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Female Sexual Function and Dysfunction

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Sexual health is defined by the World Health Organization as the integration of somatic, emotional, intellectual, and social aspects in ways that are positively enriching and that will enhance personality, communication, and love. This article identifies models of sexual function, defines and categorizes sexual dysfunction, identifies therapeutic modalities for patients who have sexual dysfunction, and discusses some of the questionnaires used to evaluate sexual function.

Sexual function

Masters and Johnson [1] were the first to study and report on both healthy sexual function and sexual dysfunction in the 1960s. In the seminal "Human Sexual Response," they described four phases of the human sexual response cycle: excitement, plateau, orgasm, and resolution (Fig. 1). This is the traditional, linear model of sexual function for both males and females, and was based on observations of 100, white middle class couples. This linear model probably more accurately depicts the male than the female sexual cycle. A more contemporary, intimacy-based model of sexual response and function has been proposed that is more female-specific [2]. This newer model of female sexual function describes a circular relationship between sexuality and satisfaction, and is not linear. In 2002, Basson described a "Sexual Response Circle" that incorporates psychological and social aspects into female sexual function, such as emotional intimacy and emotional

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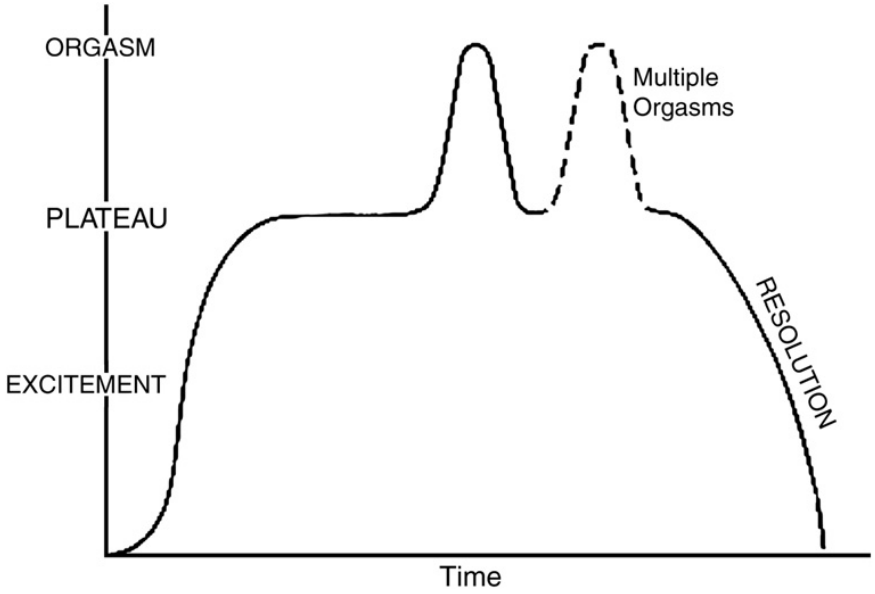

Fig. 1. Sexual response cycle defined by Masters and Johnson. (*From* Masters WH, Johnson VE. Human sexual response. Boston: Little Brown & Company; 1966; with permission.)

satisfaction as well as sexual desire and physical satisfaction (Fig. 2) [2]. This model recognizes that sexual function and response are different in men and women. Importantly, for women, desire does not always precede sexual arousal, with many women participating in sexual activity out of love and affection for their partners. Once engaged in sexual activity, women may

