The Overactive Pelvic Floor (OPF) and Sexual Dysfunction. Part 2: Evaluation and Treatment of Sexual Dysfunction in OPF Patients

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ABSTRACT

Introduction: The assessment of pelvic floor muscle (PFM) overactivity is part of a comprehensive evaluation including a detailed history (medical, gynecological history/antecedent), appraisal of the psychosocial contexts of the patient, as well as a musculoskeletal and a neurological examination.

Objectives: The aims of this article are to review (i) the assessment modalities evaluating pelvic floor function in women and men with disorders associated with an overactive pelvic floor (OPF), and (ii) therapeutic approaches to address OPF, with particular emphasis on sexual pain and function.

Methods: We outline assessment tools that evaluate psychological and cognitive states. We then review the assessment techniques to evaluate PFM involvement including digital palpation, electromyography, manometry, ultrasonography, and dynamometry, including an overview of the indications, efficacy, advantages, and limitations of each instrument. We consider each instrument’s utility in research and in clinical settings. We next review the evidence for medical, physiotherapy, and psychological interventions for OPF-related conditions.

Results: Research using these assessment techniques consistently points to findings of high PFM tone among women and men reporting disorders associated with OPF. While higher levels of evidence are needed, options for medical treatment include diazepam suppositories, botulinum toxin A, and other muscle relaxants. Effective psychological therapies include cognitive behavioral therapy, couple therapy, mindfulness, and educational interventions. Effective physiotherapy approaches include PFM exercise with biofeedback, electrotherapy, manual therapy, and the use of dilators. Multimodal approaches have demonstrated efficacy in reducing pain, normalizing PFM tone, and improving sexual function. Multidisciplinary interventions and an integrative approach to the assessment and management of OPF using a biopsychosocial framework are discussed.

Conclusion: Although the efficacy of various intervention approaches has been demonstrated, further studies are needed to personalize interventions according to a thorough assessment and determine the optimal combination of psychological, physical, and behavioral modalities.


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Key Words: Chronic Pelvic Pain; Genito-Pelvic Pain Penetration Disorders; Overactive Pelvic Floor Muscles; Provoked Vestibulodynia; Vaginismus; Male Sexual Dysfunction

INTRODUCTION

Pelvic floor overactivity is a condition defined by pelvic floor muscles (PFMs) that do not relax, or even contract, when relaxation is functionally needed, for example during micturition or defecation.1 Conditions associated with an overactive pelvic floor (OPF) are multifactorial, having multiple possible etiologies and symptom complexes. Individuals with suspected OPF often present with a combination of gastrointestinal, gynecological, musculoskeletal, sexual, and urological comorbidities, which may reflect peripheral and central sensitization (CS) mechanisms, emotional and psychological states, and comorbid responses to pain. In both women and men, sexual function is significantly impaired by OPF, and genito-pelvic pain penetration disorders
(GPPPD) are often the primary manifestation of this condition. The complex interplay among physical signs and symptoms, emotional and psychological distress, and sexual function make OPF-associated conditions very difficult to assess and manage; no detailed guidelines or recommendations have yet been provided by professional societies. In the first section of this article, we reviewed the evidence on assessment modalities for the evaluation of OPF. The second section provides an overview of therapeutic approaches addressing OPF, with emphasis on sexual pain and function.

**ASSESSMENT MODALITIES**

The assessment of OPF in general, and sexual pain in particular, is part of a comprehensive evaluation including a detailed medical and gynecological history, a psychosocial profile, and a neuro-musculoskeletal examination. Findings on anamnesis guide the specificity of the clinical assessment as well as the focus of subsequent treatments. A detailed assessment of pain may also be warranted, but is beyond the scope of this paper. For the purpose of this review, we will focus on the evaluation of patients who refer with complaints of sexual dysfunction in general and GPPPD in particular, as this condition is the most common sexual dysfunction in OPF patients. Psychological/psychosocial assessment and PFM evaluation are further analyzed in this current review.

**Psychological/Psychosocial Assessment**

Sexual pain is complex and multifactorial. Indeed, sexual pain can be produced without the presence of nociception, since "pain is an unpleasant sensory and emotional experience, which is associated with actual or potential tissue damage,"5,6 In OPF, the central nervous system may determine that heightened vigilance is required based on the "potential" for damage to this highly important region. This vigilance may be correlated with the patient's beliefs, fears, and expectations.7,8 Hypervigilance can result in a protective response, including hypersensitivity and overactivity of the PFM that may be unrelated to the health of the pelvic muscles, nerves, skin, or visceral systems.9,10 This necessitates utilization of a biopsychosocial framework when approaching persistent sexual pain.10 Empathy and motivational interviewing skills are a critical skill set when utilizing this framework in order to understand pain drivers and to help patients understand and re-conceptualize their pain.11 As part of the subjective examination, it is important to understand the psychosocial context of the patient's pain experience, as these factors play a central role in the manifestation of OPF13,14 and potentially contribute to its etiology, maintenance, and exacerbation.

