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ARTICLE

Patient reported vaginal laxity, sexual function and stress incontinence improvement following vaginal rejuvenation with fractional carbon dioxide laser

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ABSTRACT

In this study, we have evaluated the efficiency of fractional carbon dioxide laser in the treatment of vaginal laxity and urinary incontinence. Thirty patients with vaginal laxity, sexual dysfunction and urinary incontinence complaints were treated with fractional carbon dioxide laser. Results were evaluated with patient questionnaires relating to comfort during the procedure and general satisfaction following the procedure. In the survey regarding comfort during the procedure, 90% (*n*:27) of the patients reported that they were comfortable during the procedure. The survey on the level of general satisfaction six months following the procedure revealed high-moderate level of satisfaction in 86% (*n*:26) of the patients. 66% (*n*:20) of the patients reported improved vaginal tightness and 63% (*n*:19) of the patients reported improvement in the quality of their sexual activity. Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire(PISQ-12) scores six months following the procedure were not significantly different when compared to the scores prior to the procedure. The average of Questionnaire for Urinary Incontinence Diagnosis(QUID) score prior to the procedure and six months following the procedure was 7.5 and 0.9 respectively ($p < 0.05$). Fractional carbon dioxide laser treatment results in high level of satisfaction and improvement in vaginal laxity, sexual dysfunction and urinary incontinence symptoms in patients with genitourinary syndrome.

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Introduction

Vaginal laxity combined with manisfestations of genitourinary syndrome (GUS) related to menopause including vaginal atrophy-dryness, dyspareunia, recurrent urinary incontinence and urinary tract infections greatly impair quality of life and sexual function [1].

Vagina is an elastic structure between cervix uteri and labium minus which has an average length between 8 and 9 cm. It can elongate and expand. Vaginal laxity is symptom of pelvic floor dysfunction. Its mechanisms are not well understood and is usually worse in women with a history of multiple pregnancy. On the other hand, GUS and is characterized by the loss of elasticity in the vaginal structure and vaginal looseness which leads to symptoms including sexual dysfunction, dyspareunia, chronic pelvic pain and urinary incontinence.

Various treatment modalities have been used for the treatment of GUS. Non-hormonal products such as moisturizers and lubricants can be useful but only provide limited and temporary benefits. In contrast, hormonal replacement therapy (HRT) can provide long term relief [2]. But, some women may not wish to take HRT and in some cases could be contraindicated.

Laser therapy has been used in the treatment vaginal laxity as an alternative to other treatments. Ablative CO_2 laser was the one of the first lasers used in the treatment [3]. The effect caused by these lasers can stimulate tissue regeneration and repair [3,4]. Erbium laser has also be used in the treatment vaginal laxity with success [5,6]. It is a non-ablative laser and causes contraction in the collagen fibers which results in a decrease in the vaginal laxity. In addition, collagen remodeling also contributes to the final results. The aim of this study was to evaluate the patient discomfort and satisfaction after vaginal rejuvenation with fractional carbon dioxide laser.

Materials and methods

Thirty female patients who had undergone fractional carbon dioxide laser treatment for vaginal rejuvenation, vaginal tightening, stress incontinence and menopausal vaginal symptoms were included in this retrospective study. All patients provided written informed consent before treatment. Average patient age was 48.3 (±7) (Table 1). All of the patients had significant complaints of sexual dysfunction and urinary incontinence prior to the treatment. In addition, 53% (*n*:16), 16% (*n*:5), 20% (*n*:6) and 10% (*n*:3) of the patients were suffering from vaginal laxity, vaginal discharge, vaginal pruritus, and dyspareunia respectively. 73.3% (*n*:22) of the patients were in the process of menopause (perimenopause) (Table 2), 14 patients received 3 sessions of treatment with 1-month interval, 4 patients received 2 sessions of treatment with 1-month interval and the remaining 12 patients received single session treatment (Table 3).