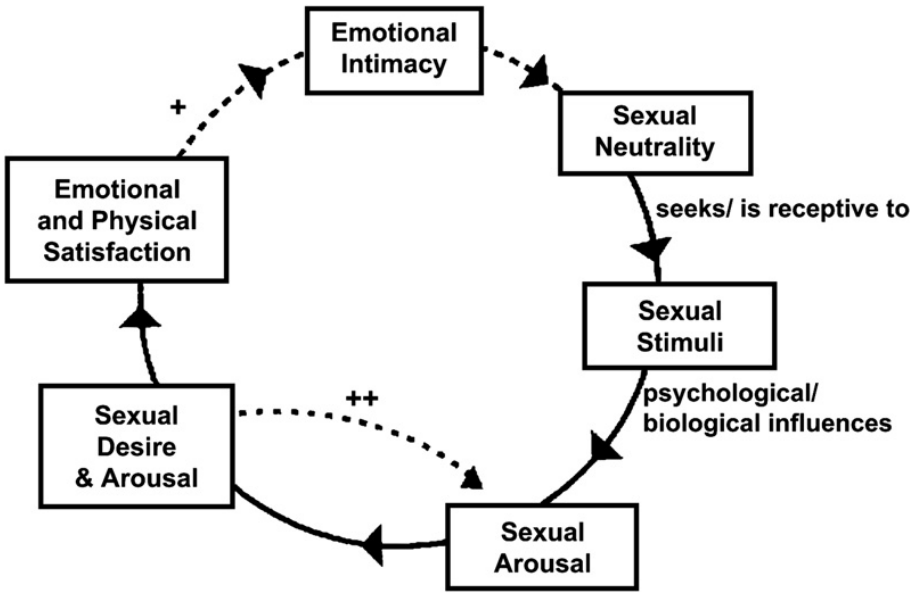

Fig. 2. The interrelatedness of intimacy, sexual arousal, desire and satisfaction. (*From* Basson R. Are the complexities of women's sexual function reflected in the new consensus definitions of dysfunction? J Sex Marital Ther 2001;27:105–12; with permission.)

then become aroused, and then experience desire. For many women, the sexual response cycle is intimately intertwined with the overall relationship that they are in, and incorporates the societal and psychological milieu.

Although prevalence and incidence data are scarce for rates of sexual activity, what data there are support the conclusion that women are sexually active throughout the lifespan. Data from the National Survey of Family Growth indicate that approximately 40% of females 15 to 19 years of age have had sexual intercourse within the last 3 months [3]. Although frequency of sexual activity declines with age, population-based studies indicate continued sexual activity in 47% of married women aged 66 to 71 years, and in one third of women over the age of 78. Recent population-based surveys of younger as well as middle aged and older women reported that 50% to 75% are sexually active [4,5]. Lack of interest and lack of partner were the most common reasons for sexual inactivity. Norms of sexual activity are not well characterized for women. Most women engage in heterosexual practices, with only 1.2% reporting sex with other women [3,6]. The average frequency of sexual activity is six times per month for women compared with seven for men, with vaginal intercourse the most common sexual practice, and oral sex a distant second, although not an uncommon practice [6]. Most women report the inability to achieve orgasm with vaginal intercourse and require direct clitoral stimulation [7,8]. About 20% have coital climaxes, and 80% of women climax before or after vaginal intercourse when stimulated manually, orally, or with a vibrator or other device. Only 30% women almost always or always achieve orgasm with sexual activity in contrast to 75% of men [7,8].

Although there are variations among individuals, differences in the sexual function of men and women start with the sexual response. For men, sexual function and response centers on the ability to achieve and maintain an erection. For women, however, sexual response is much more complex, involving social, psychological, neurologic, vascular, and hormonal processes and includes complex interaction of sexual stimulation, the central nervous system, the peripheral neurovascular system, and hormonal influences, which are not understood completely [9–11]. Female sexual dysfunction (FSD) is therefore a complex problem with neurovascular, psychosocial, and endocrine etiologies.

Sexual dysfunction

Sexual dysfunction is recognized as a widespread problem, but data are scarce as to the prevalence, which ranges from 25% to 63% of women depending on the source and definition used. An early study of sexual dysfunction in the United States analyzed data from the National Health and Social Life Survey. The survey was based on a probability sample of sexual behavior in a 1992 cohort of 1749 women and 1410 men aged 18 to 59 years and

