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Review

Rehabilitation for Women and Men Experiencing Sexual Dysfunction After Abdominal or Pelvic Surgery

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Abstract: Sexual dysfunction following abdominal or pelvic surgery is a significant concern that impacts the quality of life (QoL) for both men and women. This paper explores the multifaceted challenges and re-educational strategies associated with post-surgical sexual dysfunction. It highlights the physical and psychological repercussions of surgeries such as hysterectomies, pelvic organ prolapse repairs, radical prostatectomies, and rectal cancer resections. These procedures often lead to complications like dyspareunia, erectile dysfunction, and altered body image, necessitating comprehensive re-educational approaches. The review emphasizes the importance of tailored interventions, including pelvic floor muscle training (PFMT), biofeedback, manual therapy, and advanced techniques like botulinum toxin injections and sacral neuromodulation. For men, strategies such as phosphodiesterase type 5 inhibitors (PDE5i), vacuum erection devices (VEDs), intracavernosal injections, and penile prostheses are explored for their efficacy in restoring erectile function. Psychological support, including cognitive–behavioral therapy and couples counseling, is underscored as essential to addressing emotional and relational aspects of recovery. A multidisciplinary approach involving physiatrists, urologists, gynecologists, physiotherapists, psychologists, and sexual health counselors is advocated for to optimize outcomes. Integrating physical therapy modalities, as well as psychological and relational therapies, into individual rehabilitation projects is crucial for improving sexual function and overall QoL post-surgery. Future research should focus on refining these established strategies and investigating the potential of innovative therapeutic modalities.

Keywords: rehabilitation; quality of life; physical therapy modalities; psychological sexual dysfunctions; pelvic floor disorders; botulinum toxin; transcutaneous electrical nerve stimulation; biofeedback; phosphodiesterase type 5 inhibitors; penile prosthesis implantation

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1. Introduction

Sexual re-education following abdominal or pelvic surgery is an essential and often complex component of postoperative care, as it significantly impacts quality of life (QoL) for both men and women [1]. Many patients experience alterations in their sexual functioning due to physical and psychological changes resulting from various types of surgeries, such as those for cancers, pelvic organ prolapse, and more [2]. Understanding the dynamics

of sexual re-education is crucial for healthcare providers to facilitate a comprehensive recovery process that addresses intimate health after surgery.

In women specifically, studies indicate that surgeries for pelvic organ prolapse and stress urinary incontinence (UI) can lead to considerable variations in sexual outcomes. Caldwell et al. emphasize that women commonly report altered body image, pain, and embarrassment, which can delay or inhibit their return to sexual activity post-surgery [3]. Investigations reveal that many women express a desire for improvements in sexual function and satisfaction as a significant outcome of surgical interventions [4]. Johannesson et al. reported that pelvic floor dysfunction, often exacerbated by surgeries such as hysterectomies, correlates with diminished sexual function characterized by decreased arousal and increased dyspareunia [5]. Khandwala et al. express concern about potential sexual function deterioration following transvaginal mesh surgery [6].

Additionally, the effects of surgery on men cannot be overlooked. Radical prostatectomy remains a widely used therapeutic option for patients with prostate cancer, with long-term complications such as UI and erectile dysfunction (ED) [7,8]. In male patients, surgical interventions related to rectal cancer, including abdominoperineal resections, significantly impair sexual function due to potential damage to sacral splanchnic nerves and other branches of pelvic autonomic nerves [9]. Li et al. report that patients undergoing abdominoperineal resection face a heightened risk of ED and sexual dissatisfaction, primarily as a result of surgical alterations to the pelvic anatomy that impair sexual arousal and response [10]. Surgeries such as total mesorectal excision in males can lead to distinct challenges, particularly concerning erectile function, due to the removal of tissues surrounding nerve plexuses central to sexual arousal. This nerve involvement underscores the need for careful procedural techniques aimed at nerve preservation, as articulated by Wei et al. [11]. Emerging evidence suggests that preoperative counseling and postoperative re-education, focusing on erectile function recovery, are crucial for improved patient outcomes [12].

Additionally, the use of surgical meshes in procedures for pelvic organ prolapse and UI can lead to mixed outcomes regarding sexual function. Sukgen et al. find that while some women report improvements in sexual function post-surgery, there remains a significant subset who experience no changes or even declines in sexual satisfaction [13]. The interplay between bodily changes after pelvic surgery and the psychological dimensions associated with these changes cannot be underestimated either. Research shows that postoperative patients may experience pain during intercourse and dissatisfaction with sexual expectations, underscoring the emotional and physical complexities of recovery [14]. Wihersaari et al. note that increased coital pain, decreased sexual excitement, and partner-related erectile problems contribute significantly to postoperative sexual dysfunction in women [15]. It should also be considered that the aftermath of surgeries like pelvic organ prolapse repair frequently leads to unintended consequences, such as the emergence of new sexual dysfunctions. For example, women may develop dyspareunia or loss of sexual interest following what were intended to be corrective surgeries, illustrating the delicate balance between surgical success and potential sexual side effects [16].

Considering the possible negative impacts of pelvic surgeries on sexual satisfaction, it becomes imperative that postoperative care integrate a comprehensive sexual re-educational approach [17]. This review aims to examine the various re-educational strategies for patients experiencing sexual dysfunction following abdominal or pelvic surgery, emphasizing the importance of a multidisciplinary approach based on current scientific evidence.

