

PAIN

Anxiety and Anticipated Pain Levels of Women With Self-Reported Penetration-Related Genito-Pelvic Pain are Elevated in Response to Pain-related Images

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ABSTRACT

Background: Genito-pelvic pain (GPP) affects a sizable minority of women and results of existing treatments can be variable. A method of general pain treatment that has not yet been extended to penetration-related GPP is Explicit Motor Imagery (EMI), which uses pain-related images to help individuals with pain alter their responses to pain, resulting in reduced pain, less pain-related anxiety, and improved function.

Aim: As a first step toward determining if EMI is a feasible method for treating penetration-related GPP, this study examined whether images that potentially signal genital pain are sufficient to induce an anxiety or anticipated pain response in women.

Methods: Participants were 113 women (62 with genital pain, 51 pain-free) recruited to complete an online study. Participants viewed randomized images of women engaging in various activities that potentially cause pain for people with penetration-related GPP (sitting, walking, running, lifting, inserting a tampon, implied penetrative sex, actual penetrative sex, implied gynecological exam, actual gynecological exam). Participants then rated each image on how much anxiety they experienced viewing the picture (viewing anxiety), and how much anxiety (anticipated anxiety) and pain (anticipated pain) they expected to experience doing the activity in the picture.

Outcomes: Outcomes were the self-reported viewing anxiety, anticipated anxiety, and anticipated pain of women with and without self-reported penetration-related GPP in response to the pain-related images.

Results: Women who experienced self-reported penetration-related GPP reported significantly higher levels of viewing anxiety, anticipated anxiety, and anticipated pain in almost all categories of images, compared to women who were free of pain. The key exception was that women with and without self-reported penetration-related GPP reported similar levels of viewing anxiety when looking at images of implied and actual penetrative sex.

Clinical Translation: These results support that pelvic and genital imagery serve as a sufficient stimulus to generate anxiety and anticipated pain in our study sample. EMI, which targets desensitization of heightened anxiety warrants further research as a potential novel treatment option.

Strengths & Limitations: This study was the first to assess responses to a wide array of pain-eliciting images in women with and without self-reported penetration-related GPP. A key limitation was that the pain sample was self-reported and not clinically diagnosed.

Conclusion: Images of pain-related stimuli were sufficient to induce anxiety and anticipated pain in women with self-reported penetration-related GPP. This first step suggests that EMI may be a useful treatment option for women with penetration-related GPP. **Kelly KJM, Fisher BL, Rosen NO, et al. Anxiety and Anticipated Pain Levels of Women With Self-Reported Penetration-Related Genito-Pelvic Pain are Elevated in Response to Pain-related Images. J Sex Med 2022;XX:XXX–XXX.**

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Key Words: Genito-Pelvic Pain; Explicit Motor Imagery; Genital Pain; Pain-Related Stimuli; Chronic Pain; Sexually Explicit Materials (SEM)

Received July 6, 2021. Accepted April 28, 2022.

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<https://doi.org/10.1016/j.jsxm.2022.04.013>

Genito-pelvic pain (GPP) affects a sizable minority of women and interferes with women's overall quality of life, with the most significant consequences for their sexual functioning.¹ Past research suggests that the prevalence of GPP falls between 14% to 34% in young women and between 6.5% to 45% of older women.^{1,2} Although the occurrence of this chronic pain issue is common, prolonged GPP can lead to increased anxiety about any penetration-related activities and a hypervigilance toward genital related pain, which can greatly impact daily living.^{3,4}

Genito-pelvic pain/penetration disorder (GPPPD) is characterized by difficulties with vaginal penetration during intercourse, pain during intercourse or penetration attempts, fear or anxiety about pain or in anticipation of penetration, and pelvic floor muscle tension during attempted penetration.⁵ One or more of these symptoms must be present for at least 6 months and cause significant distress for the woman.⁵ Women with GPPPD often report difficulties and pain in non-sexual contexts such as during a gynaecological pelvic exam and tampon insertion.⁶ Furthermore, clinically, women commonly report difficulty or pain with urination, defecation, the ability to wear certain clothing, exercise, as well as simple resting postures like sitting.^{7–9}