**The Role of a Mental Health Professional**

Psychosocial factors may exceed the medical caregiver's competence and professional boundaries. For instance, a sexual abuse history, post-traumatic stress disorder, affective disorders, and major relationship conflict may require assessment by an expert in psychosocial sciences, such as a clinical psychologist, a couple therapist, and/or a sex therapist.15 Furthermore, as mentioned in our companion paper, the impact of OPF on the sexual response cycle is not limited to sexual pain: women with dyspareunia/provoked vestibulodynia (PVD) often present with desire, arousal, and orgasm disorders, have more negative attitudes toward sexuality, and more sexual distress than pain-free controls.16–18 Sometimes psychological counseling should precede medical treatment, especially when psychological issues are expected to interfere with the ability to effectively engage in treatment and in the presence of high levels of personal and/or interpersonal distress. Other patients can benefit from psychological counseling during or after medical and conservative treatments as they become aware of the influence of psychological issues and are then open to undertake psychotherapy. Therefore, a multidisciplinary team combining both physiological and psychological approaches may be beneficial to comprehensively address OPF and related sexual symptomatology.

**Addressing Psychological Factors as a Non-psychologist**

Recognizing the psychosocial and cultural background of OPF patients and their partners is integral in understanding both the origin and the impact of sexual dysfunction. Furthermore, the inclusion of psychoeducational aspects by medical caregivers is feasible and likely to improve treatment adherence and success. A discussion of all psychosocial and cultural factors potentially involved in OPF is beyond the scope of this review; nevertheless, we will focus on some important topics which we believe should be addressed by caregivers evaluating OPF patients, regardless of their specialty.

**Addressing and Validating the Impact of Trauma.** A comprehensive psychosexual history should be noted using an open, comfortable, non-judgmental, and trauma-informed approach, given the high prevalence of adverse childhood events and sexual abuse in men and women with sexual dysfunction and sexual pain.19,20 It is up to the caregiver's judgment to consider the optimal time for disclosure of a history of past traumatic events, which should be broached in a safe, clinical setting. Survivors are reluctant to spontaneously disclose their history; nevertheless, increasing evidence indicates they wish to be asked.21 Appropriate responses to abuse disclosure should include supportive messages acknowledging the client's courage, attentive listening, and questions about prior disclosure or any prior professional support after the traumatic event.22,23 Questioning the exact details of the abuse should be avoided. Inquiry regarding how the abuse is currently affecting the patient, how they handle medical evaluations, which triggers may cause post-traumatic responses, and what can be helpful to make the patient feel in control may provide a sense of safety much.
needed by survivors to create the atmosphere of trust required for successful treatment.21,24

Addressing Psychosexual Issues. A full psychosexual evaluation is usually unfeasible in the context of a medical provider’s initial assessment. Nevertheless, validated sexual function questionnaires may provide a useful initial screening tool for sexual dysfunction of the individual or of the couple. Several options are available, for instance: the “Sexual History Form”36, the “Dyadic Adjustment Scale,”26 the “Derogatis Sexual Functioning Inventory,”27 the “Female Sexual Function Index,”28 the “Brief Index of Sexual Functioning for Women,”29,30 the “International Index of Erectile Function-5,”31 the “Index of Premature Ejaculation,”32 and many more. A comprehensive description of validated sexual function screens and subjective assessment tools can be found in “The ESSM Manual of Sexual Therapy,” issued by the European Society of Sexual Therapy in 2015.33 Utilizing the best screening questionnaire for a clinician’s individual practice requires a more thorough understanding of the clinical application, validity, and reliability of each of these assessment tools and is beyond the scope of this paper.

Addressing Pain-Related Factors. Several validated questionnaires are recommended in order to evaluate symptoms that correlate with fear avoidance,34 pain catastrophizing,35 and CS.36 Starting with psychometric measures creates an opportunity to address chronic pain from a biopsychosocial perspective, guiding whether an internal examination may be potentially helpful or further threatening, through a trauma-informed lens.

CS is a proposed physiological phenomenon characterized by widespread hypersensitivity resulting from an augmented response of central neurons to receptor activity and is present in many patients with chronic sexual pain.36,37 CS is correlated with symptoms such as disproportionate pain, allodynia, and hypersensitivity and can be quantified clinically through the Central Sensitization Inventory (CSI) questionnaire.38 The CSI is a self-report screening instrument involving 2 components. Part A asks experiential questions to assess CS, and a score is thus derived.38 A score of >40 is associated with moderately severe CS. Part B is a list of conditions characterized by CS, which may be comorbid for sexual pain.39 If one of these conditions is present even in the absence of a score on Part A > 40, central pain mechanisms need to be considered.38 The use of the CSI to differentiate among different types of chronic pain patients who presumably have varying levels of CS impairment has demonstrated strong psychometric properties (test-retest reliability \( r = 0.817; \) Cronbach’s alpha = 0.879). Analyses have revealed that patients with fibromyalgia report the highest CSI scores and the normative population the lowest (\( P < .05 \)). It was also shown that the prevalence of previously diagnosed central sensitivity conditions and related disorders was highest in a fibromyalgia group and lowest in a normative group (\( P < .001 \)). The psychometric strength, clinical utility, and the initial construct validity of the CSI in evaluating CS-related clinical symptoms in chronic pain populations are high.40 Common central sensitivity conditions are listed in Table 1.

Fear avoidance and catastrophization are also correlated with the presence of CS.31 The Pain Catastrophizing Scale and the Tampa Kinesiophobia Scale are simple, validated, and reliable tools, which help to direct assessment and treatment strategies.34,35 These questionnaires take less than 5 minutes to complete and less than 1 minute to score. Literature supports the integration of these tools into clinical practice for chronic pain.32–44

In persistent pain conditions, the presence of CS predicts poor outcomes following classical local treatments such as electrotherapy, motor control exercises, and surgery.36 Therefore, screening for CS may help to determine whether the clinician should employ a biomedical or a biopsychosocial approach.