2. Sexual Re-Education in Women

Sexual re-education in women following abdominal or pelvic surgery presents complex challenges that can affect overall QoL [18]. In a longitudinal study, Johannesson et al. observed that women had reduced sexual function even prior to surgery, with implications for sexual arousal and orgasm frequencies, suggesting a correlation between existing pelvic floor dysfunction and postoperative sexual issues [5]. Many women report changes in sexual function following surgeries aimed at correcting gynecological issues. Danesh et al. stated that while some women experience improvements in sexual desire post-hysterectomy, a significant number also report challenges such as dyspareunia and decreased sexual function [19]. Other studies, such as those by Bekker et al. and Jha et al., reported that some women experienced notable improvements in sexual function related to incontinence surgery, while many exhibited no significant change in sexual desire and activity post-surgery [20,21]. Moreover, the type of surgery performed can influence outcomes. Hysterectomies, particularly abdominal ones, are associated with varied results. While some women report improvements in sexual functioning due to the alleviation of pelvic pain or discomfort from prolapse, others express dissatisfaction over the loss of anatomical structures [22]. Helström and Nilsson's study supports this observation, revealing that a significant percentage of women reported a reduced sexual functioning score one year post-vaginal surgery for pelvic floor disorders, emphasizing the significance of psychological and physical recovery in sexual re-education [23]. The psychosocial aspects of sexual re-education should not be neglected either: cultural and individual beliefs significantly influence how women perceive their sexuality post-surgery. For instance, Chandana et al. indicated that despite the expectation of improved sexual QoL post-total abdominal hysterectomy, the results did not show a statistically significant change, highlighting the influence of contextual factors on rehabilitation [24]. Given the complex interplay between physiological and psychosocial factors, effective sexual re-education for women following abdominal or pelvic surgery is paramount. A comprehensive approach is essential, encompassing both physical and psychological interventions (Table 1). Recommended strategies should consider the specific surgical method employed, individual psychological responses, and pre-existing pelvic health conditions. Recognizing these interdependencies is crucial for developing tailored individual rehabilitation projects (IRPs) that optimize recovery and improve sexual function and well-being.

Table 1. Re-educational approaches for women.

Re-Educational Approaches	Description	Benefits
Pelvic floor muscle training	Exercises to strengthen pelvic floor muscles, often combined with biofeedback or electrical stimulation.	Improves arousal, orgasm, and satisfaction, and reduces sexual pain; enhances pelvic health.
Manual therapy	Hands-on techniques like myofascial release, trigger point massage, and scar tissue mobilization.	Alleviates pelvic pain, improves mobility, and restores sexual function.
Botulinum toxin	Injections targeting hyperactive pelvic floor muscles or pain-related conditions like dyspareunia.	Reduces pain during intercourse and improves sexual satisfaction in conditions like vaginismus.
Sacral neuromodulation	Electrical stimulation of sacral nerves to regulate the pelvic floor and bladder function.	Enhances sexual desire, arousal, lubrication, and satisfaction in women with pelvic disorders.

Table 1. *Cont.*

Re-Educational Approaches	Description	Benefits
Transcutaneous electrical nerve stimulation	Non-invasive electrical stimulation to manage pain and improve circulation in the pelvic area.	Reduces vulvar pain and enhances arousal, lubrication, and orgasm.
Biofeedback	Electronic monitoring to provide feedback on pelvic floor muscle activity, enhancing awareness and control.	Augments PFMT effectiveness by improving muscle strength, reducing anxiety, and enhancing self-efficacy.
Emerging therapies	PRP and stem-cell therapy	Promising innovative therapies for ED and PD; evidence limited by study quality, heterogeneity, lack of standardized protocols, and absence of long-term follow-up.
Psychological support	Includes cognitive–behavioral therapy (CBT) and couples counseling.	Addresses anxiety, depression, body image issues, and relational challenges.

2.1. Pelvic Floor Muscle Training in Women

Pelvic floor muscle training (PFMT) encompasses exercises designed to strengthen the pelvic floor muscles, which support the bladder, uterus, and rectum, thereby enhancing bodily functions like urinary control and core stability [25]. For many women, PFMT is recognized as a critical non-invasive approach for addressing pelvic floor dysfunction, including UI, particularly after childbirth or surgical interventions like hysterectomies [26]. The role of PFMT in female sexual re-education is well established in the medical literature. PFMT has demonstrated efficacy in enhancing sexual function across various populations of women, including those experiencing sexual dysfunction, overactive bladder, pelvic organ prolapse, and postmenopausal changes [27].

The most well-known form of PFMT includes Kegel exercises, which involve contracting and relaxing the pelvic floor muscles in a manner similar to stopping the flow of urine. These exercises are a PFMT cornerstone and have been shown to improve muscle tone, strength, and endurance, allowing better control over involuntary urges and leakage during increases in intra-abdominal pressure, such as coughing or exercising [28,29]. Evidence indicates that regular practice of these exercises can also contribute to overall pelvic health, reducing the incidence of pelvic organ prolapse and enhancing sexual function [30]. Studies have emphasized that the effectiveness of PFMT can be enhanced through techniques such as biofeedback and electrical stimulation, which help to increase patients' awareness and control over their pelvic floor muscles [25,31].

A systematic review and meta-analysis reported that PFMT significantly improved domains such as arousal, orgasm, and satisfaction, and reduced sexual pain, leading to an overall enhancement in Female Sexual Function Index (FSFI) scores [32]. Furthermore, in women with overactive bladder, PFMT was associated with improvements in FSFI domains, partner sexual satisfaction, and pelvic floor muscle strength [33]. Among postmenopausal women, PFMT effectively reduced the prevalence of sexual dysfunction by improving pelvic floor muscle function [34]. Similarly, women with pelvic organ prolapse experienced enhanced sexual function following PFMT interventions, which increased pelvic floor muscle strength and endurance [27]. Supervision by a physiotherapist has been shown to optimize the effectiveness of PFMT [35]. Additionally, the use of vaginal dilators is recommended to prevent vaginal stenosis, particularly after pelvic irradiation or complex surgical procedures [36,37]. Complementary interventions such as lubricants and low-dose

vaginal estrogens can further aid in improving lubrication and alleviating pain during intercourse. The American Society of Clinical Oncology advises the use of water-based or silicone-based lubricants to manage vaginal dryness [38]. Therefore, PFMT represents an effective intervention for improving female sexual function across diverse clinical conditions by enhancing arousal, orgasm, and sexual satisfaction, and reducing sexual pain. These benefits are supported by robust evidence from randomized controlled trials and systematic reviews, underscoring the importance of PFMT as a cornerstone of female sexual re-education.

