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## A strong pelvic floor is associated with higher rates of sexual activity in women with pelvic floor disorders

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### Abstract

**Introduction and Hypothesis**—We evaluated the associations between pelvic floor muscle strength and tone with sexual activity and sexual function in women with pelvic floor disorders.

**Methods**—This was a secondary analysis of a multicenter study of women with pelvic floor disorders from the US and UK performed to validate the Pelvic Organ Prolapse/Incontinence Sexual Questionnaire, IUGA-Revised (PISQ-IR). Participants were surveyed about whether they were sexually active and completed the PISQ-IR and Female Sexual Function Index (FSFI) questionnaires to assess sexual function. Physical exams included assessment of pelvic floor strength by the Oxford Grading Scale, and assessment of pelvic floor tone per ICS guidelines.

**Results**—The cohort of 585 women was middle aged (mean age 54.9 +/-12.1) with 395 (67.5%) reporting sexual activity. Women with a strong pelvic floor (n=275) were more likely to report sexual activity than women with weak strength (n=280) (75.3 vs. 61.8%, p<0.001), but normal or hypoactive pelvic floor tone was not associated with sexual activity (68.8 vs. 60.2%, normal vs.

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hypoactive,  $p=0.08$ ). After multivariable analysis, a strong pelvic floor remained predictive of sexual activity (OR 1.89, CI 1.18–3.03,  $p<0.01$ ). Among sexually active women ( $n=370$ ), a strong pelvic floor was associated with higher scores on the PISQ-IR domain of condition impact (Parameter Estimate 0.20+/-0.09,  $P=0.04$ ), and FSFI orgasm domain (PE 0.51+/-0.17,  $P=0.004$ ).

**Conclusion**—A strong pelvic floor is associated with higher rates of sexual activity as well as higher sexual function scores on the condition impact domain of the PISQ-IR and orgasm domain of the FSFI.

### Keywords

pelvic floor disorders; pelvic floor strength; sexual activity

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### Introduction

Female sexual response is complex, involving physical, hormonal and emotional factors. The muscles of the female pelvic floor are thought to play an important role in orgasm [1, 2] and arousal [3, 4]. Evaluation of pelvic floor musculature includes assessment of pelvic floor strength and tone [5] which measure different elements of pelvic floor muscle function.

Little is known, however, about how the strength of the pelvic floor correlates with sexual activity and function, particularly in women with pelvic floor disorders. Pelvic floor strength and duration of contraction has been shown to be positively associated with sexual function in women with sexual dysfunction [6]. Small interventional studies on the effect of pelvic floor exercises on sexual function have showed mixed results. In women with urodynamically proven stress urinary incontinence, physical therapy and home exercise were shown to improve women's sex-life, as well as social life and physical activity [7]. In another study of 32 continent, sexually active women who had recently undergone menopause, home and guided pelvic floor exercise training resulted in an increased Oxford Modified Grading Scale scores, but no improvement in sexual function [8]. In contrast to pelvic floor muscle strength, we are not aware of data on how pelvic floor tone is associated with sexual activity or function.

The association between pelvic floor strength and sexual activity and function has not been defined among women with urogynecologic symptoms. In this study, we characterize the association between rates of sexual activity and sexual function, as measured by the PISQ-IR and FSFI, with pelvic floor muscle strength and pelvic floor tone, in a population of women with pelvic floor disorders. We hypothesized that women with strong pelvic floors would be more likely to be sexually active with better sexual function and that normal pelvic floor tone would be associated with higher rates of sexual activity and better sexual function.

### Methods

This is a secondary analysis of data collected during the validation of the Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire International Urogynecological Association revised (PISQ-IR)[9]. The PISQ-IR was developed to evaluate sexual function in sexually active women and to assess the impact of pelvic floor disorders on both women

who report that they are and are not sexually active. Results of the validation study and scoring system have been previously published [9, 10].