Addressing Depression and Anxiety. The assessment of emotional distress is another central aspect of pain research and treatment. The Depression, Anxiety, Stress Scale is a reliable and valid questionnaire, free to use, and easy to administer.45 It is a simple alternative to other instruments used for screening this cluster of symptoms. The subscale “stress” measures irritability and tension, which are important aspects of persistent pain.45 Anxiety may be one of the mechanisms by which childhood sexual abuse leads to an increased risk of developing genito-pelvic pain in adolescent girls.46 Depression, anxiety, and stress are all potential contributors to OPF and may need to be addressed in order to downregulate the PFMs through descending inhibition. Rosenbaum introduced a number of techniques that can assist therapists in addressing anxiety. This includes the “Rosenbaum Protocol,”47 a step-by-step exposure to interventions which allows patients to recognize and contain growing anxiety and remain present during the examination and treatment. Rosenbaum expanded this approach to include mindfulness-based treatment methods, aimed at reducing a goal-driven approach and negative self-judgment by patients.48–50

| Table 1. Comorbid conditions that could be related to central sensitization |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Fibromyalgia     | Chronic fatigue syndrome |
| Irritable bowel syndrome and other functional gastrointestinal disorders |
| Temporomandibular joint disorder |
| Restless leg syndrome and periodic limb movements in sleep |
| Idiopathic low back pain |
| Multiple chemical sensitivity |
| Primary dysmenorrhea |
| Headache (tension > migraine, mixed) |
| Interstitial cystitis/chronic prostatitis/painful bladder syndrome |
| Chronic pelvic pain and endometriosis |
| Myofascial pain syndrome/regional soft tissue pain syndrome |
Addressing Couple Factors. Rosen and Bergeron suggest applying an "interpersonal emotion regulation model" to couples with GPPPD, which implies increasingly recognizing how dyadic dimensions play a central role in this condition.49 An individual and/or couple therapist should ideally be involved in the treatment of OPF patients as very often psychological interventions are required to address both "distal" (ie, related to the past personal history of either partner) and "proximal" (ie, before, during, and immediately following painful sexual activity) interpersonal factors.49 In recent years, attachment styles have been acknowledged as important determinants of sexual problems in intimate relationships. Insecurely attached individuals may use sex to fulfill their attachment needs, leading to sexual experiences tarnished with anxiety.50 There is growing evidence that attachment style is related to sexual pain: Granot and colleagues found that women with dyspareunia were more likely to be insecurely attached.51 Helping the couple in communicating about pain and sex and reconsidering sexual scripts and stereotypes may address the social arm of sexual distress and pain. By discussing with the couple, Basson’s circular model of sexual response52 can normalize the low levels or even absence of libido in long-term, committed relationships. Part of discussing Basson’s model can include an explanation that the heterosexual script of minimal foreplay prior to intercourse may not be an effective way of creating pleasure-filled, erotic lovemaking for couples. One intervention that requires little psychotherapeutic knowledge is the suggestion to make time and space for intimate connection, as patients with OPF often present with a history of avoidance of sexuality and situations that could lead to negative experiences.55

Assessment of the PFMs
As discussed in our companion article, increased PFM tone, mediated both centrally and peripherally, is the defining feature of OPF. Assessment of PFM tone and function can be important to guide treatment and to measure its effectiveness. Yet the assessment of the PFMs, more specifically PFM tone, remains an ongoing challenge as no gold standard is available. Several assessment modalities or tools are commonly used, each featuring different advantages and limitations.53

Muscle tone can be characterized as the state of the muscle, usually defined by its resting tension, and clinically determined by its resistance to passive stretching.54 Muscle tone has 2 components: a passive/viscoelastic component, which is independent of neural activity and is related to the mechanical properties of the muscle fibers and surrounding connective tissues,55 and an active/neurogenic component that reflects contractile activity, which is mediated by the muscle sensory apparatus and excitatory/inhibitory influences at the spinal and cortical levels as discussed in our companion article.16 Both components of tone were shown to be involved in OPP and their differential contributions can influence the selection of treatment modalities for reducing tone.56 The components of muscle tone can be assessed globally or in isolation depending on the different assessment tools/techniques available.57

Palpation
Digital palpation is by far the most common technique to appraise PFM tone in clinical practice due to its rapidity and ease. It is, however, contested as an assessment method for research purposes because of its subjectivity and lack of precision/sensitivity.58,59 The examination often begins with external palpation of the perineum to assess the patient’s anticipatory and protective reactions, to evaluate PFM tone in the absence of vaginal penetration, and to detect pain or tenderness at the skin, facial, and muscular levels. In some patients, particularly during initial treatment sessions, external palpation may be the only local assessment performed, and reports of pain on external palpation may direct the clinician to complete a more comprehensive evaluation of pain processing, which, as noted earlier, is beyond the scope of this review. Intracavity palpation (per anus or per vagina) is usually performed next to detect areas of pain/tenderness and tension as well as muscle volume, asymmetry, reduced sensation, and scars but is always informed by psychological readiness.