noted a prevalence of sexual dysfunction in 43% of women and 31% of men [12]. Low libido was the most common complaint reported in 51% of respondents, followed by problems with arousal in 33%, and pain disorders in 16%. Sexual dysfunction was more common in women as compared with men (43% versus 31%), and was associated with younger age (18 to 39 years), less education, and unmarried status. Importantly, in this study, sexual dysfunction was linked to poor physical and emotional health and significantly impacted quality of life. These data, however, are limited by lack of information on individuals greater than 59 years of age, and whether the sexual dysfunction was problematic or a cause of distress to the affected individual. Recent studies have addressed sexual practices in a more inclusive population up to age 79 years and have reported on sexual dysfunction in about 35% of participants [4,5]. In one study [4], 71% of women were sexually active, and 33% of the sexually active women were classified with FSD by the answer of ''somewhat of a problem'' or ''very much a problem'' in at least one of the four domains studied including lack of interest, lack of enjoyment, difficulty in arousal, or difficulty in orgasm. When women not sexually active were included in those with sexual dysfunction, then the overall prevalence of FSD in this study was 45% [4].

The definition of FSD is problematic, and may be defined better by what it is not, rather than what it is. Media attention and progress in the pharmaceutical treatment of male erectile dysfunction have focused attention on female sexuality. This scrutiny may have created an artificial standard of expected female sexual function that if not attained is labeled a dysfunction. A less than perfect sex life becomes FSD when it causes personal distress as determined by the affected women, and not necessarily her partner [13]. The diagnosis of FSD requires that the symptom be persistent, pervasive, and cause personal distress to the woman. Symptoms that bother the woman's partner but are not distressful to the woman herself, such as lack of the woman's interest in sex, are not classified as her sexual dysfunction.

FSD has been classified into four areas by an international consensus conference: problems with arousal, orgasm, desire, and pain (Box 1) [14]. Women may have symptoms that fall into more than one dysfunction category. Sexual arousal disorder (FSAD) is defined as the persistent or recurrent inability to attain or maintain sexual excitement, with an emotional lessening of excitement or sensation. Orgasmic disorder (FOD) is defined as the difficulty or inability to reach orgasm after sufficient sexual stimulation and arousal. Sexual desire disorders are divided into two categories: hypoactive sexual desire disorder (HASDD), which involves the lack of desire for sexual activity and/or a deficiency or absence of sexual thought and fantasies, and sexual aversion disorder, defined as the fear and avoidance of sexual thought and situations. Sexual pain disorders are subdivided into three categories: dyspareunia, vaginismus, and noncoital sexual pain disorder. The first type of FSD pain disorder is dyspareunia, or genital pain that occurs with intercourse. Vaginismus, the second type of sexual pain

Box 1. Classification of female sexual dysfunction

Sexual arousal disorder
Orgasmic disorder
Sexual desire disorders
- Hypoactive sexual desire disorder
- Sexual aversion disorder

Sexual pain disorders
- Dyspareunia
- Vaginismus
- Noncoital sexual pain disorder

Data from Basson R, Berman J, Burnett A, et al. Report of the international consensus development conference on female sexual dysfunction: definitions and classifications. J Urol 2000;163:888–93.

disorder, involves involuntary muscle spasms of the lower third of the vagina that interferes with intercourse. The last category is noncoital sexual pain disorder, defined as genital pain that occurs with any type of noncoital sexual stimulation. FSD can be characterized further as primary or secondary, and persistent, versus situational. The etiology may be physical or psychological, a combination, or the cause may be unknown.

Assessment of female sexual dysfunction

The approach to the treatment of FSD involves identification of women who have the problem, identification and treatment of causes of pain, identification of the class of sexual dysfunction, and treatment tailored to the individual patient as well as her partner. The most common reason health care providers fail to question their patients about possible FSD is because of a lack of time [15]. Plouffe [16], however, has demonstrated that three simple questions are as effective as lengthy interviews to screen for sexual problems. Screening questions for female sexual function include [16]:

- Are you sexually active?
- Are there any problems?
- Do you have pain with intercourse?

An intake questionnaire with these three questions may be helpful for efficiency and privacy. The nature of the sexual problem is characterized as being associated with arousal, desire, problems with orgasm, or symptoms of pain. In addition, the history should focus on the duration of the problem (primary or secondary) and the psychosocial factors involved, such as any recent life changes or stressors. There are several female sexual function

questionnaires that can be useful, such as the Female Sexual Function Index (FSFI, available at www.fsfi-questionnaire.com), which has been validated based on Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) diagnoses of HASDD, FSAD, and FSOD [17]. A total FSFI score of 26 or less is considered at risk for sexual dysfunction.