The cause and maintenance of GPPPD is multidimensional. It is often a complex interaction between biomedical factors, including symptoms associated with vaginal infections, prolonged use of oral birth control, pelvic floor muscle over-activation and vulvo-vaginal nociceptor proliferation, as well as psychosocial components including cognitive, behavioural, affective and interpersonal influences.¹⁰ Similar to other chronic pain conditions, GPPPD sufferers demonstrate changes in structure and function of the peripheral and central nervous system, an adaptation referred to as neuroplastic change.¹¹

In response to initial acute pain, biophysiological adaptations result in neuroplastic changes that occur throughout the central nervous system (CNS).^{12,13} This increased neural response to stimuli occurring in the CNS results in an amplification of pain processing - a phenomenon known as central sensitization. Characteristics of central sensitization include a disproportionate amount of pain for the extent of the peripheral injury, pain distribution patterns that do not follow neuromuscular anatomy, and a hypersensitized pain response such as dynamic tactile allodynia, pressure hyperalgesia and temperature sensitivity.^{11,14–17} There is also evidence of reorganization of the primary sensory cortex associated with the painful body part in those with central sensitization.^{18–20} For some, these effects are long-lasting, and pain continues to persist regardless of healed peripheral pathology.²¹

Neuroplastic centralized sensitization changes have been demonstrated in those with GPPPD conditions. fMRI images taken of the brain during testing of the vaginal vestibule with cottonswab demonstrated increased activity in the cerebellum in response to non-painful pressure in those diagnosed with provoked vestibulodynia (a type of GPPPD characterized by

recurrent pain upon contact to the vestibule) compared to those without genital pain.²² Painful pressure at the vestibule was also associated with heightened neural activity in the insula and frontal cortex regions in women with provoked vestibulodynia, indicating neural differences contributing to lowered sensory thresholds compared to symptom-free controls. In this same study, the women with genital pain also reported higher levels of intensity and unpleasantness for both non-painful and painful levels of pressure.²² Additionally, increased activity in areas involved in neural processing of pain have been observed when painful pressure is applied to non-painful areas, such as the thumb, in women with GPPPD compared to those with fibromyalgia and controls.²³ Taken together, these findings suggest that an important part of treatment for GPPPD might aim to address maladaptive, neuroplastic changes.

Maladaptive neuroplastic change has been demonstrated with exposure to still images. Moseley et al²⁴ exposed participants with chronic hand pain to images of hands in pain-inducing positions. Participants were asked to view a series of images and to visualize themselves performing the hand positions in the image. After viewing and visualizing the series of images a single time, participants reported higher pain scores and demonstrated increased volume of swelling in their affected limb. Given that EMG sensors confirmed no neuromuscular activity of the hands while viewing the images, the authors concluded that the increased symptoms were probably mediated cortically rather than via stimulation of nociceptive afferents in the peripheral limb and that the act of visualising hand movements was sufficient in causing change.

Physiotherapists commonly use this phenomenon to perform neuroplastic-based treatments for those suffering with chronic low back, hand, and foot pain.^{18,25–29} These are top-down treatment methods aimed at reverting the maladaptive changes observed in the CNS and subsequently, lowering the pain, pain-related anxiety, and improving function.^{25,26,30,31} The proposed mechanisms for these improvements include cortical reorganization and the alteration of cortical proprioceptive pathways, potentially resulting in anxiety/fear reduction, improved motor capabilities, decreased motor-autonomic response to stimuli, improved body schema, and improved activity tolerance.^{11,19,24,25,32–35} Given that practicing gradual and repeated exposure to visualizing images depicting potentially painful body positions and tasks has been demonstrated to improve both pain and functional outcomes in participants with shoulder, hand, foot, knee or spine pain, it is reasonable to assume that the same might be true for women with GPPPD.^{25,32,33,36,37} However, little is known about the effects of viewing pelvic and genital based images on perceived pain and anxiety in women with GPPPD. The present study was an initial step in determining if women with penetration-related GPP respond differently to pelvic and genital-based imagery in an effort to further the question of whether visual-based,

neuroplastic treatments might be useful in treating GPPD. For the purpose of this preliminary study, we focused on women who experience self-reported penetration-related GPP, regardless of any official diagnoses. The study involved women with and without self-reported penetration-related GPP viewing images of pain-related stimuli, similar to the stimuli that would be used in an Explicit Motor Imagery (EMI) protocol. We expected that viewing the pain-related images alone would be enough to induce differences in viewing anxiety, anticipated anxiety, and anticipated pain between women with and without self-reported penetration-related GPP.