Grading PFM Tone Through Palpation. If intracavity palpation is appropriate, the superficial and deep layers of the PFMs can be assessed through intravaginal or intra-anal palpation while the external anal sphincter and deep layers of the PFMs can also be assessed intra-anally.60 The assessment of tone using palpation is informative of the summative contribution of both active and passive components; the components cannot be discriminated. Based on small cohort studies where tone was graded through palpation (although no valid scales for grading tone are available), the available evidence supports that women with vulvodynia have high PFM tone compared to controls,60,61 which was shown to decrease with multimodal physiotherapy (PT) treatment.61

Flexibility of the Vaginal Opening. As with tone, flexibility restrictions at the vaginal introitus may be attributed to both active and passive tissue properties. Flexibility has been measured as the maximal transverse diameter obtained by abducting 2 fingers inserted into the vaginal cavity, graded from 0 (less than 1 finger can be inserted) to 4 (2 fingers are inserted and abducted horizontally ≥2 cm).61 While this scale has neither been studied for its validity nor reliability, using this approach, Gentilcore-Saulnier et al61 showed that women with PVD had less vaginal flexibility than women without vulvar pain, and they found that flexibility increased after a 12-week PT intervention. Other authors have suggested measuring the
inter-digit distance (in cm) in both the transverse and anteroposterior diameters.62

Capacity to Relax the PFMs. Reissing et al60 proposed a 6-point scale to grade the extent to which the PFMs relax after a maximal contraction, with end points of 0 (returns to resting state) and 5 (remains fully contracted). They found fair inter-rater reliability of this scale when palpating with 2 digits, and further observed that women with vulvodynia had less relaxation than their pain-free peers.60 Gentilcore-Saulnier et al61 found that the ability to relax the PFMs after contraction could be improved in women with PVD after a 12-week PT intervention. The underlying pathophysiology explaining the difficulty relaxing the PFMs after contraction remains poorly understood and may reflect heightened cortical drive to the PFMs53,64; however, other neurogenic and mechanical contributions cannot be ruled out.

Tenderness on Palpation and Myofascial Trigger Point (TPs). TPs have been described as palpable taut bands or rope-like indurations identified in skeletal muscle, the palpation of which can evoke pain both locally (local tenderness) and referred to body regions specific to each TP.65 The pathophysiology of TPs is poorly understood, as is their significance in terms of muscle pain and dysfunction.66,67 Interestingly, it has been speculated that there is a positive association between the extent of CS and the intensity or distribution of referred pain from TP palpation.68–70 In support of this hypothesis, Grinberg et al showed that pain intensity on TP palpation was associated with reduced efficiency of endogenous pain modulation.71 While physical examination methods to evaluate the presence of TPs in the PFMs vary widely and are often poorly described, authors of a recent systematic review suggested performing a single digit intravaginal assessment of TPs localized in the PFMs and the obturator internus muscle while evaluating pain intensity.72 It has also been suggested to document whether palpation of TPs or taut bands reproduces the patient’s clinical symptoms.73 3 cohort studies have suggested that women and men with chronic pelvic pain report tenderness on palpation of their PFMs and possess a higher prevalence of TPs identified through palpation when compared to asymptomatic controls.13,74–76 However, assessing and treating TPs is currently a contentious issue; a recent meta-analysis of TP Manual Therapy as a single modality concludes the current evidence is poor for chronic non-cancer pain including pelvic pain.62 While there is poor agreement on the definition and identification of TPs, hypersensitivity is often present when palpating PFMs.14,77 Hypersensitivity scales77 may offer clinicians a broader view of the central mechanisms involved in the OPF by drawing attention specifically away from the state of the muscle and moving it toward the entire system. Tenderness may be better language in the future to reflect the role of the OPF without pathologizing the state of the muscle. This is an area requiring further research.

Electromyography (EMG) EMG is the only tool that can directly assess PFM activity as it measures the electrical signals which propagate along muscle fibers after depolarization of their motor nerve. It is therefore unfortunate that EMG cannot offer any diagnostic value in terms of OPF.78,79 Indeed, there is no diagnostic cutoff that can indicate whether or not the PFMs are overactive; yet it can be used to subjectively evaluate motor control patterns, particularly in dysynergic voiding.80

For surface EMG, paired electrodes can be adhered over the superficial (bulbocavernous and external anal sphincter) PFMs or can be inserted intravaginally or anally to record from the deeper layer (puborectalis). While surface EMG instrumentation is generally easy to apply, challenges lie in the interpretation of the recorded signals.61,81 Due to the complex anatomy and deep location of the PFMs, EMG signals recorded by surface electrodes may be contaminated by signals generated by other nearby muscles such as the hip rotators and/or deep abdominal muscles, a problem referred to as crosstalk.82 Also, EMG signal amplitudes can vary greatly from one application to the next, despite all efforts to keep the size and site of the electrodes consistent. Because of the multiple factors that impact the EMG signal, higher or lower EMG activity recorded from one patient to the next does not reflect higher or lower PFM activation, and this precludes the determination of a “cutoff” score to establish limits for normal tone.81,83 Similarly, the amplitude of EMG activation does not directly reflect the force generated by muscular contraction. Within a treatment session, however, there is good consistency in EMG amplitude,82,84 meaning that if the electrodes are not removed, moved, or replaced during the session, changes in EMG amplitude may indeed reflect true changes in PFM activation associated with the treatment modality applied during that session.

Despite the limitations of EMG, it has provided some evidence to support the presence of overactivity of the PFMs in women with vulvar pain. Observations of EMG amplitude in the superficial layer of the PFMs have consistently pointed to higher tonic activity in women with vulvodynia compared to pain-free controls.61,85–87 Using needle electrodes, Frasson et al found higher polysynaptic reflex amplitudes in the bulbocavernosus muscle in response to clitoral stimulation in women with vulvodynia compared to controls, providing compelling evidence for central nervous system involvement.86 The deeper layer of the PFMs also appears to be activated to a greater extent among women with PVD compared to controls when a vaginal probe is inserted,87 when pressure is applied to the vulvar vestibule,61 and/or when the arms of an intravaginal dynamometer are opened.56 As with palpation assessments, there is a need for researchers to establish whether these EMG responses are generated in anticipation of pain, as a reflex response to stimuli, or as a behavioral response to pain. While EMG is used clinically for biofeedback, other tools such as manometry,
ultrasonography, and dynamometry are more commonly used in research given their highest test-retest reliability.

