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Differences in Pelvic Morphology Between Women With and Without Provoked Vestibulodynia

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ABSTRACT

Objective: Pelvic morphology has been suggested to reflect increased tone and reduced strength of the pelvic floor muscles (PFMs) in women with provoked vestibulodynia (PVD) compared to healthy controls. We aimed to determine whether there are differences in pelvic morphology in the resting state, on maximum voluntary contraction (MVC), or on maximum effort Valsalva maneuver (MVM) between women with and without PVD.

Methods: While imaged using ultrasound, 38 women with PVD and 39 controls relaxed their PFMs, performed 3 MVCs and performed 3 MVMs. Levator plate length (LPL), levator plate angle (LPA), and anorectal angle (ARA) were determined at rest, at MVC and at MVM. The displacement of the bladder neck (BN) on MVC and on MVM was also determined. Two-way ANCOVAs were used to evaluate the main effects of group and task, the interaction between group and task, and the effect of resting morphology on LPL, LPA, and ARA. A 2-way repeated-measures ANOVA was used to determine whether the groups differed in terms of BN displacement during the tasks.

Results: Women with PVD had smaller LPLs and LPAs than controls across all tasks. The significant group differences in LPL and LPA at MVC and MVM were no longer significant once the resting values were included as covariates in the models. Bladder neck displacement differed between the groups at MVM but not at MVC.

Conclusion: Women with PVD display shorter LPL sand smaller LPAs than controls but their behavior does not differ when MVC and MVMs are performed. Our results do not support the hypothesis that women with PVD demonstrate abnormalities in PFM contractility on MVC or compliance on MVM.

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Key Words: Dyspareunia; Pelvic Floor Muscles; Ultrasound; Provoked Vestibulodynia

INTRODUCTION

Provoked vestibulodynia (PVD) is a syndrome characterized by severe, sharp, and/or burning pain in response to the application of pressure to the vulvar vestibule. The pathology and pathophysiology of PVD are poorly understood; however, the pelvic floor muscles (PFMs) have been implicated.[1-4] The superficial PFMs in women with PVD have been reported to be hypertonic, have low flexibility, be hyper-responsive to pressure at the vulvar vestibule, and to have impaired ability to relax after a contraction, all of which may aggravate the pain perceived during attempted vaginal penetration, and which may perpetuate a guarding response.[2,3] There also have been suggestions that the contractile ability of PFMs is impaired in women with PVD.[1,2,4]

Ultrasound imaging is a useful tool for evaluating the integrity of the PFMs; it provides access to views in the axial and transverse planes similar to magnetic resonance imaging[5,6] and is reliable.[7,8] Further, ultrasound imaging can sample images at higher frequency than MRI, allowing for better time resolution in the evaluation of dynamic activities. Midsagittal plane views have been used to quantify pelvic organ prolapse (POP) by visualizing the bladder neck, the cervix, and the rectal ampulla at rest and during a bearing down maneuver,[9] and to demonstrate excessive bladder neck mobility in women with stress urinary incontinence.[10] Images showing the levator plane allow us to assess the integrity of the puborectalis muscle[11] as well as views of the levator hiatus and paravaginal support structures.[5]

Recently Morin et al[4] reported, using transperineal ultrasound imaging, that women with PVD had shorter levator plate lengths (LPLs; measured as the anteroposterior [AP] diameter of the

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levator hiatus on 3D images), smaller anorectal angles (ARAs), and larger levator plate angles (LPAs) compared to pain-free controls. These findings are consistent with the higher resting tone of the deep PFMs. In the same study, women with PVD showed less displacement of their bladder neck (BN) and smaller changes in the ARA and LPA on maximum voluntary contraction (MVC) compared to controls, which the authors postulated were associated with impaired PFM contractile ability.[4] However, Morin et al[4] did not investigate differences between women with and without PVD during a bearing down maneuver (Valsalva), which may provide further information about tissue mechanics or motor control of PFMs.[12] Also, despite finding group differences in biometry at rest, Morin et al[4] did not include rest values as covariates in the subsequent statistical models to ensure that group differences associated with contraction were not primarily related to differences in resting biometry.