Medical history is important, as chronic illnesses or medications that affect neurologic, endocrine, vascular, or psychological function can impact on sexual function [18,19]. Examples of illnesses that may affect sexual function include spinal cord injuries, thyroid disease, diabetic neuropathy, surgical or medical castration with accompanying marked decreased estrogen and testosterone levels, cardiovascular disease, and depression. Medications can interfere with sexual function by alteration of mood and libido, such as antidepressants, antipsychotics, and sedatives, by alteration of blood flow to the genitals decreasing arousal and/or lubrication, such as certain antihypertensives or antiestrogens, or by increasing sex hormone-binding globulins and therefore decreasing free testosterone levels such as with oral contraceptives. Illicit drug use and alcoholism also are associated with FSD. Excessive tobacco abuse may lead to vascular insufficiency and decreased genital blood flow. Difficult vaginal delivery or vaginal surgery may cause denervation or dyspareunia. Surgical castration is another common intervention that may affect sexual function adversely, particularly in premenopausal women. Bilateral oophorectomy is the most common prophylactic operation performed with removal of otherwise healthy tissue.

The physical manifestations of the normal female sexual response cycle are the result of increased blood flow (engorgement) that occurs in the pelvis and breasts, and increased muscle tension in the body. Vaginal increases in blood flow result in increased vaginal secretions, which are important for lubrication, and are estrogen-dependent. Low estrogen levels are associated with significant decreases in clitoral, vaginal, and urethral blood flow and histologic changes of thin mucosal layers. Thus, any medical illness or medication that interferes with this complex process can contribute to sexual dysfunction.

An evaluation for possible need for psychotherapy is important, based on the patient's current life stressors, social situation and relationships, history of psychiatric illnesses, and history of sexual trauma. Determination of sexual partner involvement in the FSD is crucial. The physical examination focuses on general health and on the identification of treatable causes of pain. Additionally, women who have incontinence and prolapse have lower sexual function scores than women without these problems [20].

Routine laboratory testing is not recommended unless a hormonal abnormality is suspected, and it includes screening for prolactinoma, thyroid dysfunction, and adrenal disorders. There is some suggestion that free testosterone levels less than the lowest quartile may be associated with FSD or androgen insufficiency syndrome [18,21]. Androgen insufficiency syndrome, with symptoms of decreased sexual interest and well-being,

fatigue, persistent postmenopausal vasomotor symptoms despite estrogen replacement, and lack of motivation recently has been postulated. Normal range of testosterone levels have not been established in women, however, and testosterone levels do not correlate with libido, so random values are worthless in the evaluation of FSD [18,19]. If adrenal insufficiency is suspected, measurement of dehydroepiandrosterone sulfate (DHEAS) is useful because of isolated adrenal production [21]. Although estrogen deficiency and urogenital atrophy can contribute to FSD, including dyspareunia and vascular insufficiency, measurement of estrogen levels is also not useful [10,19]. Progesterone appears to have little impact either alone or with estrogen on female sexual function [10].

Treatment of female sexual dysfunction

The advent of new therapies for male sexual erectile dysfunction and the media attention it has received have led to widespread attention of FSD. The treatment of sexual dysfunction in the female, however, is more complex than the male. Male sexual dysfunction mainly involves the arousal stage of the sexual response and problems with erection or premature ejaculation. In the case of erectile disorders, pharmaceutical interventions that increase penile blood flow have proven efficacy. Female sexual dysfunction less commonly occurs in the arousal phase of the sexual response, with more women reporting difficulties with libido and orgasm [12]. Because the female sexual response is more complex involving neurovascular, endocrine and psychosocial factors, simply increasing clitoral and vaginal blood flow with pharmaceutical agents usually does not result in improved desire, arousal, or orgasm.