Manual therapy, especially if combined with PFMT, serves as an effective approach for sexual re-education in women following abdominal or pelvic surgery. This therapy encompasses various hands-on techniques aimed at relieving pain, improving mobility, and restoring functionality to the pelvic area [39]: trigger point massage focuses on releasing painful muscle trigger points that cause localized or referred pain, while myofascial release targets tight fascial tissues to enhance mobility and reduce discomfort; connective and scar tissue release addresses immobility caused by scar tissue, promoting tissue flexibility; strain–counterstrain is a gentle method used to correct musculoskeletal asymmetries; and visceral manipulation aims to improve the mobility and function of internal organs affected by pelvic pain. While studies specifically linking manual therapy and improved sexual function post-surgery are limited and require caution in interpretation, data from other conditions can be extrapolated and translated in sexual re-education. According to the American Urological Association guidelines, manual therapy is recommended for patients experiencing pelvic floor pain and tension, as it provides substantial symptomatic relief [40]. Other authors reported that manual therapy can alleviate symptoms of pain, urgency, and urinary frequency while improving sexual function in women with chronic pelvic pain syndrome [41]. Furthermore, it has been successfully applied to conditions such as vulvodynia, dyspareunia, and vaginismus, where physiotherapists utilize techniques to enhance mobility, reduce pain, and restore sexual function [42]. All this considered, manual therapy appears as a component of sexual re-education, and is particularly effective in treating sexual dysfunctions related to pelvic pain and pelvic floor muscle hypertonia. Its integration with PFMT may enhance outcomes by addressing both physical and functional aspects of pelvic floor health.

2.2. Botulinum Toxin

Botulinum toxin (BT), particularly Botulinum toxin type A (BoNT/A), has gained significant traction in the realm of sexual re-education after surgical interventions [43]. BoNT/A acts by inhibiting the release of acetylcholine at the neuromuscular junction, which results in decreased muscle activity and relaxation of hyperactive muscles [44]. This mechanism makes it a valuable option for treating complications associated with pelvic surgical procedures, such as postoperative pain and dysfunction.

BT has demonstrated efficacy in treating sexual dysfunction in women, particularly in conditions such as dyspareunia, vaginismus, and chronic pelvic pain. Specifically, BoNT/A has been shown to improve sexual function in women with dyspareunia and chronic pelvic pain. A systematic review by Parenti et al. reported that BoNT/A injections into the vulva and vagina significantly alleviated symptoms of dyspareunia and chronic pelvic pain, with no irreversible side effects observed [45]. Similarly, a study by Tarazona-Motes et al. found substantial clinical improvements in pain scores and sexual function among women with chronic pelvic pain associated with dyspareunia following BoNT/A infiltration [46]. BoNT/A has also proven effective in managing refractory vaginismus. Ghazizadeh and Nikzad reported that 95.8% of women with moderate to severe vaginismus experienced significant improvement after BoNT/A injections, with 75% achieving satisfactory inter-

course following the first injection [47]. Other studies indicate that intramuscular injection of BT into pelvic floor muscles may enhance sexual function by reducing pain and discomfort during sexual activity, often leading to improved QoL [48]. Conversely, the use of BoNT/A in treating provoked vestibulodynia (PVD), a common pain disorder afflicting primarily young women, has yielded mixed results. Haraldson et al. observed that while BoNT/A did not significantly reduce dyspareunia or pain during tampon use, it increased the number of women attempting intercourse and improved sexual function compared to placebo [49]. Pelletier et al. achieved major improvements in their study, demonstrating that high doses of BoNT/A significantly reduced pain and enhanced sexual function in women with PVD [50]. Additionally, Topcuoglu et al. showed that intravesical BoNT/A injections significantly improved sexual function in women with interstitial cystitis/bladder pain syndrome, as measured by the FSFI [51].

Another BoNT/A feature is the transient nature of its effects, typically observable within a few days post-injection and wearing off within weeks. This effect aligns well with the rehabilitation goals, allowing for phased recovery without extensive side effects [52]. All this considered, BT, particularly BoNT/A, appears as an effective therapeutic option for addressing sexual dysfunction in women. While still under research and subject to the need for more comprehensive clinical trials, the promising outcomes associated with BT therapy suggest it can offer significant benefits in sexual rehabilitation settings following surgery. With its ability to relax muscles and alleviate pain, BoNT/A presents a viable option for improving QoL for patients recovering from surgical interventions affecting sexual health.

2.3. Sacral Neuromodulation

Sacral neuromodulation (SNM) is a therapeutic intervention involving the delivery of electrical stimulation to the sacral nerve roots (S2–S4), which modulates the activity of the pelvic floor and the lower urinary tract [53]. The procedure involves the implantation of a pulse generator that delivers electrical impulses to the sacral nerves, with the aim of re-establishing normal bladder and bowel function by influencing central nervous system pathways [54]. Initially developed to treat overactive bladder and other urinary disorders, SNM has emerged as a promising treatment modality for enhancing sexual re-education in women following surgical procedures, such as pelvic floor surgery or radical hysterectomy [55]. The underlying mechanism of SNM is believed to involve restoring the normal neural pathways that control the bladder and pelvic floor musculature, thereby not only improving urinary function but also potentially enhancing sexual function [56].

Clinical studies have shown statistically significant improvements in various sexual health parameters, including desire, arousal, lubrication, and overall sexual satisfaction among women undergoing SNM therapy and lower urinary tract symptoms (LUTSs). A systematic review and meta-analysis by Khunda et al. highlighted that SNM significantly improved sexual function in women with pelvic floor disorders, especially bladder dysfunction [57]. Lombardi et al. reported that SNM led to significant improvements in sexual function among women treated for LUTSs, as evidenced by enhanced scores in the FSFI and the Female Sexual Distress Score [58]. Another study by Lombardi et al. demonstrated statistically significant improvements in at least one FSFI domain among women with overactive bladder following SNM treatment [59]. Parnell et al. further observed that sexually active women undergoing SNM for refractory overactive bladder experienced improvements in sexual function, as measured by the Pelvic Organ Prolapse/UI Sexual Questionnaire-12 (PISQ-12) [60]. Moreover, long-term follow-up evaluations have underscored the sustained benefits of SNM in managing lower urinary tract dysfunctions while concurrently enhancing sexual re-educational outcomes. Interventions like SNM have been recognized as fourth-line therapies for refractory conditions, emphasizing their significance

when previous treatment pathways have failed [61]. These findings collectively support the role of SNM as a viable treatment option for pelvic floor dysfunction, with the added benefit of improving sexual function.