METHOD

Participants

Participants were recruited from pelvic floor physiotherapy clinics across Canada and from both paid Facebook ads (<https://www.facebook.com>) and Mechanical Turk (MTurk; <https://www.mturk.com/>). MTurk is an online marketplace where workers complete short jobs in exchange for monetary compensation. Studies have shown that this is a useful way to obtain a large sample of reliable, quality data.^{38,39} The MTurk ads were generic, only saying that it was a survey about motor imagery. Once workers clicked on the link, they were briefly screened through a series of questions that did not reveal the population we were targeting. Participants were excluded if they were not women, if they had been pregnant or breastfeeding in the last 3 months, and if they did not have a vagina or uterus. Facebook ads were targeted toward people who experienced genital pain; however, they did not exclude women without genital pain. Participants were also required to answer questions to test their level of attention. Participants were excluded if they got more than 2 of the 9 attention testing questions incorrect.

A total of 221 participants completed the survey and passed the attention check (4 participants did not pass the attention check). From this sample of participants, we only included people who reported penetration-related GPP, and people who reported no pain at all. We decided to focus on penetration-related GPP because it was something participants could easily self-report and had a clear source, as opposed to the potentially more ambiguous existence of other genital or pelvic pain. As such, we excluded anyone who reported only non-genital pain ($n = 59$), people who reported genital or pelvic pain that was not caused by penetration ($n = 7$), and people who had not engaged in penetrative intercourse in the past month, according to the Female Sexual Function Index (FSFI),^{40,41} ($n = 17$). For inclusion into the no-pain group, participants also had to score the maximum score of 6 on the FSFI Pain subscale, indicating no pain during penetration. Anyone who did not self-report any GPP on the initial pain questionnaire, but also indicated a score less than 6, but greater than 5 on the FSFI Pain subscale was excluded ($n = 22$).

We suspect that while penetration-related GPP can be a chronic problem, because it is often intermittent in nature and

dependent on attempted penetration, many women do not recognize it as chronic pain. By avoiding the painful stimuli, they can avoid pain. This likely results in women reporting “no pain” until specifically asked about penetration-related pain. A score of 5 out of 6 on the FSFI pain subscale indicates the presence of occasional pain. Finally, 3 people were excluded for having inconsistent answers, specifically self-reporting penetration-related pain on the initial questionnaire asking about pain in various areas of the body, but then reporting no pain on the FSFI.

Our final sample consisted of 113 women with ($n = 62$) and without ($n = 51$) penetration-related genital pain, between the ages of 18 and 69 ($M = 32$, $SD = 9.88$). Participant demographics are presented in Table 1.

Stimuli

We selected images for this study from Google images. There were 33 pictures in 11 categories (3 pictures per category): sitting on a soft surface, sitting with weight on the anterior aspect of the perineum, sitting with weight posteriorly focused on the coccyx, walking, running, lifting heavy objects, insertion of a tampon, implied gynecological exam with the genitals concealed, implied vaginal sexual penetration with the genitals concealed, actual gynecological exam (with speculum or fingers inserted), and actual vaginal sexual penetration (with penis, finger or dildo inserted). Images that included faces were altered so that participants could not use the facial expressions as an indicator of pain. As this study was a pilot project to see if images in these categories could elicit responses, they were not previously validated.

Measures

Demographics and Health. Demographic questions included age, ethnicity, sexual orientation, relationship status and length (if applicable), number of children, education level, and country of residence. The health questions asked about current use of medications/supplements.