In brief, women were recruited from 12 sites across the USA and 5 sites in the UK. Institutional Review Board approval was obtained from all sites and all women gave written consent. Women included in the study were 18 years or older, not pregnant, able to read/write and understand English, and were seeking treatment for UI and/or AI and/or POP. Women were excluded if they had a diagnosis of vulvodynia, painful bladder syndrome, or chronic pelvic pain for longer than 6 months. Because the PISQ-IR includes women who report that they are not sexually active, women did not need to report sexual activity to participate.

After consent, women were given a survey packet, and underwent a physical examination, including the Pelvic Organ Prolapse Quantification Scale (POPQ) [11], the Oxford Grading Scale [12] and evaluation of pelvic muscle tone per ICS/IUGA guidelines [5]. Sexual activity was assessed by asking patients if they were or were not sexually active by a written questionnaire. For the analysis, pelvic floor tone (graded as non-functioning, underactive, normal and overactive) was dichotomized into normal and hypoactive (underactive and non-functioning). Only a single patient had hyperactive tone, and was thus excluded from analysis. Pelvic floor strength, graded on a 6 point scale, was dichotomized into weak (no contraction, flicker or weak tone or 0–2) and strong (moderate, good or strong or 3–5). Clinicians indicated one or more PFD diagnoses based on physical exam findings, history and other clinical data available. Women completed the Incontinence Severity Index (ISI) [13], a single question evaluating prolapse and its bother from the Epidemiology of Prolapse and Incontinence Questionnaire (EPIQ) [14], the Pelvic Floor Distress Inventory-20 (PFDI-20) [15–17] and the Female Sexual Function Index (FSFI) [18, 19], as well as the PISQ-IR, which this study aimed to validate[9].

Patient characteristics were compared between groups using Student's t-test for continuous variables (and verified using Wilcoxon rank sum test) and Fisher's exact test for categorical variables. P values less than 0.05 were considered to be significant. Multivariate logistic regression analysis was used to analyze the relative contributions of patient characteristics or physical exam findings on sexual activity, with results reported as odds ratio (OR) and 95 % confidence interval (95% CI). Candidates for multivariable logistic modeling were chosen if they were found to be significant in univariate logistic regression. Relative contributions of patient characteristics and pelvic floor strength on sexual function were also compared using multivariate logistic regression and were reported as a parameter estimate  $\pm$ SD. Parameter estimate was chosen as it provides the direction of correlation (positive or negative) as well as the strength of correlation, which increases further from 0. Analyses were conducted using SAS v. 9.3 (SAS institute Inc., Cary, NC) and StatXact v. 9.0 (Cytel, Cambridge, MA).

## Results

Eight hundred and seventy seven women gave consent to participate, of whom 589 (67%) returned a completed baseline survey. Of these, 585 (67%) had data sufficient for this

analysis. In this population, 395/585 (68%) reported sexual activity. Sexually active women were younger, more likely to have a partner, less likely to be postmenopausal and diabetic, and had more comorbid stress urinary incontinence (Table 1).

Sexually active women were contrasted to non-sexually active women regarding pelvic floor strength and tone. Women who were sexually active were more likely to have a strong pelvic floor (54.5% vs. 38.9%,  $P < 0.001$ ) than those who reported that they were not sexually active. However, regarding pelvic floor tone, the sexually active and non-sexually active groups had no difference in the percentage with normal as opposed to hypoactive pelvic floor tone (81.2 vs. 74.7%,  $p = 0.08$ , respectively) (Table 2). Only 1 participant had overactive tone, and was thus excluded from analysis. When controlled for age, menopausal and relationship status through multivariate logistic regression, pelvic floor strength remained an independent predictor of sexual activity (OR 1.9, 95% CI 1.2–3.1), as did being married or in a marriage-like relationship (OR 4.9, 95% CI 3.0–8.0), while age was a weak negative predictor for sexual activity (OR 0.95, 95% CI 0.92–0.94). With this adjustment for possible confounders, menopausal status was no longer predictive of sexual activity (OR 0.8, 95% CI 0.4–1.7).