2.4. Transcutaneous Electrical Nerve Stimulation

Transcutaneous electrical nerve stimulation (TENS) is a non-invasive therapeutic modality that employs electrical impulses delivered through the skin to stimulate peripheral nerves, primarily for pain relief [62]. The principles underlying TENS are based on the gate control theory of pain, which suggests that electrical impulses can inhibit the transmission of pain signals to the brain while also promoting endorphin release [63]. While direct data about TENS' effectiveness after surgery are lacking, literature reports indicate that TENS may enhance sexual re-education outcomes by indirectly increasing pelvic floor muscle function by pain reduction, muscle relaxation, and overall improvement in blood circulation in the pelvic area, leading to improved sexual function aspects such as arousal and lubrication [64]. Zimmerman et al. demonstrated that TENS significantly improved sexual function in women with general FSD, with notable increases in FSFI scores, particularly in the subdomains of lubrication, arousal, and orgasm [65]. Vallinga et al. reported that TENS significantly reduced vulvar pain and enhanced sexual function in women with therapy-resistant PVD, with these improvements remaining stable over the long term [66]. Similarly, Murina et al. observed substantial reductions in pain and improvements in sexual function among women with vestibulodynia following TENS treatment [67]. By targeting the nerves related to these discomforts, TENS improves pain management and may also enhance sexual function by reducing anxiety associated with pain or dysfunction during sexual activity. The method's affordability, ease of use, and minimal side effects bolster its potential as an appealing option for sexual re-education [68].

2.5. Biofeedback in Women

Biofeedback involves the use of electronic monitoring devices to provide information about physiological functions, allowing patients to gain awareness and control over bodily processes, particularly in muscle control and relaxation [69]. Biofeedback, through methods such as electromyographic biofeedback, facilitates awareness and training of the pelvic floor muscles, which can result in tangible benefits in sexual functioning. One study indicates that integrating EMG biofeedback with PFMT yields superior outcomes regarding neuromuscular strength and QoL in women with stress UI [70]. Another investigation revealed that biofeedback not only augments muscle strength but may also improve psychological aspects, such as reducing anxiety and enhancing self-efficacy [71]. The integration of biofeedback techniques in sexual re-education offers targeted interventions that focus on the physical re-education of pelvic musculature while also addressing psychological barriers to sexual satisfaction.

2.6. Emerging Therapies for Women

Emerging therapies are developing across various medical fields, including sexual dysfunction. Regenerative medicine, in particular, is gaining increasing attention [72–75]. Platelet-derived therapies are becoming more popular in numerous medical and surgical specialties due to their capacity to promote tissue healing and vascular remodeling. Platelet-rich plasma (PRP), a concentrated preparation of platelets derived from a person's own blood, is used to promote healing and tissue regeneration [76]. In the sexual dysfunction field, PRP can be used to manage pelvic floor disorders with positive impacts on perineal trauma, vulvovaginal atrophy, stress UI, vesicovaginal fistula, perineal rupture, and pelvic organ prolapse [77]. Tognazzo et al. also reported positive effects of PRP on clitoral epithelialization after clitoral reconstruction for female genital mutilation/cutting [78]. The

authors reported that all participants in their study achieved complete clitoral epithelialization, without short- or long-term complications, alongside easier clitoris stimulation, improved sexual arousal, lubrication, pleasure, and self-perceived body image. Ragy et al. reported benefits after PRP injections for vulvovaginal atrophy [79]. The authors compared hyaluronic acid and PRP injections in twenty post-menopausal participants and reported that both hyaluronic acid and PRP were effective, though hyaluronic acid showed more significant improvements. However, while promising results of PRP treatments are increasingly reported, a recent systematic review by Dankova et al. found that the level of current evidence remains low due to methodological issues in the available studies [80].

Stem-cell therapy is another therapy emerging as a promising avenue for treating sexual dysfunction in women. Recent advances in stem-cell therapy focus on repairing the physiological aspects of sexual function. For instance, stem cells may be utilized to rejuvenate vaginal tissues, enhance blood flow, and restore nerve function, which are crucial for sexual arousal and satisfaction [81]. Among the different types of stem cells, mesenchymal stem cells are considered particularly promising for female sexual dysfunction due to their abundance, high proliferation capacity, immunomodulatory properties, and secretion of regenerative factors [82,83]. Early-phase clinical trials have demonstrated the safety of autologous ASC therapy in women with sexual hormone deficiency. A phase II randomized controlled trial is underway to further assess the safety and efficacy of this approach in perimenopausal women with sexual dysfunction [84]. Stem-cell therapy has been compared with mini-sling surgery for treating stress urinary incontinence in women. While both treatments showed similar objective outcomes, stem cell therapy was associated with a lower rate of dyspareunia (painful intercourse) and shorter intervention time and hospital stay [85].

3. Sexual Re-Education in Men

Sexual re-education after abdominal or pelvic surgery presents unique challenges and considerations for men compared to women. The surgical approach and its consequent effects on sexual function reveal differences that warrant careful examination. For men, various studies indicate that sexual functioning often actually improves post-surgery, particularly following conditions like bariatric or colorectal procedures. Jedel et al. discuss significant improvements in various domains of sexual health post-proctocolectomy, an effect that is not uniformly observed in female patients [86]. In the context of bariatric surgery, studies by Sarwer et al. and Steffen et al. suggest that male patients often experience improved sexual functioning and satisfaction levels following weight loss, indicating a correlation with enhanced sexual health for this demographic [87,88]. Conversely, literature reports are available indicating worsening after surgery. After radical prostatectomy, many men face psychological and physiological challenges, including ED, which necessitates a structured approach to sexual re-education, as highlighted by several studies [89,90]. The literature underscores the importance of preoperative counseling that includes discussions on sexual function and re-educational options. Studies indicate that patients often have unmet needs regarding sexual re-education, primarily due to inadequate discussions with healthcare professionals about anticipated sexual difficulties post-surgery [91,92]. Thus, the integration of sexual health discussions within routine preoperative consultations and rehabilitation efforts seems crucial. Additionally, the involvement of female partners is correlated with greater patient compliance with IRPs, emphasizing the need for family-inclusive approaches in care strategies [92].

