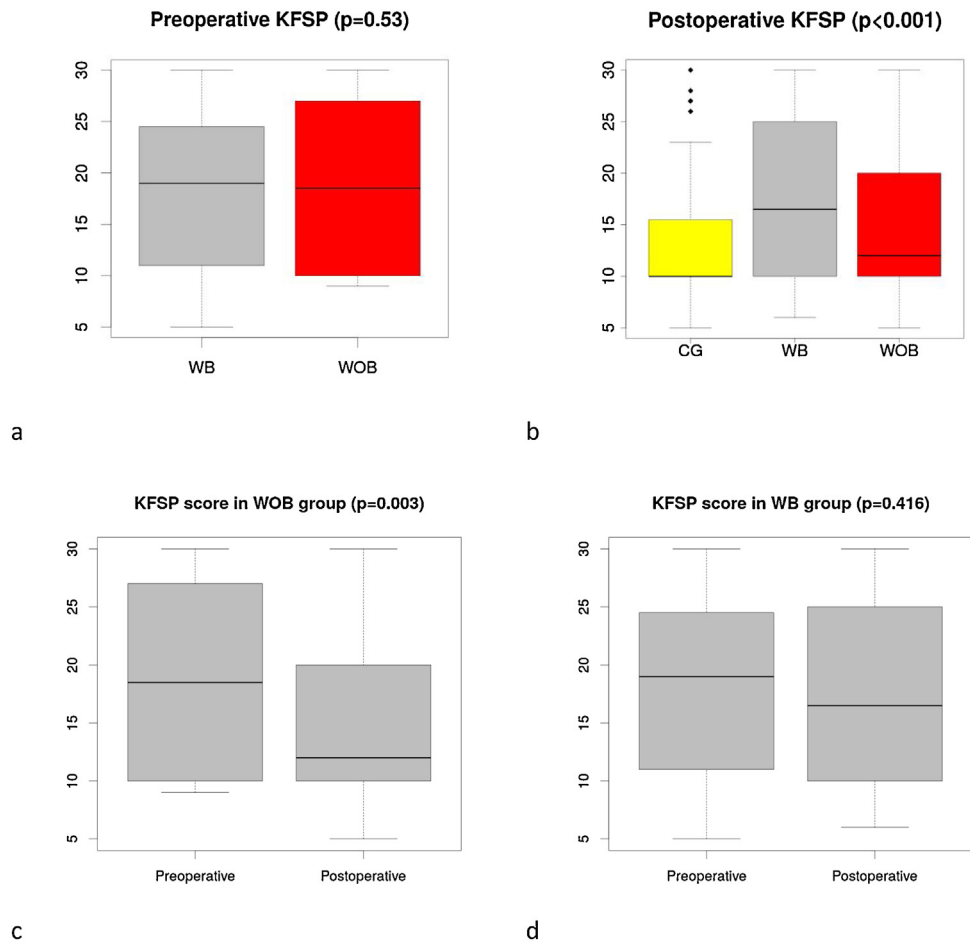


Fig. 1. a–d. Preoperative and postoperative KFSP scores. Significant differences (p) were tested using the Mann–Whitney U test (a), the Kruskal–Wallis test (b), and the Wilcoxon test (c, d). Significance with the Benjamini–Hochberg procedure: $p < 0.029$. CG, control group; KFSP, *Kurzfragebogen Sexualität und Partnerschaft* (German version of the Massachusetts General Hospital Sexual Functioning Questionnaire); WB, with bowel resection; WOB, without bowel resection.

sexual satisfaction improved (mean 2.80), whereas it deteriorated in 16 (mean 2.38) and stayed the same in 21 (total, $n = 72$). The overall score increased for 41 women (mean 10.56), decreased in 20 (mean 7.45), and remained the same in 10 patients ($n = 71$).

WB group

In the WB group, there were no postoperative improvements in the subscores or overall KFSP scores. The overall score before surgery was 18.2 (SD 7.30); after surgery, it was 17.9 (SD 7.50). The score for the item “lubrication” deteriorated postoperatively, but not significantly. All subgroups and the overall KFSP score

showed continuing significant differences in comparison with the control group ($p < 0.001$). The results are shown in Tables 3–5 and Fig. 1b,d.

Analysis and graphic depictions were again carried out for all patients who answered all of the questions both preoperatively and postoperatively and reported improvement, no change, or deterioration in any subscore or in the overall KFSP score (Fig. 3).