AIMS

The purposes of the current study were to build on the work of Morin et al,[4] with specific objectives being to (1) investigate whether there are evident differences in LPL, LPA, and/or ARA between women with and without PVD when measured using 2D transperineal ultrasound images of the pelvis at rest, on MVC and on maximal Valsalva maneuver (MVM), and, if so, (2) determine whether the relative change in LPL, LPA, and ARA or the absolute change in BN position seen at the end of MVC and/or MVM differ between women with and without PVD, when differences in resting values are accounted for in the model. We hypothesized that differences between women with PVD and controls in the amount of change in LPL, LPA, or ARA seen on MVC or MVM would be dependent on differences in the same measures acquired in the resting state.

METHODS

The study was approved by the Queen's University Health Sciences and Affiliated Teaching Hospitals' Research Ethics Board and all women provided written informed consent prior to participating.

Women with PVD and women without a history of genital pain were recruited between October 2009 and December 2013 using study flyers, online advertisements on social media websites, and flyers and letters sent to health care professionals (ie, medical doctors, physical therapists, psychologists, and sex therapists) informing them about the study. Additionally, women who had previously participated in studies carried out in our laboratory that were unrelated to the assessment of pelvic floor muscle morphology and/or function, and who gave permission to be contacted about future studies were contacted and asked if they were interested in participating.

To participate in the study, women had to be 18 years of age or older and fluent in English or French. The exclusion criteria for all participants were pregnancy, urinary or fecal incontinence, peri- or postmenopausal status, a history of gynecological or urological surgery, metabolic or neuromuscular conditions known to affect muscle contractility (eg, multiple sclerosis, diabetes), and serious medical, psychiatric, or other pain conditions that significantly interfere with daily or sexual functioning. Additionally, for the PVD group, women had to report experiencing vulvar pain upon attempted vaginal penetration for a minimum of 6 months, had to have a confirmed diagnosis of PVD by a physician with specialized knowledge and experience in vulvovaginal disorders, and could not present with another form of vulvar pain (eg, generalized or unprovoked vulvodynia, lichen sclerosus) or significant vaginismus (ie, not able to have at least one finger inserted vaginally). For the control group, women could not have a history of recurrent genital pain or difficulties with vaginal penetration. A priori statistical power calculations were performed based on pilot data recorded from 10 women with PVD and 7 nonaffected women and showed that, for a power of 0.8 to detect what we estimated to be a minimally clinically important difference between groups for each measure across all tasks (5 mm for LPL [SD 07.3 mm], 5 degrees for LPA [SD = 6.4 degrees], and 15 degrees for ARA [SD = 13.5 degrees]) at an alpha level of 0.05, sample sizes of 35, 27, and 13 per group would be required, respectively.

Procedures

Physical Examination and Ultrasound Imaging

Potentially eligible women underwent a physical examination with the study physician, a gynecologist at the Kingston site or a general practitioner with a special interest in vulvovaginal disorders at the Montreal site. The physician visually and manually examined the internal and external genitalia to rule out other potential causes of genital pain and to confirm a diagnosis of PVD. Among eligible women, the cotton-swab test[13] was conducted for descriptive purposes. Pressure was induced through the tip of a cotton swab at 5 sites (order randomized) around the vulvar vestibule (1, 4−5, 6, 7−8, and 11 o'clock, where 12 represented the anterior margin of the introitus). After each touch with the cotton swab, women rated the intensity of their pain on a numerical rating scale (NRS) from 0 (no pain at all) to 10 (worst pain ever felt). Women who were eligible for the study after the gynecological examination were scheduled for the ultrasound imaging session.

One of the investigators (S.T.G.) conducted all the ultrasound assessments. Imaging was performed using a GE Voluson *i* ultrasound system (GE Healthcare; Mississauga, ON, Canada) with an 8- to 4-MHz curved array 3D transducer used in 4D Real Time acquisition mode. The transducer was placed transperineally with the main transducer axis oriented in the midsagittal plane and the volume acquisition angle set to its maximum of 85 degrees. Imaging was performed after bladder emptying and with participants in the supine position, hips slightly abducted and flexed approximately 30 degrees, knees flexed approximately 30 degrees, and feet supported in stirrups.