Education of women who have sexual problems about average sexual behaviors and frequencies as well as determination of whether their own personal sexual practices are distressing to them can be very helpful. Specifically, media portrayals do not accurately represent the average American experience in terms of sexual activity and quality of sexual experience. In addition, it is important that women know that there is no medically expected level of sexual activity or function, and that lack of libido or ability to climax does not represent a sexual dysfunction as long as the woman experiences no personal distress. Other information that is useful is that about only 20% of women experience orgasm with vaginal intercourse and that most require clitoral stimulation to climax. Not all women experience orgasm with every sexual encounter; only 30% of women climax with almost every sexual activity [7,8]. An anatomy lesson regarding clitoral location and techniques for stimulation such as the vibrator may be helpful in giving the woman with psychosocial barriers medical permission to treat her sexual problems in this way [22].

Exploration for any recent significant physical or social changes such as childbirth, menopause, work status, or a death should be made as these life

events can affect sexual function negatively. Optimal female sexual health incorporates physical, mental, and emotional aspects, and these are the context in which a woman experiences desire, arousal, and orgasm. No medical treatment will improve a bad situation or relationship. Psychosocial intervention may be necessary based on the woman's relationship, current life stressors, and sexual problems. Women who have sexual aversion disorder, primary FOD, and noncoital pain disorder and those who have history of sexual abuse usually require psychotherapy.

Alteration of contributors to FSD, such as smoking, excess alcohol or illicit drug use, obesity, and optimal treatment of medical diseases that can affect FSD such as hypertension and diabetes are also part of management. Simple things, including exercise, a healthy diet, and adequate rest, improve physical and mental, and therefore sexual health. The woman and her partner need to improve communication and reduce relationship strains when present, as a strong impetus for female sexuality is intimacy [21]. Sensate focus is a technique that can be used by couples to resolve sexual problems and improve intimacy through communication regarding what is pleasurable [22]. This technique aims to make both partners aware of what each finds enjoyable and to reduce anxiety about performance. Initially, intercourse is banned, and the focus is on the sensation of nongenital touching, with mutual pleasure the goal. Gradually, the level of intimacy is advanced when both partners are comfortable, to mutual touching to include the genitals, and finally to intercourse with the same focus of pleasure and enjoyment that was learned in the first levels.

Sexual activity is often begun by women to improve emotional closeness with their partners, and this can impact libido. Scheduling date nights and time for sexual relations can be effective even when desire is not apparent. Remind patients that for women, desire does not always precede arousal, and making protected time for intimacy can improve sexual function [21].

Medications

The effects of systemic hormone therapy (HT) on female sexual function are inconsistent in randomized controlled trials (RCTs), including placebo-controlled trials [10,18,21]. Estrogen improves vaginal and clitoral blood flow, improving lubrication. Dyspareunia caused by atrophy is treated best by vaginal estrogen, either delivered as a crème, tablet, or ring. Progesterone can ameliorate these changes and cause persistent dryness and dyspareunia depending on type of progesterone used [18]. The ability of systemic HT to enhance sexual arousal, desire, and ability to achieve orgasm is not definitive. Studies from the 1970s did not find any changes in satisfaction, orgasm, or frequency of sexual intercourse or masturbation [18]. More recent RCTs have reported beneficial effects of estrogen therapy (ET) on sexual desire, enjoyment, orgasmic frequency, and vaginal lubrication, but

no difference in coital frequency [18]. Another study evaluating transdermal estrogen noted improvement in satisfaction, increase in sexual activity and vaginal lubrication, decreased dyspareunia, but no change in arousal or orgasm frequency [18]. Many experts do initiate systemic HT in the absence of contraindications in postmenopausal women who have FSD [21].