After surgery, 33 patients in the WB group experienced an increase in their level of sexual interest (mean 2.36), 22 saw a decrease (mean 2.36), and 21 reported no difference (total, $n = 76$). Lubrication increased in 15 women (mean 2.40), deteriorated in 26 (mean 2.35), and remained the same in 35 (total, $n = 76$).

Table 4

Postoperative results with the Massachusetts General Hospital Sexual Functioning Questionnaire: short questionnaire on sexuality and partnership (KFSP). Comparison of KFSP results between the group without bowel resection (WOB) and the group with bowel resection (WB), between each other and against the control group (CG). The data are presented as means with standard deviation (SD). Significant differences were tested (*p*) using the Mann–Whitney *U* test; the significance level using the Benjamini–Hochberg procedure was *p* < 0.029.

	WOB <i>n</i> = 83 Mean (SD)	WB <i>n</i> = 84 Mean (SD)	WOB vs. WB <i>p</i>	CG <i>n</i> = 100 Mean (SD)	WOB vs. CG <i>p</i>	WB vs. CG <i>p</i>
Sexual interest	3.27 (1.59)	3.75 (1.67)	0.056	2.60 (1.19)	0.004	< 0.001
Sexual arousal	3.01 (1.47)	3.54 (1.63)	0.027	2.55 (1.17)	0.037	< 0.001
Ability to experience an orgasm	3.07 (1.69)	3.53 (1.81)	0.071	2.65 (1.28)	0.260	0.001
Ability to achieve lubrication	2.85 (1.48)	3.55 (1.69)	0.005	2.52 (1.17)	0.171	< 0.001
Sexual satisfaction	3.20 (1.69)	3.75 (1.66)	0.024	2.61 (1.24)	0.031	< 0.001
Overall score	15.3 (6.70)	17.9 (7.50)	0.015	12.9 (5.00)	0.01	< 0.001

Table 5

Massachusetts General Hospital Sexual Functioning Questionnaire: short questionnaire on sexuality and partnership (KFSP). Comparison of preoperative versus postoperative KFSP results between the group without bowel resection (WOB) and the group with bowel resection (WB). Significant differences were tested (*p*) using the Wilcoxon test. The significance level using the Benjamini–Hochberg procedure was *p* < 0.029.

	WOB preoperative vs. postoperative <i>p</i>	WB preoperative vs. postoperative <i>p</i>
Sexual interest	0.006	0.201
Sexual arousal	< 0.001	0.297
Ability to experience an orgasm	0.005	0.910
Ability to achieve lubrication	0.007	0.153
Sexual satisfaction	0.005	0.415
Overall score	0.003	0.416

Improvement in the overall KFSP score was seen in 35 women (mean 7.94), a decrease in 27 (mean 8.26), and no change in 12 (total, *n* = 74).

Linear models for investigating factors influencing postoperative KFSP and improvement resulting from surgery

Table 6 shows the linear model with the target variable of total postoperative KFSP score. The WOB group had significantly better results (*p* = 0.042) than the WB group. Patients with two or more previous operations had significantly poorer overall scores. Sterility as the reason for surgery and the patient's age were not found to have any influence in this model.

Table 7 shows the linear model with the target variable of preoperative–postoperative difference in the total KFSP score. Significantly less improvement was seen in the total KFSP score in patients who stated that sterility was the reason for surgery (*p* = 0.010) and in patients who were aged over 40 (*p* = 0.004). Membership of the WB or WOB groups and numbers of previous operations were not found to have any influence in this model.

Discussion

A total of 247 patients were included in this study and underwent surgery with bowel resection (WB) or without bowel resection (WOB) for deeply infiltrating endometriosis. The questionnaire response rates were high, at 66.4% in the WOB group and 76.9% in the WB group. A special feature of the study is the long follow-up period, at 63.2 months in the WOB group and 69.6 months in the WB group.

There were significant differences between the two groups studied in relation to the symptoms dyschezia and sterility. Other significant differences included more frequent vaginal dissection, less frequent unilateral dissection of the sacrouterine ligament, and larger numbers of endometriosis-related prior operations in the group who underwent successful bowel resection.

Preoperatively, all of the KFSP items investigated in both treatment groups were poorer in comparison with the control group, and there were no significant preoperative differences between the WB and WOB groups.