Sexual re-education for men following radical prostatectomy is a well-researched area, with multiple treatment options available [93–95] This therapeutic approach aims to enhance the recovery of erectile function after surgery by preventing structural damage

to erectile tissue and optimizing the likelihood of functional erection restoration. Re-educational strategies commonly include the use of phosphodiesterase type 5 inhibitors (PDE5i), such as sildenafil, tadalafil, and vardenafil. These agents are often administered early in the re-education process to preserve smooth muscle integrity and improve tissue oxygenation [96,97]. Additional therapeutic modalities include vacuum erection devices (VEDs), intracavernous injections of vasoactive agents, and the medicated urethral system for erections (MUSE) [98]. Although there is no universally agreed-upon rehabilitation protocol, early initiation of therapy is widely regarded as critical for protecting erectile tissue and preventing endothelial and muscular damage [96,97]. Current evidence suggests that combining PDE5i with VED therapy yields the most favorable outcomes for erectile function recovery [99]. In addition to pharmacological and mechanical interventions, sexual re-education for men often incorporates patient education and psychological support to address the emotional and relational challenges associated with post-surgical ED [97]. For patients who do not respond to conservative therapies, penile prosthesis implantation remains a viable and effective option [96,98]. Possible re-educational approaches for men are reported in Table 2.

Table 2. Re-educational approaches for men.

Re-Educational Approach	Description	Benefits
Pelvic floor muscle training	Exercises to strengthen pelvic floor muscles, often combined with biofeedback.	Improves erectile function and urinary continence post-prostatectomy.
Extracorporeal shockwave therapy	Non-invasive acoustic pressure waves to stimulate tissue repair and improve vascular function.	Potential improvement in erectile function through enhanced blood flow and tissue regeneration.
Low-intensity pulsed ultrasound therapy	Uses ultrasonic waves to promote healing and nerve regeneration in cavernous tissue.	Experimental therapy showing promise for restoring erectile function in nerve injury-induced erectile disfunction.
Biofeedback	Provides auditory or visual feedback during PFMT to improve muscle engagement and control.	Enhances training effectiveness; reduces complications like urinary incontinence or erectile dysfunction.
Phosphodiesterase type 5 inhibitors	Medications like sildenafil and tadalafil to enhance erectile function by improving blood flow.	First-line therapy for erectile dysfunction; improves erection quality and recovery post-surgery.
Intracavernosal injections	Direct injection of vasodilators like alprostadil into the penis.	Effective for severe erectile dysfunction; rapid onset of action.
Vacuum erection devices	Devices that create a vacuum to draw blood into the penis for erection maintenance.	Promotes early recovery of erectile function and penile length post-surgery.
Penile prosthesis implantation	Surgical implantation of a device to facilitate erections in cases of refractory erectile dysfunction.	High satisfaction rates; effective for severe cases unresponsive to other treatments.
Emerging therapies	PRP and stem-cell therapy	Promising innovative therapies for ED and PD; evidence limited by study quality, heterogeneity, lack of standardized protocols, and absence of long-term follow-up.
Psychological support	Includes CBT and couples counseling to address emotional and relational challenges.	Reduces anxiety and depression; improves adherence to re-educational programs.

3.1. Pelvic Floor Muscle Training in Men

In men, PFMT has been shown to improve erectile function, particularly when performed preoperatively [100]. PFMT protocols incorporating both rapid and slow contractions in a standing position have demonstrated efficacy in enhancing pelvic floor muscle strength and function [101,102]. PFMT is highly effective in addressing post-prostatectomy UI, accelerating the recovery of continence compared to patients who do not perform these exercises, with consequent improvement in both physical parameters and QoL [103]. Furthermore, PFMT enhances the strength, duration, and coordination of pelvic floor muscle contractions, contributing to better overall pelvic floor function [104]. Biofeedback is a valuable adjunct to PFMT, providing visual or auditory feedback to help patients accurately identify and contract their pelvic floor muscles, thereby improving training effectiveness; this technique is particularly beneficial for individuals struggling with proper muscle engagement during exercises [103,105,106]. Moreover, initiating PFMT before surgery is highly recommended, as it prepares the pelvic floor muscles for postoperative recovery, reducing the time required to regain continence and improving outcomes overall [107]. Preoperative training can also mitigate complications such as UI and ED, which are common after radical prostatectomy [105].

3.2. Extracorporeal Shockwave Therapy

Extracorporeal shockwave therapy (ESWT) is a non-invasive treatment modality that utilizes acoustic pressure waves to induce biological responses in tissues [108]. Originally developed in the 1980s for the fragmentation of kidney stones (lithotripsy), its applications have expanded to various therapeutic areas such as orthopedics, urology, and re-education for musculoskeletal conditions [109]. The term "extracorporeal" signifies that the shockwaves are generated outside the body and then transmitted to the targeted tissues [110]. The mechanism of action for ESWT involves the delivery of high-energy sound waves to painful areas, promoting healing by enhancing blood flow, stimulating cellular repair, and facilitating pain relief mechanisms [111]. This is believed to activate various biological processes such as the regeneration of connective tissues, reduction in inflammation, and promotion of neovascularization [112]. In the context of sexual re-education for men, ESWT has been extensively studied, particularly for the treatment of Peyronie's disease (PD) [113]. A study analyzing three randomized controlled trials evaluated the impact of ESWT on key parameters, including penile curvature, plaque size, erectile function, and pain [114]. While ESWT demonstrated a non-significant reduction in plaque size, it did not result in significant improvements in penile curvature, erectile function, or pain. The authors concluded that, based on the available RCTs, ESWT is not an effective standalone treatment for PD. Another study highlighted an intriguing therapeutic approach combining the synergistic effects of ESWT and low-intensity laser therapy on stable plaques, yielding significant benefits in pain reduction, improvement in penile curvature, and enhancement in sexual function [115]. One challenge in evaluating ESWT outcomes for PD is the lack of standardized methodologies for assessment and monitoring, which complicates the ability to make definitive treatment recommendations.

Furthermore, ESWT has been studied for the treatment of vascular ED, with some evidence suggesting improvements in hemodynamic parameters due to its potential role in promoting neoangiogenesis [116].