Among women reporting sexual activity, patient characteristics between those with strong and weak pelvic floors differed in that those with strong floors were less likely to be menopausal and less likely to have POPQ stage 2 (Table 3). Sexually active women with a strong pelvic floor scored higher in the PISQ-IR domains of Condition Impact (CI), and Desire domains (Table 4) as well as FSFI domains of Desire, Lubrication and Orgasm and total scores. Normal (as opposed to hypoactive) pelvic floor muscle tone was not associated with sexual function.

After controlling for menopausal status and POPQ stage, pelvic strength remained positively associated with the PISQ-IR domain of Condition Impact (PE  $0.2 \pm 0.09$ ,  $p = 0.04$ ) and FSFI Orgasm domain (PE  $0.51 \pm 0.17$ ,  $p = 0.004$ ). Menopausal status, partner status, age, and POPQ stage 2 were also independent predictors of some domains of sexual function (Table 5).

## Discussion

This study of women with pelvic floor disorders demonstrates a positive association between pelvic floor strength and sexual activity and function. Among women who reported sexual activity, we found positive associations between pelvic floor strength and sexual function scores in the PISQ IR Condition Impact and FSFI Orgasm domains. This effect, though statistically significant, was modest and limited to only a single domain in each measure. However, we did not find an association between normal versus hypoactive pelvic floor muscle tone and sexual activity or function.

Consistent with our findings, Lowenstein et al [6] reported that the orgasm and arousal domains of the FSFI were positively associated with a stronger pelvic floor in a much younger cohort of women with sexual dysfunction. This was also supported by a recent small study of nulliparous, sexually active women with an average age of 23, which showed

better sexual function for those with stronger pelvic floors [20]. In women with urinary incontinence, Bo et al. noted that pelvic floor training resulted in a reduction in problems with their sex lives [7], although pelvic floor strength was not measured, and differences may also be attributed to improvement in incontinence. In contrast, Lara et al. [8] found no improvement in sexual function after guided pelvic floor exercise training in newly postmenopausal women despite an increase in pelvic floor muscle strength. Our findings support the association between a stronger pelvic floor and increased rate of sexual function in this population of women with pelvic floor disorders, but like previous studies cannot make conclusions regarding the causality of this association. The previous studies did not address rates of sexual activity directly, so comparisons with regard to this variable are not possible.

Although our study design does not allow us to make inferences about causation, it is possible that sex itself may act to strengthen the pelvic floor, both during arousal and orgasm. Because of the physiologic role that pelvic floor muscles play in the sexual response cycle, the stronger pelvic floor may be partly responsible for better sexual function.

Pelvic floor muscle tone, evaluated based on ICS/IUGA recommendations [5, 21], did not show an association with sexual activity or sexual function. In this study however, patients had either hypoactive or normal pelvic floor tone, with only a single individual with hyperactive tone. It is possible that a hypertonic pelvic floor, which has been associated with pelvic pain syndromes, may be associated with decreased sexual activity and function [22]. We excluded women with chronic pain from this study as their sexual function was likely to be greatly influenced by pelvic pain, so this population was not appropriate to look at this association.

Strengths of this study include the large sample size from multiple sites throughout the US and UK. The number of sites included [23] allowed for a diverse population that increases the generalizability of these findings. Weaknesses include the cross sectional design of the study, which did not allow us to assess causation. While we used recommended measures to evaluate pelvic floor musculature, the assessment of pelvic floor tone has not been widely validated against other measures. In addition a large number of practitioners performed the pelvic exams which support the generalizability of our findings, however we did not purposefully assess inter and intra rater reliability for these measures. In addition, there may be other confounders which were not evaluated which may be associated with pelvic floor strength and function. Given this secondary analysis, the study may have been underpowered to detect some differences. As we excluded patients with chronic pelvic pain, this cohort had only a single subject with hyperactive muscle tone, limiting generalizability to this population.

In summary, we found that pelvic floor strength is associated with sexual activity and function but sexual activity and function are not associated with normal or weak pelvic floor tone. Future work may be directed at determining whether improvements in pelvic floor strength result in improvements in sexual function among Urogynecologic patients.

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**Brief summary**

In this population of women with pelvic floor disorders, pelvic floor muscle strength, but not tone, is associated with sexual activity.