Postoperatively, the WOB group had higher scores for all of the items investigated in comparison with the control group. The differences were no longer significant, reflecting improvement in sexual function, although it was not completely aligned with the healthy control group. Following surgical resection for DIE in the rectovaginal septum without bowel involvement, the patients reported levels of sexual interest, sexual arousal, ability to experience an orgasm, lubrication, and overall sexual satisfaction that were similar to those in women who had no history of endometriosis.

By contrast, the WB group did not experience any significant postoperative improvement in any of the objective values. Possible explanations for the lack of postoperative improvement of sexual function after segmental bowel resection include the type of surgery carried out, or injury to the affected nerves resulting from the endometriosis.

There is a similar lack of published data for comparisons between preoperative and postoperative sexual function and comparisons with a control group in patients who undergo rectal resection due to carcinoma [36].

The WB group had undergone significantly more previous operations for endometriosis. Both the earlier operations and also DIE in itself may already have caused neural damage. Intraoperative damage to the affected nerves and dissection of the vaginal wall may also be involved, although the poorer preoperative scores make this appear doubtful.

Two linear models were used to examine the influencing factors of group membership (WB or WOB), patient's age, number of previous operations, and sterility as the reason for surgery in relation to the total postoperative KFSP score and the difference between the preoperative and postoperative total scores. It was found that the WOB group had significantly better total postoperative scores than the WB group, and patients with two or more previous operations had significantly poorer results.

This shows that the indication for surgical treatment of endometriosis needs to be established carefully in order to avoid unnecessary operations that may have negative effects on the patient's sexuality. Drug treatment options should be examined as an alternative.

Patients aged over 40 and patients who stated that sterility was the reason for surgery both had significantly poorer total postoperative scores in comparison with the preoperative ones. An important reason for this is that women with sterility as the reason for surgery also had better total preoperative scores than women who did not give this as the reason, so that the improvement (i.e., the difference) in the total score was not capable of being as large. The fact that women with sterility as the reason for surgery had better total preoperative scores is

