

PAIN

## Relationships Between 3-Dimensional Transperineal Ultrasound Imaging and Digital Intravaginal Palpation Assessments of the Pelvic Floor Muscles in Women With and Without Provoked Vestibulodynia



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### ABSTRACT

**Background:** Digital intravaginal palpation remains the favored method for clinical assessment of pelvic floor muscle (PFM) function in women; however, there is growing interest in using transperineal ultrasound imaging (TPUSI). TPUSI does not involve vaginal penetration, making it particularly relevant for PFM assessment in women with genito-pelvic pain and penetration disorders.

**Aims:** To study the relations between measures of PFM morphology and function assessed using 3-dimensional (3D) TPUSI and PFM assessment through intravaginal palpation.

**Methods:** 77 nulliparous premenopausal women with (n = 38) and without (n = 39) PVD participated. 3D TPUSI was used to measure levator hiatal dimensions at rest, at maximal voluntary contraction (MVC) of the PFM, and at maximal Valsalva maneuver (MVM). Intravaginal palpation was used to assess PFM strength, PFM tone, PFM relaxation after contraction, and vaginal flexibility; each was scored using an ordinal grading scale. Ultrasound and palpation outcomes were compared using Spearman correlation coefficients and Kruskal-Wallis 1-way analyses of variance by rank.

**Outcomes:** Outcomes included ultrasound measures of the levator hiatal area, anteroposterior diameter, and left-right transverse diameter at rest, at MVC, and at MVM; raw and relative changes in hiatal dimensions between rest and MVC and between rest and MVM; and palpation measures of PFM strength, tone, and relaxation after contraction, and vaginal flexibility.

**Results:** Weak to fair correlations were found between ultrasound and palpation measures. A smaller levator hiatus at rest was associated with greater PFM tone, less PFM relaxation, and less vaginal flexibility. Greater levator hiatal constriction and shortening of the hiatal anteroposterior diameter at MVC were associated with greater palpated PFM strength. Greater hiatal distention at MVM was associated with lower PFM tone and greater relaxation.

**Clinical Translation:** 3D TPUSI and intravaginal palpation provide related but distinct information about PFM function in young women with and without PVD with high functioning PFM.

**Strengths and Limitations:** This was the first study to compare PFM assessment using 3D TPUSI and intravaginal palpation in nulliparous premenopausal women. A main strength of the study was the inclusion of women with PVD and asymptomatic controls, which provided a wide range in outcomes because differences in PFM morphology and function exist between women with and without PVD. The lack of inclusion of older women and women with weaker and/or hypotonic PFM limits the generalizability of the findings.

**Conclusion:** Although TPUSI has several advantages, including painless application, it is not recommended as a replacement for digital palpation in the clinical assessment of PFM function. **Thibault-Gagnon S, Goldfinger C, Pukall C, et al. Relationships Between 3-Dimensional Transperineal Ultrasound Imaging and Digital Intravaginal Palpation Assessments of the Pelvic Floor Muscles in Women With and Without Provoked Vestibulodynia. J Sex Med 2018;15:346–360.**

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**Key Words:** Pelvic Floor Muscles; Assessment; Ultrasound imaging; Palpation; Strength; Tone

## INTRODUCTION

There is no accepted “gold standard” for the assessment of pelvic floor muscle (PFM) function. However, digital intravaginal palpation remains the favored method by physical therapists for clinical PFM assessment because it is quick and easy, no equipment is required, and it can provide valuable clinical information.<sup>1</sup>

Many different ordinal grading scales have been described to assess PFM function through intravaginal palpation.<sup>2–10</sup> The best known grading scale is the Modified Oxford Scale (MOS), which is a 6-point scale used to score maximal PFM contraction strength, ranging from 0 (no contraction) to 5 (strong contraction and lift, sufficient to elevate the examiner’s fingers against strong resistance<sup>2</sup>; Table 1). Although other scales have been described for evaluating PFM strength,<sup>3–5,11</sup> the MOS is most commonly used.<sup>1,12,13</sup> The MOS has been found to demonstrate acceptable intra-rater and between-day reliability.<sup>11,12</sup> Assigned grades of PFM strength using the MOS have been shown to correlate with intravaginal pressure measurements assessed using perineometry,<sup>2,11,14–16</sup> force measurements assessed using dynamometry,<sup>11,17</sup> and the amount of pelvic floor lift seen in the sagittal plane through ultrasound imaging (USI)<sup>13,18</sup> during PFM contraction.