Inclusion criteria consisted of patients self- reported vaginal laxity graded during pelvic examination as 'moderately loose'(at least 3 fingers can are required to feel the vaginal tightness during bimanual exam) or 'slightly loose' (at least 2 fingers can are required to feel the vaginal tightness during bimanual exam), no breastfeeding for 3 months prior to procedure, sexual activity (vaginal intercourse at least once per month), in a monogamous,

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Table 1. Demographic data of the patients ($n = 30$).

	Mean	Standard deviation
Age	48.3	±7
Parity	1.6	±1.1
Vaginal birth	1.13	±1.2
Previous cesarean section	0.5	±0.7

Table 2. Menopausal status, findings and symptoms prior to procedure.

	Number	Percentage
Premenopausal	3	10
Perimenopausal	22	73.3
Postmenopausal	5	16.6
Decrease quality of sexual intercourse	30	100
Urinary incontinence	30	100
Vaginal laxity (vaginal looseness)		
Moderately loose	16	53
Slightly loose	14	47
Vaginal discharge	5	16
Vaginal pruritus	6	20%
Dyspareunia	3	10

Table 3. Number of treatment sessions versus vaginal laxity level.

	Moderately loose	Slightly loose
1 session	–	12
2 sessions	2	2
3 sessions	14	–

heterosexual relationship, and normal Papanicolou smear in the previous year and negative pregnancy test within 3 months prior to treatment. Exclusion criteria were women with 'very loose' (4 or more fingers can are required to feel the vaginal tightness during bimanual exam) vaginal laxity which would require surgical correction, evidence of thin Denonvilliers' fascia, pelvic organ prolapsus, cervicovulvar malignancies, those taking medications known to affect sexual function or that can affect collagen or healing, (e.g. anti-inflammatory drugs, chemo-therapeutic agents, corticosteroids), or a medical problem that might interfere with wound healing, an active sexually transmitted disease and chronic vulvar pain or vulvar dystrophy [7].

Vaginal rejuvenation was performed with Fraxis duo fractional carbon dioxide laser device (Ilooda, Gyeonggi-do, Korea) with vaginal hand piece (Figure 1). Vaginal hand piece was designed to scan whole of the vaginal surface area without causing stretching or pain. The procedure was performed without local or general anesthesia. No medication was used prior to or following the procedure. Following the cleaning of vulvovaginal area vaginal probe was commenced into the vaginal canal. The treatment was performed with 30 – 45 mJ energy and 1–1.2 mm distance settings. All of the vaginal lining was covered with 8 mm intervals with 2 or 3 overlaps. Each session lasted between 15 and 20 min.

Questionnaires related to discomfort during the procedure and general satisfaction following the treatment were completed by the patients. In addition, The Questionnaire for Urinary Incontinence Diagnosis (QUID) [8] and Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12) [9] were completed by the patients prior to and six months following the last session of treatment. Maximum score for PISQ-12 was 48 which corresponds to severe sexual dysfunction. Maximum score for QUID was 30 which corresponds to severe urinary incontinence. PISQ12 survey was performed to document sexual well-being and to detect the patients with variation in these results prior to and following the procedure which would correspond to other problems that would contribute to sexual dysfunction.

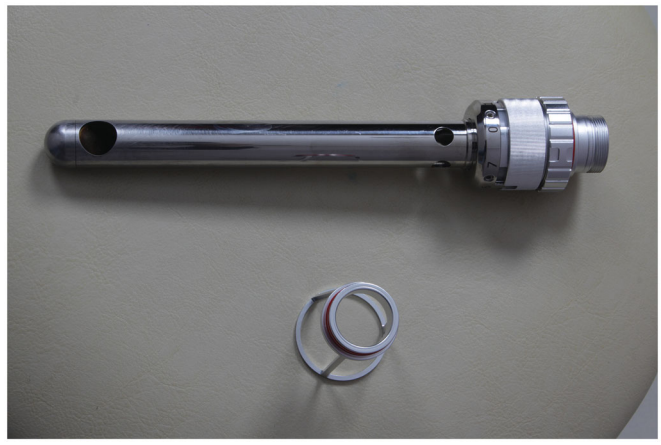

Figure 1. Vaginal rejuvenation probe for fractional carbon dioxide laser.