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**Table 1**

Demographics and characteristics of sexually active vs. non-sexually active. P values by t-test for continuous variables, and by Fisher's exact test for categorical.

Patient characteristics	Sexually Active (N=395)	Not Sexually Active (N=190)	p value
Age years +/- SD (N)	52.4 ± 11.4 (370)	61.6 ± 11.6 (135)	<0.001
Has Partner (%)	315/370 (85.1)	70/135 (51.9)	<0.001
Postmenopausal (%)	212/382 (55.50)	155/188 (82.5)	<0.001
BMI, kg/m <sup>2</sup> ±SD (N) **	27.7 ± 5.0 (353)	28.5 ± 4.3 (163)	0.07
Gravidity, mean ± SD (N)	2.9 ± 1.5 (387)	2.8 ± 1.7 (183)	0.8
Parity mean ± SD (N)	2.4 ± 1.2 (387)	2.3 ± 1.4 (183)	0.59
Mode of Delivery			0.20
All Vaginal	317/368 (86.1)	148/165(89.7)	
All Cesarean	12/368(3.3)	7/165(4.2)	
Both Vaginal and Cesarean	39/368(10.6)	10/165(6.1)	
Latino or Hispanic (%)	32/271 (11.8)	7/98 (7.1)	0.25
White Race (%)	329/369 (89.4)	120/134 (89.6)	1
POPQ stage 2 (%)	127/376 (33.4)	70/180 (38.9)	0.26
Stress Urinary Incontinence Diagnosis (%)	270/389 (69.4)	107/188 (56.1)	<0.01
Urgency Incontinence diagnosis (%)	174/389 (44.7)	101/188 (53.7)	0.05
Mixed urinary incontinence (%)	147/389 (37.8)	70/188 (37.2)	0.92
Anal Incontinence (%)	36/389 (9.3)	27/188 (14.4)	0.09
Previous Hysterectomy (%)	42/144 (29.2)	28/76 (36.8)	0.29
Diabetes (%)	23/386 (6.0)	20/185 (10.8)	0.04
Neurologic Disease(%)	15/384 (3.91)	12/185 (6.5)	0.21
Education: Some College or More (%)	254/363 (70.0)	72/116 (62.1)	0.14

\*\* BMI significantly different by Wilcoxon rank some test, p=0.04

**Table 2**

Pelvic muscle tone and strength in sexually active and non-sexually active patients.

	<b>Sexually Active N=395</b>	<b>Not Sexually Active N=190</b>	<b>p value</b>
<b>Pelvic Muscle Strength</b>			<b>&lt;0.001</b>
Weak (%)	173/380 (45.5)	107/175 (61.1)	
Strong (%)	207/380 (54.5)	68/175 (38.9)	
<b>Pelvic Muscle Tone</b>			0.08
Hypoactive (%)	71/377 (18.8)	47/186 (25.3)	
Normal (%)	306/377 (81.2)	139/186 (74.7)	

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**Table 3**

Pelvic floor strength in relation to various domains of the PISQ-IR and FSFI scales of sexual function.

Patient characteristics	Weak N=173	Strong N=207	P Value
Age years +/- SD (N)	53.3 ± 11.5 (160)	51.3 ± 11.3 (201)	0.11
Has Partner (%)	143/160 (89.4)	165/201 (82.1)	0.05
BMI, kg/m <sup>2</sup> ±SD (N)	27.7 ± 4.9 (160)	27.7 ± 5.1 (186)	0.91
Postmenopausal (%)	104/168 (61.9)	100/205 (48.8)	<b>0.01</b>
Gravidity, mean ± SD (N)	2.9 ± 1.48 (172)	2.84 ± 1.6 (206)	0.63
Parity mean ± SD (N)	2.5 ± 1.2 (172)	2.34 ± 1.2 (206)	0.19
Mode of Delivery			0.32
All Vaginal	149/167(89.2)	161/192(83.9)	
All Cesarean	4/167(2.4)	7/192(3.7)	
Both Vaginal and Cesarean	14/167(8.4)	24/192(12.5)	
POPQ stage 2 (%)	67/166 (40.4)	57/201 (28.3)	<b>0.02</b>
Latino or Hispanic (%)	13/112 (11.6)	18/154 (11.7)	1.0
White Race (%)	143/160 (89.4)	177/199 (88.9)	0.38
Stress Urinary Incontinence (%)	116/173 (67.1)	151/207 (73.0)	0.22
Urgency Incontinence	87/173 (50.3)	86/207 (41.6)	0.10
Mixed urinary incontinence (%)	75/173 (43.4)	71/207 (34.3)	0.07
Anal incontinence (%)	15/173 (8.7)	21/207 (10.1)	0.73
Diabetes (%)	7/172 (4.07)	14/206 (6.8)	0.27
Neurologic Disease (%)	4/171 (2.3)	11/205 (5.4)	0.19
Education: Some College or More (%)	105/154 (68.2)	143/199 (71.9)	0.48