Pain Questionnaire. Participants were asked if they had experienced pain in any part of their body that had been occurring for 3 months or longer. If they answered yes to this question, they were then asked additional yes/no questions about the areas of the body that the pain occurred from a list of 15 locations, including the genitals. If they indicated pain in their genitals, they were then asked more specific yes/no questions about that area, including whether the pain occurred during the following activities: pelvic exam (ie, Pap test), sexual intercourse, inserting a tampon or other female product, wearing tight clothing, sitting, walking, standing still, self-hygiene (bathing, showering, towel-drying off), physical activity or exercise, riding a bike, horse, stationary cycle, motor biking, sitting astride/straddling.

Female Sexual Function Index (FSFI)⁴⁰. The well-validated FSFI is comprised of 19 items, which ask about the domains of desire, arousal, lubrication, orgasm, satisfaction, and pain. Each domain has a score out of 6 and the full-scale ranges from 2 to

Table 1. Demographics

	No pain (n = 51)	Genital pain (n = 62)
Mean age in years (SD)	34.8 (9.7)	29.1 (9.4)*
Ethnicity %		
Indigenous	2.0	
Black	3.9	3.2
Asian	2.0	3.2
White	88.2	85.5
Latina	2.0	6.5
Biracial/Multiracial	2.0	1.6
Education %		
Some high school	–	1.6
Graduated high school	7.8	9.7
Some university/college	37.3	41.9
University/college degree	41.2	32.3
Some graduate/professional	7.8	6.5
Graduate/professional degree	5.9	8.1
Sexual orientation %		
Gay	3.9	–
Straight	84.3	75.8
Bisexual	5.9	16.1
Other	5.9	8.1
Relationship status %		
Single	5.9	19.4
Dating	2.0	4.8
Long-term relationship	13.7	17.7
Cohabiting	21.6	24.2
Married	54.9	33.9
Other	2.0	–
Mean FSFI scores (SD)	30.0 (4.1)	22.3 (6.3)*
Pain subscale	6 (0)	3.2 (1.5)*

FSFI = female sexual function index.

*For continuous variables indicates a significant group difference $P < .01$.

36 with higher scores indicating better sexual function. For this study, we were interested in participants' scores on the pain domain only (*Cronbach's* $\alpha = 0.94$) for assignment to groups based on experience of penetration-related pain.

Pain-Related Images and Ranking. Participants saw all 33 images in randomized order. They were asked to rate each image on a scale from 0 (not anxious/no pain) to 9 (extremely anxious/extremely painful) for the following three questions: (1) How anxious do you feel looking at this image? (viewing anxiety), (2) Imagine you are the woman in this image, how anxious would you feel performing this activity? (anticipated anxiety), and (3)

Imagine you are the woman in this image, what would you rate your perceived pain in this situation? (anticipated pain).

Procedure

Recruitment materials directed potential participants to a survey website where they were screened for eligibility. If eligible, participants were redirected to an informed consent page. After consenting, participants completed the measures in the order they are listed above. The survey took approximately 20 minutes to complete. Participants were presented with information on genital pain resources on the final page of the survey. Individuals who were recruited via MTurk were compensated with \$2 USD for their time. Those who were recruited via social media and clinician offices were eligible to enter their name in a draw for a \$100 Amazon gift card. Study procedures were approved by the Research Ethics board of two Canadian universities.

Data Analysis

We analyzed each of the dependent variables (viewing anxiety, anticipated anxiety, anticipated pain) in separate mixed-model ANOVAs with group (penetration-related GPP vs no pain) as the between-subjects variable and image category as the within-subjects variable. Post-hoc comparisons for each of the 11 image categories were analyzed with an alpha of 0.005 to control for Type 1 error.

RESULTS

Participants in the pain group were significantly younger than those in the no pain group. FSFI scores were significantly lower for participants in the pain group compared to the no pain group both for overall and for the pain subscale (Table 1).

As stated in our hypothesis, we expected that viewing the pain-related images would induce differences in viewing anxiety, anticipated anxiety, and anticipated pain between women with and without self-reported penetration-related GPP.