Results

In the survey regarding comfort during the procedure, 90% (*n*:27 – total number of patients who replied agree and strongly agree to question 1) of the patients reported that they were comfortable during the procedure. The 56% (*n*:17 – total number of patients who replied agree and strongly agree to question 4) of the patients reported that they did not feel any pain during procedure. The average score of the comfort survey was 3.63(±0.8) out of possible 5 (Table 4).

The survey on the level of general satisfaction six months following the procedure revealed high-moderate level of satisfaction in 86% (*n*:26 – total number of patients who replied agree and strongly agree to question 5) of the patients. 66% (*n*:20 – total number of patients who replied agree and strongly agree to question 1) of the patients reported improved vaginal tightness and 63% (*n*:19 – total number of patients who replied agree and strongly agree to question 3) of the patients reported improvement in the quality of their sexual activity. 100% of the patients (all of the 5 patients) reported improvement in vaginal discharge and 8% (5 of the 6 patients) reported improvement in vaginal pruritus symptoms. The average of QUID score prior to the procedure and six months following the procedure was 7.5 (±7.27) and 0.9 (±1.78) respectively out of possible 30. This difference was statistically significant (Table 5). The average of PISQ-12 score prior to the procedure and six months following the procedure was 15.3 (±4) and s 14.4 (±3.6) respectively out of possible 48. This difference was statistically insignificant (Table 6) (Figure 2).

Discussion

Various surgical procedures have been reported as successful in improving the sexual dysfunction and vaginal laxity [10]. But, despite their success, these procedures are associated with rare but serious complications such as infection and bleeding [11]. In addition, recovery period following these surgical procedures can be as long as 6–8 weeks which means retraining from sexual activity in this period. In contrast, fast recovery is possible following the procedure with carbon dioxide laser treatment. In this study the survey regarding the level of discomfort during and after the procedure was reported as none or low in 74% and 82% of the patients, respectively. This is a definite advantage of non-invasive methods such as the laser and radiofrequency over surgical procedures [12,13–16].

It has been shown in previous studies that vaginal rejuvenation with fractional lasers results in an increase in the epithelial

Table 4. Questionnaire results regarding general satisfaction 6 months following the procedure and comfort during the procedure. Score corresponding to each response is given in parenthesis ($n = 30$).