3.3. Low-Intensity Pulsed Ultrasound Therapy

Low-intensity pulsed ultrasound therapy (LIPUS) is a non-invasive treatment modality that employs low-intensity ultrasonic waves to promote healing and regeneration in various tissues [117]. LIPUS operates through the application of mechanical stimuli that in-

fluence cellular behavior at the molecular level, leading to a cascade of biological responses, including the secretion of growth factors and the enhancement in cellular activities involving proliferation and migration [118]. LIPUS has shown potential in preclinical studies for addressing specific contexts of ED, such as diabetic ED and nerve injury-induced ED. These findings are primarily derived from animal models and in vitro research. In a report, LIPUS supported the restoration of normal penile histology by inducing angiogenesis and the proliferation of endothelial progenitor cells within the cavernous tissue [119]. LIPUS has also been demonstrated to improve erectile function in diabetic rat models by enhancing endothelial and smooth muscle content, increasing elastic fibers, and modulating signaling pathways implicated in ED pathology [120,121]. Additionally, LIPUS has been hypothesized to support nerve regeneration and repair, which could be beneficial for ED resulting from nerve injury [122,123]. Despite these promising experimental findings, the evidence remains insufficient to establish LIPUS as a clinically effective treatment for sexual dysfunction in men. Current clinical guidelines for the management of ED do not include LIPUS as a recommended therapy [95,115].

3.4. Biofeedback in Men

Biofeedback plays a significant role in the rehabilitation of men with sexual dysfunction, particularly in the management of ED and chronic pelvic pain syndrome (CPPS). Biofeedback has been shown to effectively improve erectile function by enhancing pelvic floor muscle strength. A study by Perez et al. demonstrated that preoperative biofeedback aimed at strengthening perineal muscles significantly reduced the incidence of postoperative ED in men undergoing radical prostatectomy [124]. Furthermore, Lavoisier et al. reported that pelvic floor muscle re-education, which incorporates biofeedback, can increase intracavernous pressure, thereby improving penile rigidity and overall erectile function [125]. In the context of CPPS, Cornel et al. found that biofeedback combined with pelvic floor re-education significantly alleviated symptoms by promoting pelvic floor muscle relaxation and reducing muscle tone [126]. This approach addresses the underlying muscular tension often associated with CPPS, leading to improved symptom management and quality of life. Biofeedback helps men gain better control over their pelvic floor muscles, which is essential for optimal sexual function. Sahin et al. highlighted that pelvic physical therapy, including biofeedback, is an evidence-based first-line treatment for various male sexual disorders, such as premature ejaculation and ED [127]. By improving muscle coordination and strength, biofeedback enhances sexual performance and reduces associated symptoms.

3.5. Phosphodiesterase Type 5 Inhibitors

PDE5is work by enhancing the effects of nitric oxide, which is released during sexual stimulation, leading to increased blood flow to the penis and resulting in improved erections [128]. PDE5is, including sildenafil, tadalafil, and vardenafil, are widely regarded as the first-line treatment for post-prostatectomy ED [129,130]. A systematic review and network meta-analysis by Yuan et al., which included 118 trials with 31,195 participants, demonstrated that PDE5i significantly outperformed placebo in improving erectile function. Among the agents studied, tadalafil emerged as the most effective in enhancing the erectile function domain of the International Index of Erectile Function (IIEF), followed closely by vardenafil [131]. Similarly, a meta-analysis by Tsertsvadze et al. confirmed that PDE5is substantially improved sexual intercourse success and EF compared to placebo, with the proportion of men reporting improved erections ranging from 67% to 89% for PDE5 inhibitors versus 27% to 35% for placebo [132]. Madeira et al. further supported these findings in a meta-analysis of 179 randomized controlled trials involving

50,620 patients. The study revealed that sildenafil at low doses (25 mg) was statistically superior in enhancing IIEF scores compared to higher doses of sildenafil (50 mg) and tadalafil (10 mg and 20 mg) [133]. The American Urological Association guidelines agree with previous reports and recommend PDE5is as the first-line therapy for ED due to their proven efficacy and favorable safety profile. The guidelines note that sildenafil, tadalafil, vardenafil, and avanafil exhibit comparable efficacy across the general ED population, with dose–response effects being small and non-linear [134]. Thus, PDE5is play a central role in postoperative sexual re-education for men. Research indicates that early initiation of PDE5is following surgeries, especially radical prostatectomy, is associated with improved rates of recovery in erectile function [135]. Moreover, PDE5 inhibitors have demonstrated efficacy in mitigating the complications associated with treatments for pelvic cancers, which often lead to substantial sexual dysfunction. Clinical data support the use of these medications not only in enhancing sexual function but also in improving overall QoLfor these patients [136]. Lastly, integrating PDE5is has led to promising results emerging from multimodal re-educational approaches including VEDs and intracavernous injections [137]. This comprehensive strategy can further enhance the restoration of erectile function, particularly in patients at higher risk of ED post-surgery.

3.6. Intracavernosal Injections

Intracavernosal injections (ICIs) involve the direct injection of vasodilators into the corpora cavernosa of the penis, typically employing agents such as alprostadil (prostaglandin E1), which facilitates an erection by inducing relaxation of penile smooth muscle and increasing blood flow to the area [138]. This method is valued for its high efficacy and rapid onset compared to oral medications, which require a longer time to take effect [139]. Clinical studies have illustrated that ICIs can lead to significant improvements in erectile function, especially when integrated early into an IRP following surgical procedures, such as radical prostatectomy [140]. This incorporation helps address the physiological elements of ED while also improving overall sexual satisfaction. In this context, combination therapies that include ICIs and PDE5 inhibitors can be effective strategies for enhancing erectile recovery and sustaining sexual activity post-surgery [141]. According to the American Urological Association guidelines, ICI is recommended as a second-line therapy for ED, particularly in patients with contraindications to PDE5i or in cases where these medications are ineffective [134]. These results underscore the efficacy and utility of ICI as a reliable alternative for managing ED, particularly in challenging cases.