For viewing anxiety, the ANOVA results found a significant main effect of image category, $F(10, 1100) = 104.03, P < .001, \eta^2 = .49$, a significant main effect of group, $F(1, 110) = 15.70, P < .001, \eta^2 = .66$, and a significant interaction between group and image category, $F(10, 1100) = 2.55, P = .005, \eta^2 = .02$. We used post-hoc t-tests to examine planned comparisons between groups on all 11 image categories. Women with self-reported penetration-related GPP reported significantly higher levels of anxiety from viewing the images than the no pain group for all image categories except for implied sex and actual penetrative sex, which were similarly anxiety-inducing for both groups. Figure 1 for means and effect sizes.

For anticipated anxiety, ANOVA results indicated that there was a significant main effect of image category, $F(10, 1100) = 140.48, P < .001, \eta^2 = .56$, a significant main effect of group, $F(1, 110) = 31.02, P < .001, \eta^2 = .22$, and a significant

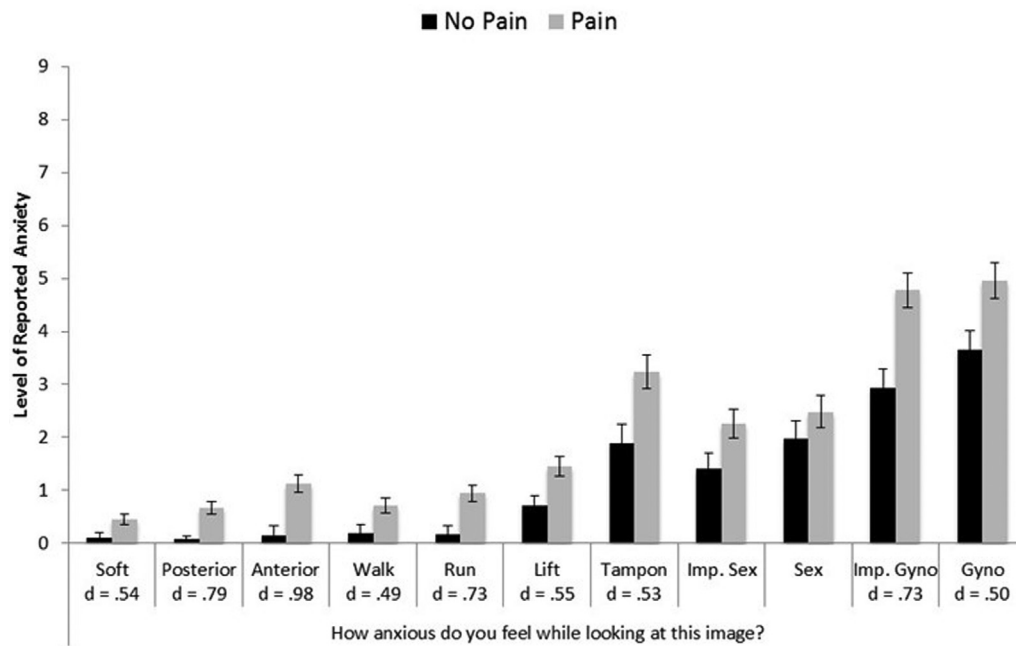


Figure 1. Mean (+/- SEM) differences between women with and without genital pain in their rankings of viewing anxiety in response to the question, how anxious would you feel while looking at this image? Effect sizes are listed for all differences significant at $P < .005$.

interaction between group and image category, $F(10, 1100) = 3.49$, $P < .001$, $\eta^2 = .03$. Post-hoc tests found that women in the self-reported penetration-related GPP group reported significantly higher levels of anticipated anxiety for engaging in any activity compared to the no pain group for all image categories except for the lifting category. Figure 2 for means and effect sizes.