	Number of responses	Percentage	Mean Scale score	Standart deviation of scale score
Comfort level during the procedure				
I was comfortable during the procedure.				
Strongly disagree (1)	1	3.3%	4.46	±0.89
Disagree (2)	0	0.0%		
Neutral (3)	2	6.7%		
Agree (4)	8	26.7%		
Strongly agree (5)	19	63.3%		
I felt little heat during the procedure which wasn't discomforting.				
Strongly disagree (1)	1	3.33%	4.27	±0.98
Disagree (2)	1	3.33%		
Neutral (3)	2	6.67%		
Agree (4)	11	36.67%		
Strongly agree (5)	15	50.00%		
I felt little cold during the procedure.				
Strongly disagree (1)	19	63.33%	2.23	±1.77
Disagree (2)	1	3.33%		
Neutral (3)	2	6.67%		
Agree (4)	0	0.00%		
Strongly agree (5)	8	26.67%		
I did not feel any pain during the treatment.				
Strongly disagree (1)	3	10.00%	3.57	±1.25
Disagree (2)	2	6.67%		
Neutral (3)	8	26.67%		
Agree (4)	9	30.00%		
Strongly agree (5)	8	26.67%		
MEAN SCORE	3.63 ± 0.8			
General Satisfaction Following The Procedure				
1. I feel improved vaginal tightness following the procedure.				
Strongly disagree (1)	0	0.00%	4.07	±1.08
Disagree (2)	3	10.00%		
Neutral (3)	7	23.33%		
Agree (4)	5	16.67%		
Strongly agree (5)	15	50.00%		
2. My partner felt improved vaginal tightness following the procedure.				
Strongly disagree (1)	7	23.33%	3.23	±1.63
Disagree (2)	4	13.33%		
Neutral (3)	5	16.67%		
Agree (4)	3	10.00%		
Strongly agree (5)	11	36.67%		
3. The quality of the sexual activity improved following the treatment.				
Strongly disagree (1)	0	0.00%	4	±1.14
Disagree (2)	4	13.33%		
Neutral (3)	7	23.33%		
Agree (4)	4	13.33%		
Strongly agree (5)	15	50.00%		
4. I would suggest this treatment to other patients with similar symptoms.				
Strongly disagree (1)	0	0.00%	4.63	±0.72
Disagree (2)	0	0.00%		
Neutral (3)	4	13.33%		
Agree (4)	3	10.00%		
Strongly agree (5)	23	76.67%		
5. I am satisfied with the results of the treatment.				
Strongly disagree (1)	0	0.00%	4.53	±0.73
Disagree (2)	0	0.00%		
Neutral (3)	4	13.33%		
Agree (4)	6	20.00%		
Strongly agree (5)	20	66.67%		
6. Have you noticed any side effects other than the discomfort during the procedure?				
Yes	0	0%		
No	30	100%		

cells, papillary formation, glycogen storages, fibroblastic activity and collagen production. These changes increase the mucosal thickness and elasticity which results in an improvement in sexual dysfunction as well as urinary incontinence related symptoms [17,18].

In our study we found that the general patient satisfaction was very high following carbon dioxide laser treatment for vaginal laxity/sexual dysfunction and stress incontinence. 85% of the patients reported high and moderate level of improvement in vaginal laxity and sexual activity. The reported level of improvement with stress incontinence was even higher as all the patients with stress incontinence symptoms reported high level of improvement. Sexual dysfunction is a complex problem which can't be solely accounted on vaginal laxity and GUS. It has psychological, neurological and hormonal aspects which cannot be improved with the laser treatment. Despite the improvement in vaginal laxity, sexual function might not improve in these patients.

One of the shortcomings of the current study is that it lacks any objective measurement such as POP-Q stages to evaluate the

Table 5. QUID questionnaire results.

	Before the procedure		6 months following the procedure		
	Number of responses	Percentage	Number of responses	Percentage	Chi square test *p*-value
1. Do you leak urine (even small drops), wet yourself, or wet your pads or undergarments when you cough or sneeze?					
None of the time (0)	7	23.3%	25	83.3%	0.000232
Rarely (1)	9	30.0%	4	13.3%	
Once in a while (2)	4	13.3%	1	3.3%	
Often (3)	3	10.0%	0	0.0%	
Most of the time (4)	5	16.7%	0	0.0%	
All of the time (5)	2	6.7%	0	0.0%	
2. Do you leak urine (even small drops), wet yourself, or wet your pads or undergarments when you bend down or lift something up?					
None of the time (0)	12	40.0%	26	86.7%	0.008672
Rarely (1)	8	26.7%	3	10.0%	
Once in a while (2)	3	10.0%	1	3.3%	
Often (3)	2	6.7%	0	0.0%	
Most of the time (4)	4	13.3%	0	0.0%	
All of the time (5)	1	3.3%	0	0.0%	
3. Do you leak urine (even small drops), wet yourself, or wet your pads or undergarments when you walk quickly, jog or exercise?					
None of the time (0)	13	43.3%	26	86.7%	0.016038
Rarely (1)	7	23.3%	3	10.0%	
Once in a while (2)	3	10.0%	1	3.3%	
Often (3)	1	3.3%	0	0.0%	
Most of the time (4)	5	16.7%	0	0.0%	
All of the time (5)	1	3.3%	0	0.0%	
4. Do you leak urine (even small drops), wet yourself, or wet your pads or undergarments while you are undressing in order to use the toilet?					
None of the time (0)	16	53.3%	27	90.0%	0.02379
Rarely (1)	4	13.3%	3	10.0%	
Once in a while (2)	7	23.3%	0	0.0%	
Often (3)	2	6.7%	0	0.0%	
Most of the time (4)	0	0.0%	0	0.0%	
All of the time (5)	1	3.3%	0	0.0%	
5. Do you get such a strong and uncomfortable need to urinate that you leak urine (even small drops) or wet yourself before reaching the toilet?					
None of the time (0)	15	50.0%	26	86.7%	0.022802
Rarely (1)	5	16.7%	4	13.3%	
Once in a while (2)	5	16.7%	0	0.0%	
Often (3)	4	13.3%	0	0.0%	
Most of the time (4)	0	0.0%	0	0.0%	
All of the time (5)	1	3.3%	0	0.0%	
6. Do you have to rush to the bathroom because you get a sudden, strong need to urinate?					
None of the time (0)	14	46.7%	26	86.7%	0.032513
Rarely (1)	10	33.3%	4	13.3%	
Once in a while (2)	4	13.3%	0	0.0%	
Often (3)	1	3.3%	0	0.0%	
Most of the time (4)	0	0.0%	0	0.0%	
All of the time (5)	1	3.3%	0	0.0%	
Mean Score	7.5 (±7.27)		0.9 (±1.78)		