3.7. Vacuum Erection Devices

VEDs create a vacuum around the penis, drawing blood into the corpora cavernosa to induce an erection, which can be further maintained with a tension ring if desired [142]. VEDs are particularly significant for post-surgical patients, where sexual dysfunction frequently occurs due to potential nerve damage or reduced blood flow following procedures like radical prostatectomy or rectal surgery [143]. A systematic review indicated that early use of VEDs leads to improved erectile function recovery and maintenance of penile length post-surgery, which is essential for postoperative QoL [144]. These devices are especially beneficial for men who cannot use or do not respond to oral PDE5i [145]. Notably, one randomized trial demonstrated that combining VED therapy with PDE5i improved outcomes compared to either treatment alone, underscoring the importance of multimodal approaches to address postoperative ED [146]. Studies have demonstrated that VEDs can improve erectile function and penile length, particularly in the context of post-prostatectomy penile re-education [147,148]. VEDs could also act as an alternative to ICIs for men who prefer non-invasive options or experience discomfort or side effects from

injections [149]. Importantly, psychological readiness and patient education are vital for the successful use of VEDs. Research has shown that patients who are well informed about VEDs exhibit higher satisfaction rates and adherence to therapy [150]. Lastly, VEDs do not carry the same risks associated with pharmacological treatments, such as priapism, making them a safer alternative for many patients [151].

3.8. Penile Prosthesis Implantation

In cases of ED refractory to other treatments, the implantation of a penile prosthesis may be considered a valid option [152]. The satisfaction rates following penile prosthesis surgery are remarkably high, with studies reporting that over 80% of patients are content with the results [153]. A significant concern with penile prosthesis implantation is the potential for penile shortening, a common complaint among patients; however, evidence suggests that the actual loss in length may not be as prevalent as perceived [154]. Penile prosthesis implantation post-abdominal or -pelvic surgery not only addresses ED symptoms but also enhances the quality of sexual life for patients, and research consistently supports its effectiveness, as well as the psychological benefits and satisfaction rates among users [155].

3.9. Emerging Therapies for Men

Therapies are emerging in the rehabilitation of men with sexual disfuntion as well as women. A systematic review of three RCTs assessing the effectiveness of intracorporeal PRP injection for ED patients indicates that PRP appears to be a safe and effective treatment for mild to moderate ED, with the overall effect favoring PRP over placebo [156]. Another systematic review assessed the efficacy of PRP alone or in combination with low-intensity shockwave therapy for treating ED. The results indicated that PRP demonstrated superior efficacy, particularly during a 6-month follow-up period. Compared with low-intensity shockwave therapy alone, the addition of PRP significantly improved the IIEF scores of ED patients. However, the authors concluded that these findings require verification through large-scale clinical trials [157]. Ismy et al. investigated the effect of PRP administration on axon and collagen regeneration in cavernous nerve injury using an animal model (25 male Wistar rats). The study found that collagen growth was slower in the cavernous nerve injury (CNI) group without PRP compared to all PRP groups. PRP administration improved the number of myelinated axons in CNI, suggesting PRP's role in CNI regeneration and its potential as an innovative approach to treating erectile dysfunction associated with CNI [158]. PRP has also been tested for PD. A systematic review reported small to moderate benefits, with mild and transient side effects and no major adverse events. General limitations included variations in PRP protocols, small sample sizes, short follow-up periods, and a lack of control groups [159].

Stem-cell therapy is gaining attention in men. Recent findings from a systematic review suggest the potential efficacy and safety of stem-cell therapy in patients with ED or PD. Nevertheless, the authors point out that the available evidence is constrained by several factors, including the low quality of the included studies, significant methodological heterogeneity, uncertainty regarding the extent of beneficial effects, and the absence of long-term follow-up data [160]. Another systematic review concurs that stem-cell therapy shows promise as an innovative and safe treatment for organic erectile dysfunction and that the lack of standardized techniques and control groups in many studies hinders the ability to evaluate and compare trials [161].

4. Psychological Support

Sexual dysfunction often involves significant psychological factors, including anxiety, depression, stress, and interpersonal relationship challenges, in both male and female patients [162–164]. Psychological support is a valuable tool for addressing issues related to anxiety, fear, and pain catastrophizing, particularly in the context of sexual dysfunction [165–167]. The American Urological Association recommends psychological support to manage psychological and interpersonal contributors to sexual dysfunction, such as depression and anxiety [134]. Cognitive behavioral therapy (CBT) is particularly effective in this context by helping patients restructure negative thoughts and behaviors associated with sexuality [168]. CBT can be integrated with other therapies, such as PDE5is in post-prostatectomy penile re-education, to improve overall outcomes [163]. Additionally, couples therapy is beneficial for addressing the relational impact of sexual dysfunctions, improving communication and intimacy while reducing conflict and increasing sexual satisfaction [169]. Lastly, patient education is a key part of psychological support, and is necessary for the subject to understand his or her condition and its functional implications, with the goal of implementing compensatory strategies aimed at improving QoL [170,171].

In addition to general psychological support, it is important to consider gender-specific differences in the emotional and relational challenges faced by patients. A deeper understanding of these distinctions can help tailor more effective rehabilitation strategies. Psychological support should be tailored to address the distinct challenges faced by men and women after abdominal or pelvic surgery. Women often encounter difficulties related to body image, self-esteem, and changes in sexual identity, particularly following gynecological surgeries [172,173]. Interventions focusing on body image rehabilitation, emotional intimacy, and coping strategies can be particularly beneficial [174,175]. In contrast, men may struggle more prominently with the stigma associated with erectile dysfunction, anxiety regarding sexual performance, and concerns about masculinity [176–178]. CBT aimed at reducing performance anxiety, addressing feelings of shame, and promoting acceptance can enhance recovery [179,180]. Tailoring psychological interventions to these gender-specific needs is essential to optimizing outcomes and improving overall QoL.