Manometry
Manometry is used to measure resting pressure or the extent of pressure rise during PFM contraction using a sensor located in the urethra, vagina, or rectum. The assessment of vaginal resting pressure, measured by an air-filled probe and reflecting the summative contribution of both the active and passive components of PFM tone as well as the paravaginal tissues, recently showed good test/re-test reliability when measurements were made in a supine position. As with other PFM assessment techniques, the size and positioning of the probe must be taken into account since it is known to influence the measurement. Concurrent rises in intra-abdominal pressure can be mistakenly interpreted as PFM activation. Despite its limitations, and consistent with findings derived from the other assessment techniques, higher vaginal resting pressure has been found in women with vulvodynia compared to controls.

Ultrasonography
Real time 3-dimensional/4-dimensional ultrasound has very good inter-rater and test/re-test reliability in men and women for assessing morphological parameters in the mid-sagittal (eg, bladder neck and anorectal junction positioning and angles) and axial (eg, levator hiatus dimension) planes. Using 3-dimensional/4-dimensional transperineal imaging, Morin et al recently found that, at rest, women with PVD had smaller levator hiatal dimensions, larger levator plate angles, and more acute anorectal angles than pain-free women, and suggested that these findings were due to higher PFM tone. These results were confirmed by McLean et al and Thibault-Gagnon et al. When evaluating men with urological chronic pelvic pain syndrome, similar ultrasound findings were reported. The fact that ultrasound assessment does not involve intracavitary insertion represents a significant advantage when assessing patients with pelvic pain, as they avoid the bias of pain/protective reactions. However, ultrasound imaging provides information about morphometry and thus these findings are not direct measures of muscle tone but rather an inferred appraisal of global tone, and cannot discriminate between active and passive components. This should be taken into account in the interpretation of findings.

Dynamometry
Several intravaginal dynamometers have been developed to assess PFM function including tone, mainly in an anteroposterior orientation. Some enable force to be assessed only at one fixed PFM length while others can measure resistance during dynamic passive elongation of the PFMs. Those that have arms that open at a known rate offer an important advantage as they measure parameters such as muscle stiffness, expressed as the variation of passive force (N) divided by the variation of aperture (mm), and viscoelastic properties such as stress relaxation. Good to excellent test-retest reliability has been demonstrated for several of these devices. While dynamometers are predominantly used in research, some are now becoming commercially available. When using dynamometry alone, the resting parameters (eg, forces and stiffness) reflect the summative contribution of the active and passive components of PFM tone. Morin et al recently combined dynamometry and EMG to investigate the relative contribution of the active and the passive components of PFM tone in women with vulvodynia. They demonstrated that women with pain presented with higher EMG activation recorded during vaginal tissue elongation when compared to their pain-free counterparts. Moreover, when considering only those women who demonstrated quiescent PFM EMG during dynamometer opening, they showed that women with pain had higher peak passive forces and greater tissue stiffness. Overall, these findings support the involvement of both active and passive components of PFM tone in women with vulvar pain. The relative contribution of the 2 components of tone may serve to orient treatment for women with PVD. For instance, control and relaxation techniques may be useful for reducing neurogenic involvement while dilators and manual techniques may be more appropriate to target viscoelastic stiffness. In addition to tone, measures of PFM strength, endurance, and motor control evaluated using dynamometry may also be important components of the clinical evaluation of OPF.

Myotonometry has recently been suggested for the evaluation of PFM tone. It consists of a hand-held unit used to apply a predetermined pressure externally on the perineum with the advantage of not requiring vaginal insertion. The device elicits mechanical impulses followed by release, inducing damped oscillation of the perineal tissues while women attempt to keep their PFMs relaxed. Several parameters can be assessed, most notably stiffness. Inter-rater reliability was found to be good to excellent for assessing perineal stiffness, and a cohort study showed that women with vulvodynia had higher perineal stiffness compared to asymptomatic controls. These findings provide support that the summative contribution of active and passive components to the tone of the superficial layer of the PFMs is involved in vulvodynia.

Overall, the evidence derived from the available assessment tools/techniques concurs to support the involvement of high PFM tone in conditions such as vulvodynia and chronic pelvic pain. Evidence points to both the active-neurogenic and the passive-viscoelastic components being implicated. These alterations may arise from changes in local morphologic or mechanical properties, or may be cortically driven, which would be targeted differently with the available treatment modalities.
TREATMENT OF OPF

Treatment outcomes for chronic pain conditions in general, and GPPPD in particular, benefit from multidisciplinary and multimodal approaches that address the biopsychosocial components of pain. 2 systematic reviews on the outcome of medical and psychosexual interventions for vaginismus showed that women benefit from a range of treatments (behavioral sex therapy, cognitive behavioral therapy [CBT], pharmacological therapy, PFM training, and removal of hymenal remnants) in almost 80% of cases; no approach has proven superior in achieving penetrative intercourse. In this section, we provide an overview of the main therapeutic approaches to OPF, with more emphasis on the associated sexual pain and dysfunction.