Score corresponding to each response is given in parenthesis ($n = 30$).

results. These measurements would be valuable in the assessment of pelvic floor muscles and degrees of vaginal structural changes [19,20]. Despite this, survey scores do reflect the high level of general satisfaction reported following the procedure. QUID questionnaire results were significantly lower following the procedure which corresponds to an improvement in the urinary incontinence symptoms. PISQ-12 scores of the patients prior to and following the procedure were similar which were designed to reflect general sexual health rather than the vaginal laxity and GUS-related manifestations. The lack of this variation helped us to point out that the sexual improvement following the procedure was due the procedure rather than other psychological and physiological factors that might effect sexual dysfunction. Another shortcoming of this study is that no imaging was performed to visualize vaginal walls. Other objective measurements were not performed to grade vaginal tightness and no pathological evaluations were made. More subjective physical examination was used to grade vaginal laxity. Since these further evaluation methods for assessing the effectiveness usually involve more comprehensive or detailed procedures, they were not been accepted by our patients and as well as the hospital ethical comity and invasive procedures were avoided to minimize patient discomfort

We conclude that fractional carbon dioxide laser treatment results in high level of satisfaction and improvement in vaginal laxity and urinary incontinence symptoms in patients with GUS. The level of discomfort during and following the procedure was low in the majority of the patients and return to normal sexual activity was quick. These are obvious advantages over surgical treatments. Despite the limited number of patients in the study, these results can lead the way for future multi-centric studies with higher number of patients.