The final question was about anticipated pain if performing the activity shown in the image. The ANOVA for the anticipated pain dependent variable also had a main effect of image category, $F(10, 1100) = 63.13$, $P < .001$, $\eta^2 = .37$, a significant main effect of group, $F(1, 110) = 60.04$, $P < .001$, $\eta^2 = .35$, and a significant interaction between group and image category, $F(10, 1100) = 13.52$, $P < .001$, $\eta^2 = .11$. Post-hoc t-tests showed that

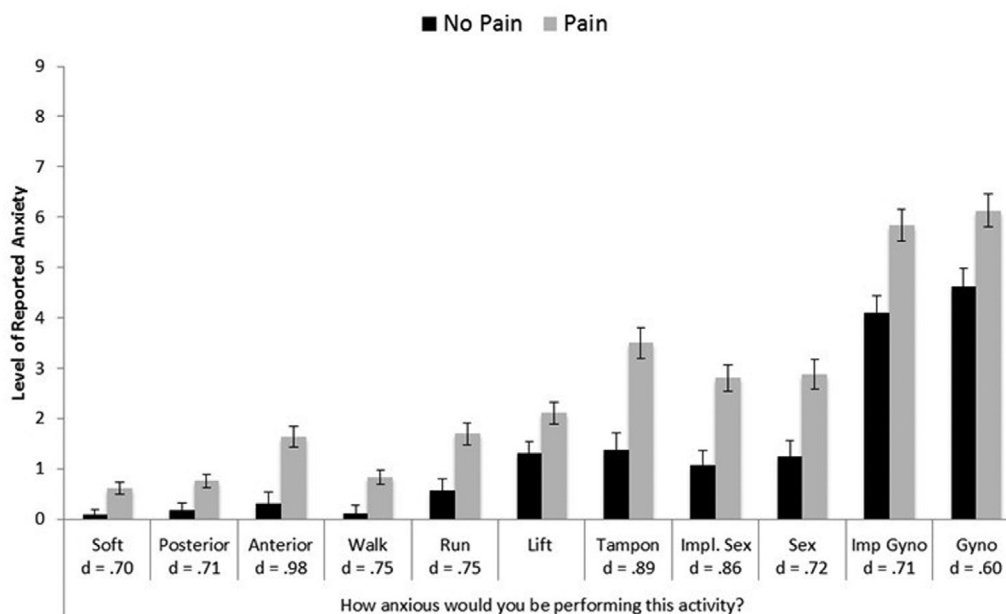


Figure 2. Mean (+/- SEM) differences between women with and without genital pain in their rankings of anticipated anxiety in response to the question, imagine you were the woman in this picture, how anxious would you feel performing this activity? Effect sizes are listed for all differences significant at $P < .005$.