Medical Treatment

Medications for OPF are commonly administered as adjuvant treatment and no evidence-based protocols for medical treatment are available; so one must rely on expert opinion. Some authors suggest starting with diazepam suppositories and muscle relaxants, reserving botulinum toxin for more recalcitrant OPF. Local or systemic neuromodulatory medications, such as topical or systemic gabapentin, tricyclic antidepressants, and serotonin–norepinephrine reuptake inhibitors are often used to address pain in CPP and GPPPD patients; as their effect is not directly targeting muscle function, we will not discuss them in detail.

Diazepam Suppositories and Other Muscle Relaxants

The evidence for vaginal diazepam is equivocal at best. A 2010 retrospective study indicated that vaginal diazepam suppositories, in conjunction with pelvic floor PT and TP injections, relieved discomfort from pelvic pain. Another study with no adjuvant treatment indicated no improvement in PFM tone. A recent double-blind, randomized, placebo-controlled trial on women with pelvic pain and OPF found no difference in pain between groups after 4 weeks. Murina et al assessed the efficacy of vaginal diazepam in addition to transcutaneous electrical nerve stimulation (TENS) in a double-blind, randomized, placebo-controlled trial including 42 women with PVD. Visual analog scale scores showed similar improvement with diazepam + TENS and placebo; dyspareunia scores with diazepam + TENS showed a significant improvement compared to placebo and the ability to relax the PFM after contraction was greater with diazepam + TENS than placebo.

Other options have been explored clinically. For example, cyclobenzaprine has been suggested as a treatment option, based on a single case report, and nitroglycerin has been shown to reduce musculoskeletal pain in women with dyspareunia/PVD. In summary, muscle relaxants may be clinically useful in some cases but, for the time being, limited evidence is available to support their use.

Botulinum Toxin Type A (BTTA)

A recent review on BTTA therapy for CPP and GPPPD in women identified 38 publications on the topic ever since it was first reported in 1997. Injected muscles include the obturator internus, levator ani, coccygeus, bulbospongiosus, and ischiocavernosus. 3 studies reported adjuvant PT modalities including massage and the insertion of a vaginal dilator immediately after the injection. Response rates to BTTA for CPP ranged from 58% to 100% among 1,046 participants. In the 10 reports on GPPPD, 71–100% of 367 patients achieved intercourse or reported a significant decrease in dyspareunia. The only double-blind, placebo-controlled study randomized 60 women with CPP and OPF. Pain decreased in both the intervention and control groups while a decrease in resting vaginal pressure was observed only in the BTTA cohort. A few studies have shown significant improvement in pain scores with transurethral or transrectal intraprostatic injection of BT tale for chronic prostatitis/chronic pelvic pain syndrome, but the effect on sexual function has not been studied. In conclusion, little evidence supports the efficacy of BTTA for GPPPD and OPF and prospective randomized studies are needed to provide clear recommendations.

“TP” Injections

Injection of local anesthetics or steroids into TP in the levator ani has been shown to improve pain; however, studies have had limited sample sizes and no randomization or blinding. Langford et al reported a success rate of 72% in 18 women with CPP following a TP injection of bupivacaine, lidocaine, and triamcinolone. 2 retrospective reviews of women with OPF and CPP with post-partum perineal pain treated by injections showed a decrease in dyspareunia. Tadros and colleagues observed 50% symptom improvement using TP injections as an adjunct to PT in chronic prostatitis/chronic pelvic pain syndrome. In all, these results are derived from small prospective and retrospective studies; robust and well-designed randomized controlled trials are needed to confirm these findings.

Psychotherapy and Sexual Therapy

Individual CBT

There is some evidence that CBT can effectively reduce pain and improve sexual function in women with vulvodynia. van Lankveld et al randomly assigned 117 women with lifelong vaginismus to group-based CBT, bibliotherapy, or wait-list control. At 12-month follow-up, 21% of the CBT participants and 15% of the bibliotherapy participants reported successful intercourse, vs none in the control group. Following CBT, Engman et al found that 61% of women with dyspareunia or vaginismus rated their ability to have intercourse without pain as ≥ 6 on a scale from 0 to 10, and that the effect was maintained in the long term (mean follow-up of 39 months). In a study by Goldfinger et al, while pain was reduced through both PT and
CBT, significant improvements in sexual functioning were observed only in participants who completed CBT.143

Couple Factors and Couple CBT
A growing body of literature indicates that partners play a critical role in the pain and treatment experience.144–146 Rosen and her colleagues suggested the importance of adaptive coping in decreasing pain and increasing sexual adjustment and satisfaction for both partners. Therefore, involving the partner in therapy may improve the outcomes of medical and physical therapy treatments.

2 small studies have suggested that couple-based CBT may be effective. Corsini-Munt et al reported on a 12-session CBT approach in 9 couples with PVD. 1 couple separated before the end of therapy, but the remaining 8 couples achieved significant improvements in the woman’s pain and sexuality outcomes for both partners. Improvements were identified in pain-related cognitions, anxiety, and depression.147 In a retrospective audit of 28 couples referred to CBT, half of the couples discontinued the therapy after the initial assessment session. Among those who continued with the therapy, women reported reduced anxiety, and improved marital satisfaction and sexual functioning.148 No studies have compared individual CBT to group-based or couple-based CBT.

Mindfulness
The most recent evidence suggests that mindfulness-based approaches may be as effective as CBT for improving pain intensity.149 Brozzo et al randomized 130 women with PVD to either a mindfulness-based group or a CBT group. There was a significant interaction between group and time for self-reported pain, such that improvements with mindfulness-based cognitive therapy were greater than those with CBT. For all other endpoints, both groups demonstrated similar significant improvements, and benefits were maintained at 6 months.