5. Multidisciplinary Approach

Taking into account the considerations discussed in the preceding paragraphs, it is evident that a multidisciplinary approach to post-surgical sexual re-education is crucial for effectively addressing the complex emotional, physical, and relational challenges encountered by patients following abdominal or pelvic surgery [181]. As in other conditions, the collaboration of various healthcare professionals—including physiatrists, urologists, gynecologists, physiotherapists, psychologists, and sexual health counselors—ensures a holistic treatment model that optimizes patient outcomes [182–187]. Physiatrists play a crucial role in rehabilitation, focusing on improving functional outcomes and QoL for patients. Their expertise in developing tailored IRPs helps mitigate the physical side effects of surgery and promotes overall well-being [188]. IRPs are structured, patient-specific plans developed by multidisciplinary teams to address disabilities of various kinds, comprising the complex sequelae of sexual dysfunction following abdominal or pelvic surgery [189]. The IRP framework in sexual disfunctions should involve an initial evaluation by physiatrists, urologists, gynecologists, physiotherapists, psychologists, and sexual health counselors to identify physical, psychological, and relational factors affecting sexual health. The team should establish realistic, measurable goals tailored to the patient's surgical history, baseline function, and personal expectations. Evidence-based interventions may be integrated to achieve these goals, including PFMT, biofeedback, manual therapy, pharmacological treatments (e.g., PDE5 inhibitors, intracavernosal injections), and advanced modalities (e.g., botulinum

toxin, SNM). Regular interdisciplinary meetings would be helpful to review progress, adapt interventions, and ensure continuity of care. For example, physiatrists and physiotherapists may jointly adjust PFMT protocols or pharmacotherapy based on functional outcomes and patient feedback. Education and counseling sessions could be provided to empower patients and their partners, facilitating adherence and optimizing psychosocial adaptation. A truly patient-centered IRP prioritizes individual preferences regarding the invasiveness, side-effect profiles, and lifestyle implications of various therapies. For instance, many patients may prefer non-invasive interventions such as pelvic floor muscle training (PFMT), biofeedback, and vacuum erection devices due to their lower risk and ease of use. Conversely, others might opt for more invasive but potentially more effective interventions, like penile prostheses, botulinum toxin injections, or SNM, if non-invasive options fail or are unsuitable [190]. Systematic reviews underscore the importance of shared decision-making, where clinicians present the risks, benefits, and expected outcomes of each option, and patients actively participate in selecting the most appropriate therapy [191]. Importantly, teamwork improves overall functional outcomes for patients even further, and the role of the physiatrist in this area is central in building a personalized approach, in the context of an IRP [192]. Effective communication and collaboration among professionals are essential to developing personalized and effective treatment plans based on the patient's specific needs, taking into account the type of surgery performed, potential complications, and individual preferences [186,193–195].

In conjunction with physiatrists' efforts, gynecologists and urologists provide specialized care targeting sexual health issues that may arise from surgical interventions, such as ED or pelvic pain [196]. The integration of psychological support is also paramount. Psychologists and sexual health counselors can assist patients in navigating the emotional repercussions of surgery, which may include anxiety, depression, and issues surrounding body image and self-esteem [197]. Addressing these psychological aspects is fundamental, as studies have shown that many patients report improvements in sexual satisfaction and functioning when supported by adequate counseling post-surgery [21]. Additionally, incorporating physiotherapists into the rehabilitation team provides significant benefits, especially through pelvic floor therapy, which can directly influence sexual recovery post-surgery. By aiding in the strengthening of pelvic muscles, physiotherapists can help ameliorate conditions that compromise sexual function, thereby enhancing sexual health outcomes for surgical patients [198,199]. Moreover, education and advocacy within this multidisciplinary framework allow for culturally sensitive and scientifically grounded practices in sexual health education. Counselors trained in these areas contribute decisively by developing age-appropriate messages regarding sexual health, thus fostering an environment conducive to open discussions about sexual function and the psychological effects of surgical outcomes [200].

Ethical delivery of multidisciplinary sexual rehabilitation necessitates a clear focus on cultural, socioeconomic, and systemic barriers. Rehabilitation teams must demonstrate cultural sensitivity by acknowledging and respecting diverse cultural beliefs regarding sexuality, gender roles, and body image, as these beliefs can significantly influence a patient's willingness to discuss sexual health or engage in specific therapies [201,202]. Socioeconomic factors, including insurance coverage, access to transportation, and health literacy, can create inequities in access to multidisciplinary care; therefore, strategies such as offering telehealth consultations, providing educational materials in multiple languages, and advocating for coverage of essential rehabilitation services are crucial [203,204].

This multidimensional collaboration not only promotes recovery but also ensures that patient care is empathetic and respectful of individual backgrounds and needs, emphasizing the importance of addressing sexual health as an integral part of overall health care post-surgery.

6. Conclusions

In conclusion, sexual dysfunction following abdominal or pelvic surgery significantly impacts QoL for both men and women, necessitating a comprehensive and multidisciplinary re-educational approach. This paper has highlighted the physical, psychological, and relational complexities that arise post-surgery, emphasizing the importance of tailored interventions to address these challenges. Effective re-educational strategies range from physical therapy modalities such as PFMT, biofeedback, and manual therapy to advanced techniques like BT injections and SNM. For men, options such as PDE5is, VEDs, ICIs, and penile prostheses offer promising pathways for recovery. Psychological support, including CBT and couples counseling, is equally critical for addressing emotional and relational dimensions of sexual health.

The integration of these interventions into IRPs, administered by a multidisciplinary team of physiatrists, urologists, gynecologists, physiotherapists, psychologists, and sexual health counselors, is essential for optimizing outcomes. This holistic model not only enhances sexual function but also improves overall well-being. Future research should focus on refining these therapeutic modalities (e.g., standardization of rehabilitation protocols by large-scale, multicenter, randomized controlled trials to establish best practices and comparative effectiveness; personalization and shared decision-making with studies exploring shared decision-making models and their impact on adherence and outcomes; socioeconomic and cultural barriers to accessing multidisciplinary sexual rehabilitation) and exploring innovative approaches to further improve post-surgical recovery and QoL. By addressing both the physical and the psychosocial aspects of sexual dysfunction, healthcare providers can ensure that sexual health is recognized as a vital component of comprehensive postoperative care.

Lastly, as a narrative review, this paper did not include a formal risk-of-bias assessment. However, some limitations should be acknowledged. The studies cited exhibit considerable heterogeneity in terms of sample size, follow-up duration, and outcome measures, which may impact the strength and generalizability of the conclusions. Specifically, regarding the efficacy of SNM in women, although meta-analytic data were referenced [57], a systematic evaluation of potential biases in the included studies was not performed. Moreover, although the studies suggest a potential role for LIPUS in the re-education of erectile dysfunction, the current clinical evidence remains limited. Further clinical studies are necessary to validate its efficacy and establish its routine use in clinical practice. These limitations underline the need for further standardized, high-quality, and long-term research to strengthen the current evidence base. Future systematic reviews with meta-analysis will help in increasing the generalizability of this paper's findings.

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