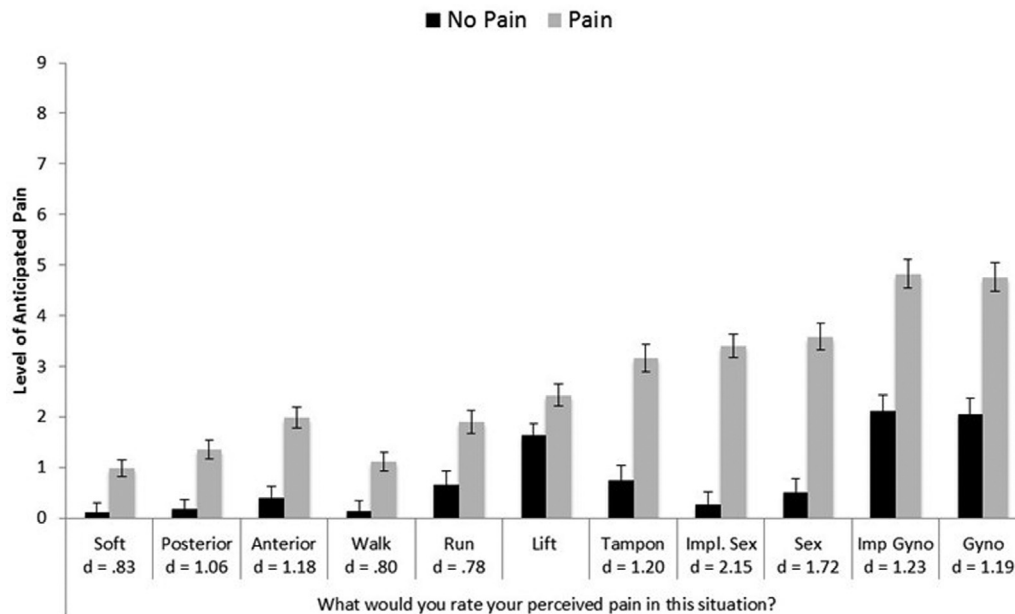


Figure 3. Mean (+/- SEM) differences between women with and without genital pain in their rankings of anticipated pain in response to the question, what would you rate your perceived pain in this situation? Effect sizes are listed for all differences significant at $P < .005$.

women in the self-reported penetration-related GPP group reported significantly higher levels of anticipated pain compared to the no pain group for all image categories except for the lifting category. Figure 3 for means and effect sizes. The effect sizes for reported anticipated pain were the highest, compared to viewing anxiety and anticipated anxiety.

Although we did not design the study to compare across stimuli, visual inspection of the data demonstrated that both groups of participants rated the gynecological images highly on all dependent variables. We wanted to comment on this result as an added, unplanned analysis. All participants reported the highest levels of viewing anxiety, anticipated anxiety, and anticipated pain when viewing the gynecological images (both implied and actual; all means in the 3.5–6 range on a scale of 0–9) compared to all other types of images (P s all $< .001$, Cohen's d s all greater than 0.6).

DISCUSSION

The present study aimed to investigate whether women who experience self-reported penetration-related GPP report more anxiety, anticipated anxiety and anticipated pain when viewing images of genital pain-related stimuli compared to women with no pain. Our results suggest that the penetration-related GPP group reported higher levels of all three outcome variables when exposed to a single viewing of most of the penetration related images compared to their pain-free counterparts. The exceptions were that there were no differences between the groups in response to the sexual images when reporting viewing anxiety.

Although a small number of studies have shown differences between women with and without GPP in levels of disgust or

threat response to erotic film,^{42,43} to our knowledge, this is the first time this difference has been demonstrated using only still images. Results support the feasibility of potentially using still images in anxiety and pain provoking stimuli in future EMI based treatments. The differences between groups on many image categories were in the range of medium to large effect sizes, indicating a robust difference between groups.

In a study by Van der Velde and colleagues, women with and without GPPPD viewed neutral, erotic, threatening or sexually-threatening films, while vaginal electromyography (EMG) sensors monitored their response to the videos.⁴² For both groups of women, involuntary activity of the pelvic floor muscles was observed in response to both the threatening and sexually threatening films, but not in response to the erotic film, which did not present an explicit threat at the time. The authors suggest that if women with genital pain perceive penetration as a threat, the response of involuntary pelvic floor muscle contraction might be a contributing factor for their pain. Gradual exposure to images of potentially painful activities might be a plausible treatment method to reduce the threat response.

Lykins et al⁴⁴ compared the attention of women with GPPPD to a control group of women with a pain-free sexual dysfunction (ie, women with low sexual desire) and to an asymptomatic control group (ie, no pain, no sexual dysfunction) when viewing images of heterosexual couples engaging in foreplay. Using eye-tracking technology, women with GPPPD attended significantly less to the erotic images than both control groups and significantly more to the context or background of the scenes than did the asymptomatic controls. Additional research demonstrates that when a threat of genital pain is introduced to women

watching erotic film, they experience decreased physiological sexual arousal, lubrication, and positive affect, regardless of genital-pain state, though those with GPPPD expressed significantly more negative affect than did controls.⁴³ These authors speculated that pain-related fear can affect genital responsiveness and might be a factor in penetration related GPP.⁴³ At a minimum, these studies provide evidence that those with GPPPD view and attend to sexual imagery differently than those without genital pain.