The resistance provided by the PFMs when a passive manual stretch is applied to them, referred to as PFM tone,<sup>6,19</sup> also is a common clinical palpation outcome measure. Reissing et al<sup>7,8</sup> described a 7-point PFM tone scale ranging from –3 (very hypotonic) to +3 (very hypertonic), with 0 representing a “normal, healthy vaginal/pelvic muscle tone.” Other grading scales have been proposed for evaluating PFM tone,<sup>3,6,9</sup> but the scale of Reissing et al<sup>7,8</sup> has been reported to be the most suitable because it has shown good inter-rater agreement between experienced physical therapists<sup>8</sup> and because the descriptors for the levels of scoring, unlike other tone scales, pertain only to tone.<sup>20</sup> Reissing et al also described a 5-point scale for evaluating the degree of PFM relaxation after a contraction ranging from 0 (returns to resting state) to 4 (remains fully contracted) and described the assessment of the maximal capacity of the distal vagina to withstand a stretch laterally (ie, vaginal flexibility<sup>7,8</sup>). Gentilcore-Saulnier et al<sup>10</sup> subsequently proposed a 5-point grading scale ranging from 0 (<1 finger inserted into the vagina) to 4 (2 fingers inserted into the vagina, oriented so that the finger breadths are in the frontal plane and abducted  $\geq 2$  cm) for the assessment of vaginal flexibility. The assessments of PFM relaxation after contraction and vaginal flexibility are commonly performed in the clinic by physical therapists.<sup>21,22</sup> They appear to be associated with PFM tone outcomes and are particularly relevant in the assessment of women with genito-pelvic pain or penetration difficulties.<sup>7,8,10</sup>

Despite its widespread use, digital palpation has been criticized for being a subjective PFM assessment method, lacking precision, having limited inter-rater reliability,<sup>1,5,6,11,17,23</sup> and not being suitable for all women, especially those with genito-pelvic pain or penetration difficulties. It has been proposed that transperineal USI (TPUSI) might have utility as a non-invasive (ie, it does not involve vaginal penetration), objective, and reliable alternative to digital palpation in the assessment of PFM function.<sup>24</sup>

3-dimensional (3D) TPUSI has been shown to be useful for evaluating PFM morphology and function, particularly through measurement of levator hiatal dimensions at rest and during tasks including PFM contraction and Valsalva maneuvers. Levator hiatal measures obtained using 3D TPUSI have been found to be reliable<sup>25–28</sup> and valid compared with magnetic resonance imaging measures.<sup>29</sup> Although TPUSI has been used primarily in research, it is becoming of increased interest to clinical physical therapists. With the evolution of ultrasound technology, 2-dimensional and 3D imaging systems are becoming more affordable for clinicians; therefore, TPUSI might soon become a mainstream tool used in the physical therapy assessment of PFM function. It also might be useful as a biofeedback tool in the physical therapy management of conditions that involve PFM dysfunction.

Before TPUSI is deemed useful for clinical practice, it is important to understand how image data should be interpreted. For example, the association between PFM strength graded using the MOS and the amount of constriction of the levator hiatus observed during a maximum voluntary contraction (MVC) could allow us to interpret TPUSI outcomes in the assessment of PFM strength. Similarly, the associations between the resistance of the PFMs to a stretch induced through digital intravaginal palpation and levator hiatal dimensions at rest and the capacity of the levator hiatus to distend during a maximal Valsalva maneuver (MVM) observed at TPUSI could allow us to interpret TPUSI findings in terms of PFM tone.

Despite sparse evidence, changes in levator hiatal morphology have been considered analogous to measures of PFM tone and strength. For example, in a recent study by Morin et al,<sup>30</sup> the differences in levator hiatal morphology found during rest and during PFM MVC between cohorts of women with and without provoked vestibulodynia (PVD) were attributed to PFM tone and strength differences, respectively, between the 2 groups. Only a few studies to date have investigated the association between TPUSI measures of levator hiatal morphology and PFM outcomes assessed using palpation and only in women who were pregnant, parous, and/or who had urogynecologic complaints such as urinary incontinence (UI) and/or pelvic organ prolapse

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