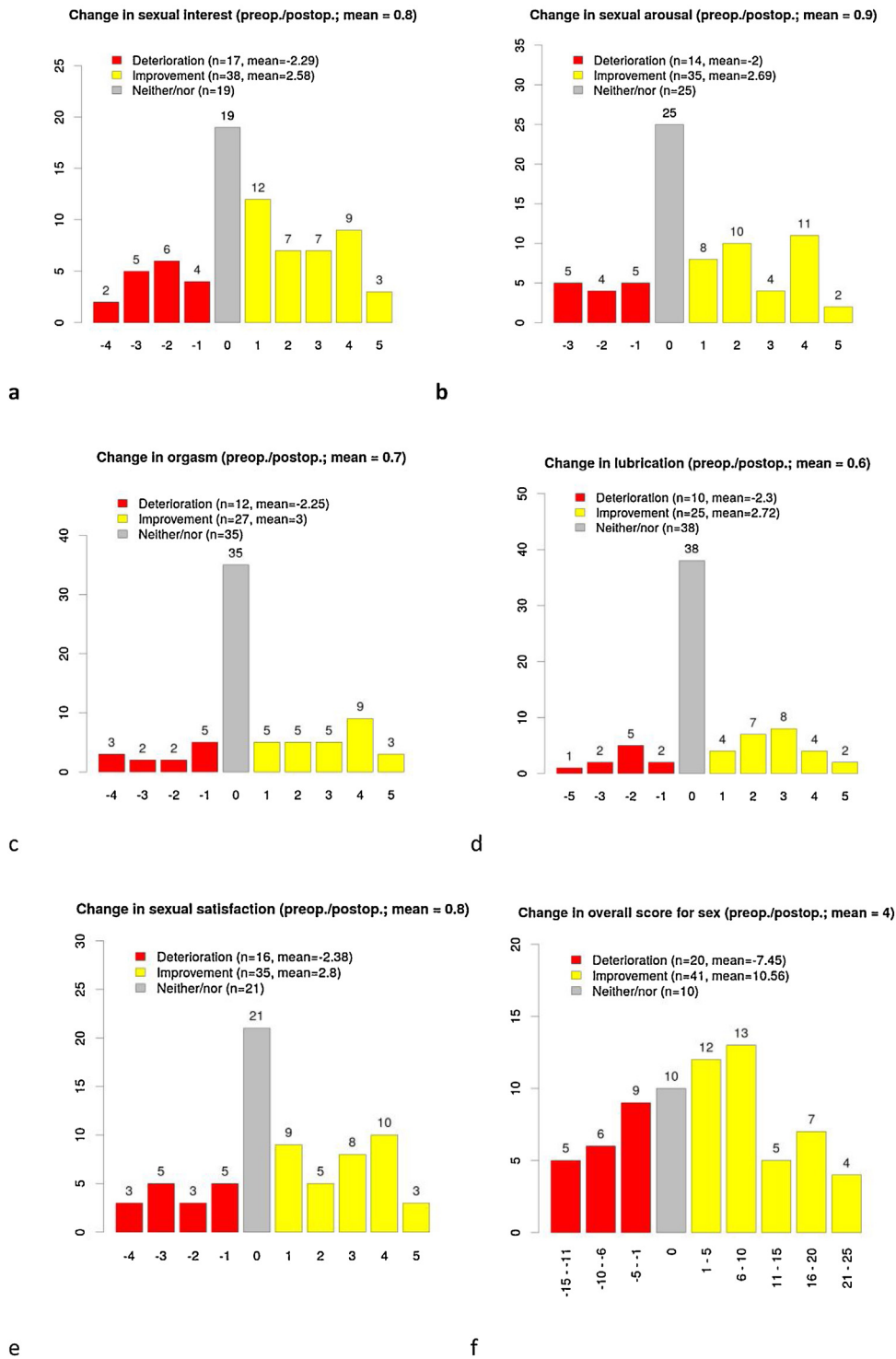


Fig. 2. a –d. Preoperative/postoperative changes in the KFSP (*Kurzfragebogen Sexualität und Partnerschaft*) score and subscores in the group without bowel resection: details for patients with deterioration, improvement, or constant symptoms, with total (n) and mean for each.

inconsistent with the literature findings, according to which women with a diagnosis of infertility are at greater risk for sexual dysfunction [37]. This is because when endometriosis is diagnosed, sterility may be the only symptom, so that factors with a negative influence on the KFSP such as dyspareunia are not present.

There have been few publications investigating long-term minor complications affecting the lower pelvis (bowel function, bladder function, and sexual function). Various authors have reported improvements in sexual function as a result of surgical

treatment for deeply infiltrating endometriosis. Abbott et al. [26] analyzed 135 patients after surgery for endometriosis (grades rASRM I–IV), assessing their sexual function using the Sexual Activity Questionnaire developed by Thirlaway et al. [38]. The authors reported a significant increase in the items “pleasure,” “habit,” and “discomfort” that is maintained for up to 5 years. Using the McCoy Female Sexuality Questionnaire, Setala et al. [25] analyzed 22 patients who had undergone resection of nodules in the posterior fornix, including vaginal resection. The

