THE JOURNAL OF
SEXUAL MEDICINE

Heightened Pelvic Floor Muscle Tone and Altered Contractility in Women With Provoked Vestibulodynia

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ABSTRACT

Background: Pelvic floor muscle (PFM) dysfunctions are reported to be involved in provoked vestibulodynia (PVD). Although heightened PFM tone has been suggested, the relative contribution of active and passive components of tone remains misunderstood. Likewise, alterations in PFM contractility have been scarcely studied.

Aims: To compare PFM tone, including the relative contribution of its active and passive components, and muscular contractility in women with PVD and asymptomatic controls.

Methods: Fifty-six asymptomatic women and 56 women with PVD participated in the study. The PVD diagnosis was confirmed by a gynecologist based on a standardized examination.

Outcomes: PFM function was evaluated using a dynamometric speculum combined with surface electromyography (EMG). PFM general tone was evaluated in static conditions at different vaginal apertures and during repeated dynamic cyclic stretching. The active contribution of tone was characterized using the ratio between EMG in a static position and during stretching and the proportion of women presenting PFM activation during stretching. Contribution of the passive component was evaluated using resting forces, stiffness, and hysteresis in women sustaining a negligible EMG signal during stretching. PFM contractility, such as strength, speed of contraction, coordination, and endurance, also was assessed during voluntary isometric efforts.

Results: Greater PFM resting forces and stiffness were found in women with PVD compared with controls, indicating an increased general tone. An increased active component also was found in women with PVD because they presented a superior EMG ratio, and a larger proportion of them presented PFM activation during stretching. Higher passive properties also were found in women with PVD. Women with PVD also showed decreased strength, speed of contraction, coordination, and endurance compared with controls.

Clinical Implications: Findings provide further evidence of the contribution of PFM alterations in the etiology of PVD. These alterations should be assessed to provide patient-centered targeted treatment options.

Strengths and Limitations: The use of a validated tool investigating PFM alterations constitutes a strength of this study. However, the study design does not allow the determination of the sequence of events in which these muscle alterations occurred—before or after the onset of PVD.

Conclusion: Findings support the involvement of active and passive components of PFM tone and an altered PFM contractility in women with PVD. **Morin M, Binik YM, Bourbonnais D, et al. Heightened Pelvic Floor Muscle Tone and Altered Contractility in Women With Provoked Vestibulodynia. J Sex Med 2017;14:592–600.**

Key Words: Provoked Vestibulodynia; Dyspareunia; Vulvodynia; Pelvic Floor; Muscle Tone; Muscle Tensions; Muscle Strength; Dynamometer; Electromyography

Received December 19, 2016. Accepted February 19, 2017.

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http://dx.doi.org/10.1016/j.jsxm.2017.02.012