The role of androgens in the treatment of FSD is controversial. Testosterone has been linked to sexual desire [10,18,19,21]. Androgen levels gradually decrease with age starting at about 30 years, but there is no abrupt drop at the time of menopause. Ovarian and adrenal production of androgens continue into the menopause, with levels about half of peak levels [21]. The data on testosterone use for the treatment of FSD are limited, however, with few RCTs and no information on long-term use. The best studies come from the treatment of postmenopausal and surgically castrated women evaluated in RCT [23–26]. The addition of testosterone, either oral or transdermal to ET resulted in significant improvement in sexual function, including desire, arousal, and orgasm, compared with ET alone. Some patients withdrew secondary to adverse effects [23], however, and supraphysiologic testosterone levels were reported [26]. The use of androgens in premenopausal women who have FSD has been poorly studied. One small RCT reported improvement in arousal with use of testosterone gel administered 4 to 8 hours before planned sexual activity compared with placebo [27]. Premenopausal women who have serum-free testosterone levels below the lowest quartile of normal range and who have symptoms of androgen insufficiency including FSD may be offered testosterone but need to be counseled on the absence of efficacy data and safety. Blood levels should be monitored to achieve physiologic levels in the mid–upper level of normal range [10,18,21]. Transdermal testosterone may minimize the adverse effects. Because testosterone can affect lipid profile negatively and cause liver damage, it may be prudent to evaluate liver function and lipids at regular intervals. Long-term adverse effects of testosterone therapy that are irreversible include clitoral enlargement, voice changes, and male pattern baldness, but these complications are rare with physiologic levels [21]. Other androgens such as DHEAS and dehydroepiandrosterone (DHEA) have been used to treat FSD but with very limited evidence for effectiveness. One small uncontrolled study reported an improvement in desire, arousal, satisfaction, and orgasm in pre- and postmenopausal women with decreased androgen levels and libido treated with DHEA [28]. DHEA is available as a nutritional supplement, and although not regulated by the FDA, it can be used to treat premenopausal women with androgen insufficiency at a dose of 50 mg/d after counseling regarding the experimental nature of this use [21].

Tibolone is a synthetic steroid with estrogenic, progesterogenic, and androgenic properties, with possible positive effect on sexual function used in Europe for more than 20 years [10,21]. In a recent RCT, tibolone was shown to increase clitoral circulation and sexual function scores significantly as

compared with conventional HT in postmenopausal women who had FSD [29].

Medications used to treat male erectile dysfunction such as sildenafil also have been studied in women who have FSD. These medications increase genital blood flow by inhibition of phosphodiesterase, thereby facilitating nitric oxide-mediated relaxation of clitoral and vaginal smooth muscle. In women, increased vaginal and clitoral blood flow and increased lubrication and engorgement caused by sildenafil did not translate into consistently improved sexual function in several large trials of women with FSD [19,21]. There does not appear to be any clear benefit to the use of sildenafil in women FSD. In women with isolated FSAD who have low vaginal engorgement as measured by vaginal pulse amplitude with photoplethysmography, however, a few RCTs have reported significantly increased subjective arousal and perception of genital arousal [21,30,31]. Women who benefit from this class of drugs may be those who have deficient genital engorgement, especially those who have a specific underlying cause of FSAD, such as type 1 diabetes, and not those who have deficient subjective arousal [21,32].

Other medications used to treat HASDD, FSAD, and FOD include topical and oral medications. Arginmax is an oral nutritional supplement containing L-arginine, a precursor for nitric oxide, which facilitates genital smooth muscle relaxation, damiana, ginseng, ginkgo, multivitamins and minerals [21,33]. Two small, placebo-controlled RCTs both conducted by the same authors noted significantly improved desire, orgasm, sexual frequency, and clitoral sensation, including increased sexual function scores using the FSFI in women randomized to Arginmax [33,34].

Zestra is a botanical massage oil composed of PA-free borage seed oil, evening primrose oil, angelica extract, coleus extract, vitamin C, vitamin E, and natural fragrances to applied to the vulva before sexual activity. One small RCT in 20 women, 10 who had FSAD, reported significant improvement in arousal, desire, orgasm, and sexual pleasure as compared with placebo [35].

Avlimil is a tablet advertised on the Internet and magazines as a ''daily supplement shown to promote better blood flow and increased muscular relaxation for an improved libido and a healthier, more energetic sexual response.'' Although the company reports significant improvement in sexual function in a RCT, there are no studies published in peer-reviewed journals using this product, which contains multiple herbs. The US Federal Trade Commission has charged the marketers of Avlimil in making false and unsubstantiated claims. Avlimil's ingredients are substantially different from the formula used in the clinical trial cited in advertisements.