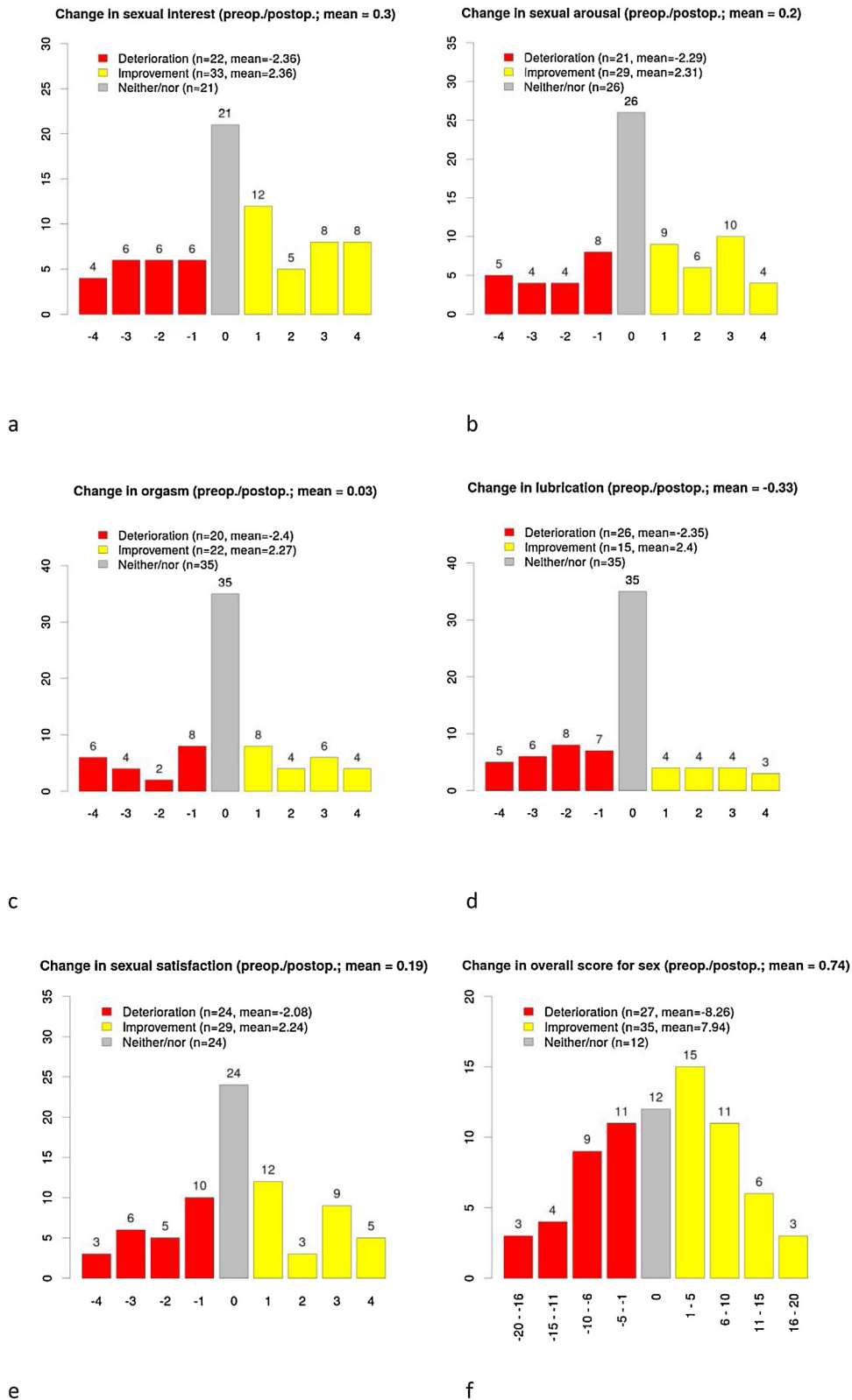


Fig. 3. a–d. Preoperative/postoperative changes in the KFSP (*Kurzfragebogen Sexualität und Partnerschaft*) score and subscores in the group with bowel resection: details for patients with deterioration, improvement, or constant symptoms, with total (n) and mean for each.

questionnaires were completed before and 12 months after surgery. Twelve months after surgery, the sexual satisfaction score was higher ($p = 0.03$) and the score for sexual problems was lower ($p = 0.04$) in comparison with baseline values.

Garry et al. [39] analyzed 57 patients using the Thirlaway Sexual Activity Questionnaire [38] to investigate postoperative sexual activity after surgery for DIE without bowel involvement. The questionnaire items included were pleasure, discomfort, and habit.

Table 6

Linear model with the target variable of total postoperative KFSP score. Influencing factors: group (WB/WOB), previous operations ("0," "1," "2 or more"), sterility as the reason for surgery, and age ("up to 30," "31–35," "36–40," and "41 or more"). The significance level was $p < 0.05$.

	Coefficient	95% CI	<i>p</i>
Intercept	16.035	12.522 to 19.547	< 0.001
Group: reference WB			
WOB	-2.498	-4.906 to -0.089	0.042
Pre-OP: reference 0			
1	0.144	-2.536 to 2.824	0.916
2 or more	3.040	0.185 to 5.896	0.037
Sterility as reason for surgery	0.346	-2.063 to 2.755	0.777
Age: reference up to 30			
31 bis 35	-0.071	-3.406 to 3.264	0.967
36 bis 40	1.562	-1.877 to 5.001	0.371
41 or more	1.240	-2.283 to 4.763	0.488

CI, confidence intervals; KFSP, *Kurzfragebogen Sexualität und Partnerschaft*, short questionnaire on sexuality and partnership; WB, group with bowel resection; WOB, group without bowel resection.

Table 7

Linear model with the target variable of preoperative–postoperative difference in the total KFSP score. Influencing factors: group (WB/WOB), previous operations ("0," "1," "2 or more"), sterility as the reason for surgery, and age ("up to 30," "31–35," "36–40," and "41 or more"). The significance level was $p < 0.05$.