**Table 4**

Sexual function among sexually active patients with weak and strong pelvic floors. Reported as mean score  $\pm$  SD (N).

Domain	Weak N=280	Strong N=275	P Value
PISQ-IR Scale			
Arousal/Orgasm	3.33 $\pm$ 0.77 (167)	3.47 $\pm$ 0.76 (205)	0.07
Partner Related	3.2 $\pm$ 0.73 (152)	3.25 $\pm$ 0.66 (189)	0.51
Condition Specific	4.46 $\pm$ 0.72 (159)	4.41 $\pm$ 0.71 (200)	0.58
Global Quality	2.99 $\pm$ 1.17 (168)	3.08 $\pm$ 1.04 (199)	0.43
Condition Impact	2.86 $\pm$ 0.92 (172)	3.09 $\pm$ 0.92 (205)	<b>0.02</b>
Desire	2.86 $\pm$ 0.87 (172)	3.06 $\pm$ 0.84 (207)	<b>0.02</b>
FSFI Scale			
Desire	3.11 $\pm$ 1.30 (171)	3.38 $\pm$ 1.33 (206)	<b>0.04</b>
Arousal	3.81 $\pm$ 1.47 (136)	4.10 $\pm$ 1.32 (182)	0.07
Lubrication	4.14 $\pm$ 1.60 (136)	4.52 $\pm$ 1.42 (182)	<b>0.03</b>
Orgasm	3.86 $\pm$ 1.62 (138)	4.37 $\pm$ 1.49 (183)	<b>0.0043</b>
Satisfaction	2.88 $\pm$ 0.96 (136)	2.90 $\pm$ 2.76 (180)	0.81
Pain	4.93 $\pm$ 1.30 (121)	4.88 $\pm$ 1.42 (164)	0.79
Total (of 19)	18.71 $\pm$ 5.91 (139)	20.06 $\pm$ 5.47 (184)	<b>0.038</b>

**Table 5**

“Best” multivariate models of sexually active patients looking at strength and potential confounders. For each domain, listed are independent predictors after multivariate logistic regression.

		Parameter Estimate +/- SE	P value
FSFI Domains	<b>FSFI Total</b>		
	Postmenopausal	-2.01+/-0.64	0.002
	POPQ >= 2	-1.50+/-0.68	.03
	<b>Desire</b>		
	Postmenopausal	-0.38+/-0.14	0.005
	Partner	-1.17+/-0.19	<-0.001
	<b>Lubrication</b>		
	Postmenopausal	-0.89+/-0.17	<0.001
	Partner	-0.58+/-0.24	0.02
	<b>Orgasm</b>		
Strength	0.51+/-0.17	0.004	
PISQ-IR Domains	<b>Condition Impact</b>		
	Strength	0.20+/-0.09	0.04
	Partner	-0.36+/-0.01	<0.001
	<b>Desire</b>		
	Age	-0.01+/-0.003	<0.001
	POPQ >= 2	-0.76+/-0.12	<0.001

Reported as parameter estimate +/- standard error (p value).

\*\* Bonferroni correction is made by comparing P-values to  $\alpha=0.05/5=0.01$