INTRODUCTION

Vulvodynia is a common gynecologic pain condition with a population prevalence rate as high as 7% to 8% by 40 years of age.[1] The most common type of vulvodynia, provoked vestibulodynia (PVD), is characterized by a burning pain at the entry of the vagina during the application of pressure or while attempting vaginal penetration.[2] Although the etiology of PVD remains poorly understood, pelvic floor muscle (PFM) dysfunctions, most notably heightened PFM tone, have been proposed among key pathophysiologic mechanisms.[3] It has been hypothesized that increased PFM tone could act as an initiator of vestibular pain and/or a perpetuating factor, which results in a vicious cycle involving pain and further muscle tensions.[4–7] However, the comparison of PFM tone in women with PVD with that in asymptomatic controls has generated conflicting results.[7–15] This can stem from insufficient understanding of muscle tone physiology and limitations of current assessment tools. Muscle tone (also referred to as general PFM tone) is defined as the resistance provided by an innervated muscle when stretching is applied. Muscle tone is composed of an active (electrogenic) component and a passive (viscoelastic) component.[16] No studies to date have considered these components of PFM tone in women with PVD. Several studies have used digital palpation, a general but subjective approximation of muscle tone.[17,18] Others have used resting electromyography (EMG) amplitude as an index of the active component (electrogenic), although this measurement has several limitations when used for inter-subject comparison.[19] Because confounding factors such as vaginal lubrication, thickness of the vaginal tissue, and contact between the electrodes and the mucosa can influence EMG amplitude, it is recommended in musculoskeletal research to use ratio or normalized EMG values or muscle activation.[20–22] A methodology combining EMG and dynamometry has been developed to overcome the limitations of current pelvic floor assessment tools and has been validated to investigate general PFM tone and the relative contribution of active and passive components.[23,24] Further, alterations in PFM contractility, such as strength, speed of contraction, coordination, and endurance, have rarely been studied in women with PVD[8–10,14,15] and should be investigated with direct and validated tools such as a dynamometer. Not only is this is important for a better understanding of PVD pathophysiology, but it also has significant clinical implications for treatment. For instance, the active component that encompasses the electrogenic spasms would be specifically addressed by teaching proper muscle relaxation and control with biofeedback, whereas heightened viscoelastic properties (passive component)[21] would require stretching. Thus, the goals of this study were to (i) assess and compare PFM tone, including general muscle tone and the relative contribution of active and passive components, in women diagnosed with PVD and asymptomatic controls and (ii) compare PFM strength, speed of contraction, coordination, and endurance between the two groups.

METHODS

Participants

Participants were recruited through posters in universities and affiliated hospitals, health professional referrals, and newspaper and website advertisements. For the PVD group, 87% were recruited through posters and advertisements, 9% from health professional referrals (gynecologists and psychologists), and 4% from another PVD study in which women expressed an interest in being re-contacted for participating in similar studies. For the control group, 73% were recruited through posters and advertisements and 27% by word of mouth. Eligibility criteria were verified by a telephone screening interview and the physiotherapist's assessment. In addition, women with PVD had their diagnosis confirmed by a gynecologist from our team (S.K. and S.O.) based on a standardized and validated protocol consisting of an interview and a physical examination.[25] As part of the protocol, a cotton-swab test was performed to evaluate the sensitivity of the vestibule by applying random pressure at 3, 6, and 9 o'clock. The women had to report a pain intensity of at least 5 on the numerical rating scale (from 0 to 10) and to express similar pain to the one perceived during vaginal intercourse. The gynecologic assessment was conducted on a different occasion than the PFM assessment. Other inclusion criteria for women with PVD were (i) pain during intercourse that was subjectively distressing and occurred during 80% of intercourse attempts in the past 6 months and (ii) pain limited to intercourse and other activities involving vestibular pressure (eg, bicycling). Asymptomatic women had to be sexually active (ie, vaginal penetration in the past 6 months) and report no history of vulvovaginal pain and no difficulties with sexual activity, gynecologic examinations, or tampon insertion. The exclusion criteria for the two groups were (i) deep dyspareunia; (ii) postmenopausal status; (iii) current or previous pregnancy that lasted longer than 18 weeks; (iv) urogynecologic symptoms such as urinary or anal incontinence or urinary urgency; (v) pelvic organ prolapse (stage $>$ 1 at the pelvic organ prolapse quantification)[26] and active urinary or vaginal infection (or in the past 3 months); (vi) previous vulvovaginal surgery or pelvic floor physical therapy treatment; (vii) ongoing treatment for dyspareunia; and (viii) age younger than 18 or older than 45 years. The present study was approved by the institutional review boards of the Centre hospitalier de l'Université de Montréal and McGill University and all women gave written informed consent.

Instrumentation

The PFM function was evaluated with a dynamometric speculum according to a previously described and validated methodology (Figure 1).[27,28] The psychometric properties related to the assessment of PFM tone during stasis and repeated cyclic stretching show strong reliability and validity and have been presented elsewhere.[23,24] To allow the assessment of women with vulvovaginal pain, the speculum's upper and lower