Where past EMI research has typically focused on people suffering from chronic back or limb pain, our study extends previous literature by examining the reports of women experiencing self-reported penetration-related GPP with the intention of utilizing this information to inform EMI therapies geared toward people experiencing GPPPD. Finding that there are robust differences between participants with and without self-reported penetration-related GPP in their affective responses to these still images provides support for incorporating such images into an EMI protocol. EMI aims to desensitize and normalize centrally sensitized changes to the brain, potentially resulting in anxiety/fear reduction, improved motor capabilities, decreased motor-autonomic response to stimuli, improved activity tolerance and decreased pain levels - all relevant clinical outcomes in women with GPPPD.^{24,25,32,34,36,37}

Interestingly, both the self-reported penetration-related GPP and control groups demonstrated similar levels of viewing anxiety when looking at sexual penetration images, both implied and explicit. Previous research suggests an inverse relationship with viewing sexually explicit material and sexual anxiety, and a positive correlation with sexual self-esteem.⁴⁵ The current study did not control for prior experience with viewing sexually explicit material. If participants had not had much exposure to sexual imagery, then this could explain the heightened anxiety for those without penetration-related genito-pain. This potential third variable—prior exposure to sexually explicit material—should be included in subsequent research.

We observed comparable anticipated anxiety and anticipated pain scores in women reporting penetration-related GPP when viewing either implied or explicit images of vaginal penetration. This finding infers that images merely implying the act of vaginal penetration are enough to trigger self-reported expectations for increased anxiety and anticipated pain scores in this population. It also suggests that the implied actions in the images are familiar enough for women to make a general assumption of vaginal penetration, without explicitly viewing the genitals. Previous research investigating EMI in hand, low-back and foot patients has yet to encounter this phenomenon, as there is no taboo associated with viewing these body parts and therefore, images of the actual body part have always been used.^{24–27,31} Our interest in contrasting implied and explicit vaginal penetration images was practical. The current results might directly affect future treatment protocols, as obtaining images of implied penetration is easier than explicit penetration and may be more palatable than the genital explicit images for some women.

Viewing gynecological related images resulted in higher anticipated anxiety ratings across both self-reported penetration-related GPP and control groups, suggesting that regardless of pain status, all participants experienced higher anxiety when it comes to viewing or anticipating a gynecological pelvic exam. Prior studies have suggested that 1 in 4 women experience high levels of anxiety during pelvic examinations.^{46,47} Many suggestions have been offered to improve patient comfort during gynecological exams, including omitting use of foot stirrups, self-insertion of speculum, use of lubricating gel, and warming the speculum.^{48–52} Previous research demonstrated that an educational presentation, viewing a video of a pelvic exam, or a combination of the two helped to reduce anxiety scores before undergoing a woman's first pelvic exam.⁵³ Thus, there may be benefits to the application of EMI techniques for reducing anxiety around pelvic examinations in all patients. Certainly, graded exposure techniques have been used to treat dental and needle anxiety.^{54,55} This is a promising direction for future intervention studies with women experiencing GPPPD.

Based on the results of the present study, which suggests that women with self-reported penetration-related GPP report increased anxiety, anticipated anxiety and anticipated pain when viewing genital-related images compared to women without this pain, the next step in our research is to develop an EMI protocol that can be used to determine if women's anticipated and actual anxiety and pain levels can be reduced through repeated exposure to imagery. This would be similar to what has been seen in other motor imagery therapies designed for chronic pain patients.^{24–26,30,31} Such protocols might also be useful for women who report no penetration pain but who experience anxiety about gynecological exams. Both pain and fear of cervical screening tests is a barrier to adherence of the recommended guidelines.^{56–58} Gradual visualization exercises of speculum insertion combined with education might serve to reduce anxiety and general tolerance of pelvic exams.

An at-home image-based treatment protocol could be useful for patients while waiting for consultation with specialists after receiving diagnosis, or for those who might not have access to specialized clinicians, especially in more rural areas. Phase 2 of this research program aims to examine whether EMI might be a useful tool for those who suffer with GPPPD, specifically for patients who cannot yet tolerate vulvar touch, and therefore cannot undergo standard pelvic floor physiotherapy assessment and treatment. Based on our participants' responses, EMI might be a viable non-tactile treatment option to help initiate rehabilitation.

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Conflict of Interest: The authors report no conflicts of interest.

Funding: None.

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