Educational Seminars
Brozzo et al showed significant improvements in psychological symptoms of depression, anxiety, somatization, hostility, paranoid ideation, psychoticism, and the global severity index, following a series of educational seminars delivered by a gynecologist. Sexual arousal, orgasm, overall sexual function, and sexual distress also improved.150

No psychological and sex therapy study has specifically evaluated the impact of therapy on OPF.

PT: Classical and Integrative Approaches
Physiotherapists have access to several treatment modalities to treat OPF. A recent systematic review pointed out that, although the evidence relied on only a handful of high-quality trials, the available studies converge to support the effectiveness of the most common isolated modalities.151

Evidence on Isolated PT Modalities

Manual therapy. Typically considered the cornerstone of PT intervention, manual therapy encompasses several techniques including myofascial release, stretching, massage, desensitization, neural mobilization, as well as visceral manipulation.152–154 Among these techniques, the available studies (2 randomized clinical trials [RCTs] and 1 prospective study) support the effectiveness of myofascial techniques in reducing pain in women and men with chronic pelvic pain.155–157

PFM exercises assisted with biofeedback. These have received the highest empirical support and have been proposed as an effective approach to promote muscle relaxation and to improve motor control.151 It has also been suggested that PFM exercises can improve blood flow in the vulvovaginal region, thereby promoting oxygenation of tissue and reducing inflammation.158,159 2 small prospective studies showed that 52% of women with PVD were pain-free after 16 weeks of PFM exercises assisted with biofeedback.160,161 2 RCTs also reported favorable results with less pronounced improvement, where low adherence to home exercises was suspected to have moderated the effects reported previously.162,163

Electrotherapy. This modality involves the use of electrical current that, depending on the parameters selected, acts on pain through several mechanisms. In other skeletal muscles, there is evidence that electrotherapy can improve muscle proprioception, increase local blood circulation, decrease nociceptive signaling (ie, gate control theory), and stimulate the secretion of endorphins.164 A small RCT by Murina et al165 involving 40 women with vulvodynia showed that TENS yielded significant improvement in pain and sexual function.

Dilators. The use of vaginal dilators (accommodators) can help women overcome fear of pain and promote pelvic floor relaxation during insertion activities. Once the active component of tone is under control, the passive component can be addressed by elongating shortened PFMs and improving flexibility and tissue viscoelastic properties.166 3 prospective studies with small sample sizes (n = 10–18) reported promising results in women with dyspareunia for reducing pain.167–169

While isolated PT modalities demonstrate some effectiveness in managing conditions associated with OPF, a combination of modalities most closely represents current practice in PT for OPF.169
Evidence Regarding Multimodal PT Intervention

Multimodal PT is recommended as a first-line treatment for vulvodynia and chronic pelvic pain in clinical guidelines issued by leading societies.170–172 As revealed by a survey study169 and a systematic review,151 the modalities most consistently used by physical therapists include PFM exercises, manual techniques, surface EMG biofeedback, and dilators. The goal of these modalities is to target the active/neurogenic (ie, increasing muscle awareness, proprioception, and improving muscle relaxation) as well as the passive (ie, increasing viscoelasticity of the muscles and vaginal tissues) component of pelvic floor tone. These modalities are also thought to contribute to desensitizing the painful area and increasing blood circulation, thereby reducing myalgia and positively addressing psychosexual factors such as fear of vaginal penetration. The same survey also found that most physiotherapists offer patient education as a key component of their intervention.169

Both retrospective and prospective studies on multimodal PT have shown it to be effective with a significant improvement in pain for 71–80% of women with PVD.173,174 Therefore, the overall effectiveness of multimodal PT appears to surpass isolated modalities. Among these studies, Goldfinger et al175 used validated outcomes and found significant improvements not only in pain intensity but also in pain threshold and sexual function in 13 women with vulvodynia after 8 weeks of treatment. Gentilcore-Saulnier et al151 extended the analysis to investigate PFM function and found significant improvements in PFM tone, flexibility, and relaxation capacity as well as a reduction in pain intensity associated with intravaginal assessment. Another randomized pilot study by Goldfinger et al143 showed that both multimodal PT and CBT significantly reduced pain intensity, as measured by a numerical rating scale; yet, the study was not adequately powered to investigate the difference between the 2 interventions.

A large multicenter RCT was recently completed in 212 women with vulvodynia.176,177 The efficacy of multimodal PT was compared to overnight topical lidocaine, a frequent first-line medical treatment for vulvodynia. The PT intervention included a combination of modalities delivered over 10 weekly sessions and was found to be significantly more effective than lidocaine in reducing pain intensity during intercourse (as measured using a numerical rating scale). These significant statistical outcomes were also found to be clinically relevant, as 89% of women in the PT group, as opposed to 55% in the lidocaine group, showed clinically meaningful changes, reflected by a reduction of 30% in pain intensity at follow-up. This study also provided strong evidence that multimodal PT is more effective than lidocaine in improving sexual function, sexual distress, catastrophization, and pain anxiety and all results were maintained at 6-month follow-up. These results strongly support PT as a first-line treatment. Further research is required to see if outcomes can be further improved using a psychologically informed PT approach.