Alprostadil, a prostaglandin topically applied to the genitals, is under investigation to treat FSD. Alprostadil increases genital vasocongestion, lubrication, and some indices of sexual arousal, but results are inconsistent, with not all trials demonstrating significant benefit compared with control [36].

There are ongoing clinical trials that will help to determine if alprostadil is beneficial for FSD, however.

In summary, women who have sexual dysfunction may have problems that overlap the different stages of sexual function, arousal, desire, orgasm, or pain. Management involves assessment of the level of dysfunction, education of average sexual practices, ways to improve intimacy, treatment of pain, evaluation for psychotherapy depending on current and past relationships and life stressors including history of sexual abuse, and medical management when indicated. Hormone replacement therapy, including testosterone, may be used in postmenopausal woman, but the role of androgens in premenopausal women who have sexual dysfunction remains under investigation. Primary orgasmic disorder, sexual aversion disorder, and noncoital sexual pain disorder are difficult to treat and generally require psychiatric referral and long-term counseling.

Sexual function in women with pelvic floor disorders

Pelvic floor disorders, including urinary and anal incontinence and pelvic organ prolapse, are common and have a negative impact on the sexual function of women [20]. In a large national survey of sexual function, urinary tract symptoms were associated with increased rates of arousal and sexual pain disorders [12]. In another epidemiologic study that evaluated women undergoing hysterectomy, urinary incontinence was associated with low libido, vaginal dryness, and dyspareunia, but pelvic organ prolapse was not associated with any sexual complaints measured [37]. Coital incontinence, or loss of urine with sexual intercourse, can be particularly troublesome to patients and occurs either with vaginal penetration in women who have stress incontinence or with orgasm in women who have overactive bladder symptoms [38]. The effects of pelvic organ prolapse and urinary incontinence as well as vaginal anatomy on sexual function have been evaluated in two studies by the same authors [39,40]. Although increasing grade of prolapse predicted interference with sexual activity, prolapse itself did not affect frequency of intercourse or subjective satisfaction. Sexual activity was not correlated with vaginal length or introital caliber, and no association was noted between anatomy and complaints of dyspareunia. More advanced stages of prolapse have been associated with reports of impairment in sexual life and increased rates of abstinence [41]. Multiple studies have shown that surgical treatment of the underlying pelvic floor disorder, either prolapse or stress urinary incontinence, improves sexual function as measured by a condition-specific validated questionnaire [42–44]. Not all studies report an improvement, however, A recent publication reported no difference in sexual function following vaginal surgery for prolapse and stress urinary incontinence, but these authors used a validated questionnaire, which was not specific for pelvic floor disorders [45].

Sexual function after hysterectomy

Hysterectomy is the most common major gynecologic surgery, and there is popular belief of adverse effect on sexual function. Older studies that reported the effects of hysterectomy on sexual function did not use validated questionnaires or prospective design. Multiple prospective studies have demonstrated a positive effect of total and subtotal abdominal and vaginal hysterectomy on sexual function [46–49]. RCTs have shown no benefit for sexual function by cervical preservation with subtotal (supracervical) hysterectomy [49].

Pregnancy and childbirth

Sexual dysfunction is common after childbirth, but generally is addressed poorly by providers. Up to 86% of women report sexual problems in the first 3 months after childbirth [50,51]. At 6 months postpartum, 18% to 30% of women still experience sexual problems, mostly related to dyspareunia [52]. Fortunately, most women resume prepregnancy orgasmic function and sexual intercourse without severe pain by 6 months postpartum [53]. Risk factors for postpartum sexual dysfunction include continued breast feeding and severity of genital tract trauma sustained at childbirth [53,54]. At 6 months postpartum, women who have severe perineal lacerations into the anal sphincter are 270% more likely to report pain with intercourse than women who delivered without laceration [54]. Compared with spontaneous vaginal delivery, assisted vaginal delivery is associated with postpartum sexual dysfunction, but the effect of cesarean delivery on sexual function is not consistent [51,53]. Prevention of severe laceration at childbirth and increased communication postpartum with women, especially those who are breast feeding, would improve the detection and subsequent treatment of FSD in this young population.

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