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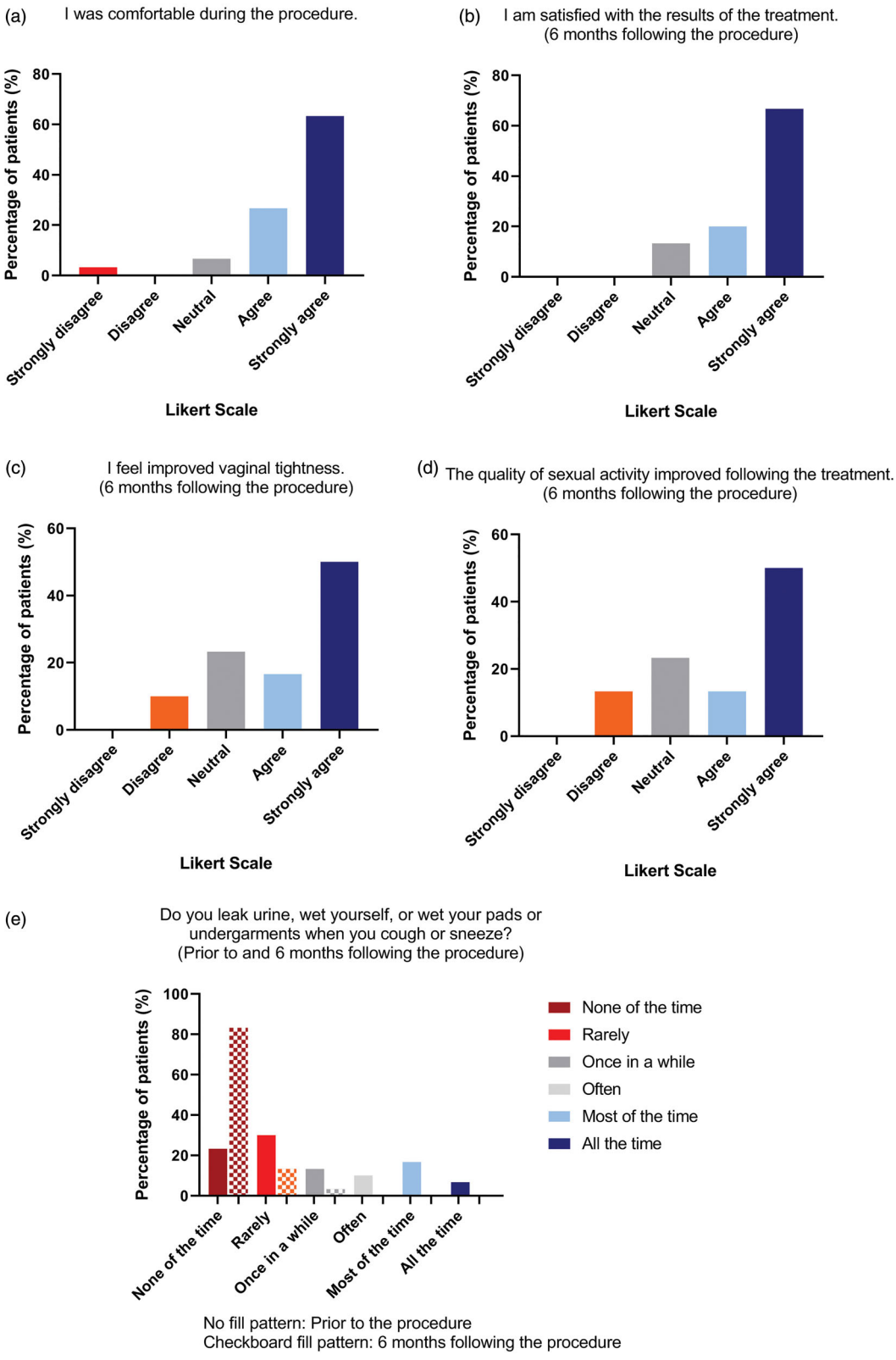

Figure 2. Graphical representation of the results of selected survey questions. (a) Comfort during the procedure. (b) General satisfaction. (c) Improvement in vaginal tightness. (d) Improvement in sexual quality. (d) Improvement in urinary incontinence.

Table 6. PISQ-12 questionnaire results (6 months following the procedure).