An Integrated Approach to Treatment

Applying principles that have been efficaciously used for other persistent musculoskeletal pain states to the OFP may improve restoration of pain-free intercourse and sexual function.178–180 Pain biology education, targeting cortical structures, creating healthy tissues by decreasing nociceptive input in a non-threatening way, grading exposure to functional goals, and restoring independence and self-management are all important components of a biopsychosocial (psychologically informed) treatment plan.181 Clinicians treating sexual pain may consider both central and peripheral pain mediators in a progressive format that helps the clinician design and implement an appropriate treatment program within their own scope of practice. The presence of high levels of fear avoidance and catastrophization suggests that pain biology education and other behavioral treatments are warranted in order to address these cortical changes.9 No studies to date have analyzed the effect on fear and catastrophization when pain biology education principles are utilized. This is a recommended area of further research.

In order to integrate a biopsychosocial approach, 4 suggested phases of treatment are summarized in Table 2.181

More research is needed to help select the best strategies to address the sensitive nervous system in all persistent pain states. In persistent, centralized, musculoskeletal pain, evidence guides the utilization of CBT, pain biology education, mindfulness-based stress reduction, yoga, and imagery-based exercises, including graded motor imagery—all framed within a biopsychosocial context.9,182–186 The incorporation of these approaches, along with classical PT modalities, into an integrated treatment model may improve both physical and functional outcomes.

Providing care for individuals suffering from sexual pain is complex. Framing the evaluation and treatment progression within a biopsychosocial perspective and measuring change with standardized assessment tools may help improve outcomes in this challenging population.

MULTIDISCIPLINARY APPROACH

Given the current evidence of effectiveness of the different approaches to the management of conditions associated with OFP, an interdisciplinary approach involving medical doctors, physiotherapists, sex therapists, and/or psychologists may be ideal. Indeed, several studies have evaluated the efficacy of interdisciplinary therapies, including a variety of psychological, medical, and PT modalities for the treatment of dyspareunia and vaginismus.151 An interdisciplinary management program comprising medical treatment, psychotherapy, PT, and dietary advice reported significant benefit in 27 of 29 women with vulvodynia.187 9 women who completed the program were pain-free.187 Backman et al evaluated a group of 24 patients following combined physical and psychosexual
therapy at least 6 months after treatment; 19 women (79%) considered themselves to be cured or greatly improved. In a retrospective study on 64 women with PVD, 5 years following a multidisciplinary treatment program, pain reduction and resumption of intercourse were reported by 80% of women, though only 8% of them were completely pain-free. Brotto et al evaluated a multidisciplinary vulvodynia program integrating psychological skills training, pelvic floor PT, and medical management on the primary outcomes of dyspareunia and sexual functioning. After 2–3 months, there were significant effects for reduction in dyspareunia, and improvements in sexual arousal and overall sexual functioning. Although more modest, significant improvements were reported in desire, lubrication, orgasmic function, and satisfaction.

CONCLUSION

The management of OPF requires a comprehensive assessment in order to guide selection of treatment approaches and modalities. Assessment should be adapted to each patient and should include the evaluation of a patient’s psychological state, pain sensitization, self-efficacy, and pelvic floor functioning.

Currently, there is no gold standard for the evaluation of PFM involvement and each assessment technique/tool presents with different advantages and limitations. Findings consistently support the involvement of high PFM tone in OPF-related conditions, and more specifically, the active/electrogenic and passive/viscoelastic component of PFM tone. Several medical treatment approaches such as Botox, diazepam, and TP injection into the PFMs have shown favorable effects but further well-designed RCTs are needed. While stronger evidence is available to support both CBT and multimodal PT, little is currently known about the most effective combination of approaches or modalities. Further studies are needed to individualize interventions and to tailor them to more effectively address the complex nature of OPF.

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(c) Analysis and Interpretation of Data
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Table 2. Phases of treatment in a biopsychosocial framework

<table>
<thead>
<tr>
<th>Phase</th>
<th>Stage</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Phase 1</td>
<td>Assessment</td>
<td>• Complete measures: PCS, TSK, CSI, DASS (repeated at multiple intervals for re-assessment)</td>
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<td>• Complete appropriate musculoskeletal and neuromuscular evaluation if in your scope of practice</td>
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<td>• Identify strengths upon which to build treatment strategies focusing on self-efficacy</td>
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<tr>
<td>Phase 2</td>
<td>Desensitization</td>
<td>• Start pain biology education</td>
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<td></td>
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<td>• Restore and normalize sensorimotor awareness</td>
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<td></td>
<td></td>
<td>• Maximize activities that downregulate the central nervous system</td>
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<tr>
<td></td>
<td></td>
<td>◦ Breathing exercises</td>
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<td></td>
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<td>◦ Guided relaxation/meditation</td>
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<td>◦ Qi gong/Tai chi</td>
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<td>◦ Cognitive behavioral therapy</td>
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<td>◦ Joy/laughter and other positive reinforcement strategies</td>
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<tr>
<td>Phase 3</td>
<td>Graded exposure</td>
<td>• Establish value-based, patient-centered goals</td>
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<td></td>
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<td>• Step-wise progression to return to functional activity</td>
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<td>• Establish a flare-up plan and utilize it</td>
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<td>• Use neurodynamic movements as needed in order to optimize tolerance to movement</td>
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<tr>
<td>Phase 4</td>
<td>Supported independence</td>
<td>• Reinforce self-efficacy</td>
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<tr>
<td></td>
<td></td>
<td>• Support progress with check-ups and progression as needed</td>
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</tbody>
</table>

CSI = Central Sensitization Inventory; DASS = Depression, Anxiety, Stress Scale; PCS = Pain Catastrophizing Scale; TSK = Tampa Kinesiophobia Scale.
OPF and SD: Evaluation and Treatment

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