	Coefficient	95% CI	<i>p</i>
Intercept	6.062	1.294 to 10.830	0.013
Group: reference WB			
WOB	1.167	-2.111 to 4.444	0.483
Previous operations: reference 0			
1	2.188	-1.395 to 5.771	0.229
2 or more	1.494	-2.413 to 5.400	0.451
Sterility as reason for surgery	-4.337	-7.634 to -1.040	0.010
Age: reference up to 30			
31–35	-3.084	-7.622 to 1.455	0.181
36–40	-2.815	-7.484 to 1.853	0.235
41 or more	-7.157	-11.981 to -2.332	0.004

CI, confidence intervals; KFSP, *Kurzfragebogen Sexualität und Partnerschaft*, short questionnaire on sexuality and partnership; WB, group with bowel resection; WOB, group without bowel resection.

In 3.5% of the cases, women who had been sexually active preoperatively developed apareunia postoperatively. According to the authors, radical laparoscopic excision significantly improved overall sexual function. Di Donato et al. carried out a prospective study including 250 patients who underwent surgery for DIE without bowel resection and compared them with a group of 250 healthy women [40]. A sexual activity questionnaire, the Sexual Health Outcomes in Women Questionnaire (SHOW-Q), was given to the patients before and after surgery to investigate the women's satisfaction, orgasm, desire, and interference by pelvic problems with sexual function. The authors reported improvements in sexual function after surgery for DIE [40]. Long-term impairment of sexual function was not described.

Van den Broeck et al. [41] studied two groups of patients affected by endometriosis, one with rectal resection and one without. They compared symptoms such as depression, satisfaction with one's partner, and sexual function before and after surgery, as well as between the two groups. Both groups reported improvement after surgery. Satisfaction with one's partner was assessed using the Dyadic Adjustment Scale (DAS) [42] and sexual function with the Short Sexual Function Scale (SSFS) [43]. The Short Sexual Function Scale showed greater improvement in the group who underwent rectal resection. Six months after surgery, the group with rectal resection also reported less dyspareunia and fewer problems in reaching an orgasm.

Kossi et al. [44] analyzed 26 patients who had undergone rectal resection for deep endometriosis, with a 12-month follow-

up period, using the 15D Questionnaire and the McCoy Female Sexuality Questionnaire. The findings showed significant improvements in the items "sexual satisfaction" and "painful sexual intercourse." The items "insufficient lubrication" and "sexual problems" did not show any change. Two patients reported newly developed impairments 12 months after surgery, involving "decreased lubrication," "decreased libido," and "deep dyspareunia."

In the present group of patients, a postoperative assimilation of KFSP scores to those in the control group was observed in patients who underwent curative surgery for deeply infiltrating endometriosis without bowel resection (WOB). This supports the value of surgical treatment for endometriosis in this group. However, a similar improvement was not observed in patients who underwent bowel resection.

Sexual function is an important parameter on which further research is required with regard to patients with deep endometriosis. Standardized assessment tools are needed. Sexuality is complex and multidimensional and is influenced by physiological, psychological, and social wellbeing [45]. Physiological elimination of endometriosis alone may therefore not be able to improve sexual function. For the patient, prolonged experience of dyspareunia and the associated impairment of sexuality and psychological aspects also need to be taken into consideration [46].

There is an urgent need for further data on the incidence of long-term limitations of sexual function in patients with deeply infiltrating endometriosis with or without bowel involvement. The analytic methods used need to be standardized, since the methods of assessment used in the published data are very heterogeneous and involve different questionnaires or questionnaires without validation.

Radical resection of endometriosis may lead to an improvement in sexual function, but it is associated with a corresponding increase in the risk of complications [18,19]. The patient therefore needs to receive very detailed information about side effects and about complications that may possibly arise. Alternatives that must be discussed with the patient include drug treatments [23] and also surgery with incomplete resection of the endometriosis with or without subsequent drug therapy, possibly with a reduced complication rate but also a lower success rate. Surgical removal of deeply infiltrating endometriosis should be carried out by surgeons with the relevant experience in specialized centers.

The strengths of the present study are the large number of patients included and the long follow-up period. The use of a strict distinction between groups with and without bowel resection reflects the international literature on the topic, and the distinction is a useful one in view of the results. The study's retrospective design is a limitation. Patients were asked postoperatively about their preoperative symptoms, and in addition some of these had also been more than 10 years earlier. The findings of the study will therefore need to be checked in further research with a prospective design. Another limitation is the selection of the control group, which included hospital staff and doctoral students (acquaintances, friends, and other students). The fact that the control group was not assessed for parity and/or infertility, or for medical conditions other than endometriosis that might cause pelvic pain or dyspareunia, must also be regarded as a limitation.

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