	Prior to the procedure		6 months following the procedure		Chi square test
	Number of responses	Percentage	Number of responses	Percentage	*p*-value
1. How frequently do you feel sexual desire?					
Always (0)	4	13.3%	3	10.0%	0.982303
Usually (1)	8	26.7%	10	33.3%	
Sometimes (2)	14	46.7%	13	43.3%	
Seldom (3)	4	13.3%	4	13.3%	
Never (4)	0	0.0%	0	0.0%	
2. Do you climax when having sexual intercourse with your partner?					
Always (0)	10	33.3%	10	33.3%	1
Usually (1)	10	33.3%	10	33.3%	
Sometimes (2)	6	20.0%	6	20.0%	
Seldom (3)	3	10.0%	3	10.0%	
Never (4)	1	3.3%	1	3.3%	
3. Do you feel sexually excited when having sexual activity with your partner?					
Always (0)	10	33.3%	9	30.0%	0.97956
Usually (1)	10	33.3%	12	40.0%	
Sometimes (2)	3	10.0%	2	6.7%	
Seldom (3)	7	23.3%	7	23.3%	
Never (4)	0	0.0%	0	0.0%	
4. How satisfied are you with the variety of sexual activities in your current sex life?					
Always (0)	4	13.3%	5	16.7%	0.996588
Usually (1)	13	43.3%	13	43.3%	
Sometimes (2)	3	10.0%	3	10.0%	
Seldom (3)	9	30.0%	8	26.7%	
Never (4)	1	3.3%	1	3.3%	
5. Do you feel pain during intercourse?					
Never (0)	13	43.3%	15	50.0%	0.863795
Seldom (1)	10	33.3%	10	33.3%	
Sometimes (2)	4	13.3%	3	10.0%	
Usually (3)	1	3.3%	0	0.0%	
Always (4)	2	6.7%	2	6.7%	
6. Are you incontinent of urine with sexual activity?					
Never (0)	23	76.7%	27	90.0%	0.483548
Seldom (1)	4	13.3%	3	10.0%	
Sometimes (2)	3	10.0%	0	0.0%	
Usually (3)	0	0.0%	0	0.0%	
Always (4)	0	0.0%	0	0.0%	
7. Does fear of incontinence restrict your sexual activity?					
Never (0)	26	86.7%	29	96.7%	0.645178
Seldom (1)	2	6.7%	1	3.3%	
Sometimes (2)	2	6.7%	0	0.0%	
Usually (3)	0	0.0%	0	0.0%	
Always (4)	0	0.0%	0	0.0%	
8. Do you avoid sexual intercourse because of bulging in the vagina?					
Never (0)	26	86.7%	28	93.3%	0.865759
Seldom (1)	3	10.0%	2	6.7%	
Sometimes (2)	1	3.3%	0	0.0%	
Usually (3)	0	0.0%	0	0.0%	
Always (4)	0	0.0%	0	0.0%	
9. When you have sex with your partner, do you have negative emotional reactions such as fear, disgust, shame, or guilt?					
Never (0)	26	86.7%	26	86.7%	0.855695
Seldom (1)	1	3.3%	2	6.7%	
Sometimes (2)	2	6.7%	2	6.7%	
Usually (3)	1	3.3%	0	0.0%	
Always (4)	0	0.0%	0	0.0%	
10. Does your partner have a problem with erections that affects your sexual activity?					
Never (0)	19	63.3%	18	60.0%	0.99659
Seldom (1)	8	26.7%	8	26.7%	
Sometimes (2)	3	10.0%	4	13.3%	
Usually (3)	0	0.0%	0	0.0%	
Always (4)	0	0.0%	0	0.0%	
11. Does your partner have a problem with premature ejaculation that affects your sexual activity?					
Never (0)	16	53.3%	17	56.7%	0.999164
Seldom (1)	10	33.3%	9	30.0%	
Sometimes (2)	3	10.0%	3	10.0%	
Usually (3)	1	3.3%	1	3.3%	
Always (4)	0	0.0%	0	0.0%	
12. Compared to orgasms that you have had in the past, how intense are the orgasms you have had in the past 6 months?					
Much less intense (4)	0	0.0%	0	0.0%	0.153202
Less intense(3)	6	20.0%	13	43.3%	
Same intensity(2)	22	73.3%	14	46.7%	
More intense(1)	0	0.0%	2	6.7%	
Much more intense(0)	2	6.7%	1	3.3%	
Mean Score	15.3 (±4)		14.4 (±3.6)		

Score corresponding to each response is given in parenthesis ($n = 30$).

to do this wonderful project on the topic and guided us along the way.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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