Table 12. Sensation, Ejaculation, and Orgasm

Author Year; Country Total sample size Level of evidence Type of study Score	Methods	Results
Cardenas et al. 2014 US and Canada RCT Level 1 PEDro=6 Study SCI-F301 N=213 Study SCI-F302 N=204	**Population:** Patients with incomplete chronic SCI from two identical double-blinded, placebo-controlled studies (SCI-F301 and SCI-F302), from 45 and 33 centres, respectively, in the US and Canada. Both patient populations were balanced at baseline rendering comparability of patient populations. SCI-F301: Placebo (n=98): Mean age: 40.1 yr; Gender: males=85, females=13. Fampridine-SR (n=114): Mean age: 41.6 yr, Gender: males=100, females=14. SCI-F301: Placebo (n=100): Mean age: 40.5 yr. Fampridine-SR (n=103): Mean age: 41.3 yr. **Treatment:** Patients were randomly assigned to either fampridine-SR 25 mg or placebo, twice daily for 2 wk in addition to a 2 wk titration, 12 wk of stable dosing, 2 wk of downward titration and 2 wk of untreated follow-up. Within treatment groups, patients were further stratified by concomitant antispasmodic medication within the two treatment groups. **Outcome Measures:** Ashworth Spasticity Scale (AS) scores for bilateral knee flexors and extensors, Subject Global Impression (SGI), Penn Spasm Frequency Scale (SFS), International Index of Erectile Function (IIEF), Bowel and Bladder assessments, Sexual function.	1. There were no significant between group differences except for an improvement among men treated with fampridine-SR on two IIEF domains - erectile function (p=0.016) and orgasmic function (p=0.032) in SCI-F301.
Leduc et al. 2015 Canada	**Population**: 20 men with traumatic SCI (level C4-T9) of at least one year duration, and anejaculation. **Treatment**: Participants were randomized into two groups, Group M and Group P where group	1. Treatment of anejaculation after SCI with midodrine and PVS did not result in a better rate of antegrade ejaculation in 10 men than in 10 men treated with a placebo and PVS.

RCT Level 1 PEDRO=8 N=20	M received an oral administration of flexible sham-midodrine (7.5-22.5 mg max) followed by PVS, and group P received oral administration of (placebo) followed by PVS. Intervention occurred once a week for a maximum of 3 weeks or until ejaculation occurred. **Outcome Measures**: Ejaculation, and measurement of AD.	2. One participant (10%) from group M reached ejaculation and two participants (20%) from group P reached ejaculation. 3. Autonomic dysreflexia occurred in three patients (none of which ejaculated) during PVS.
Sipski et al. 2006 USA Prospective controlled trial Level 2 N=61	**Objective:** To determine the impact of spinal cord injuries (SCIs) on the ability of males to achieve orgasm. **Population**: N = 61 (45 SCI, 16 non-SCI), Mean age (±SD) of 37.3±11.6 years. Level of injury C3-L4. 29 (64.4%) complete, 16 (35.5%) incomplete. **Treatment:** A laboratory-based analysis of participants ability to achieve orgasm using erotic videos and self-stimulation. **Outcome measure:** International Index of Erectile Function.	1. Men with SCI were less likely than controls to achieve orgasm. Mean time to orgasm, blood pressure and heart rates at orgasm were not significantly different between controls and SCI participants. 2. 78.9% of men with incomplete SCIs achieved orgasm compared with 28% of those with complete SCI (P<.001). Completeness of injury was also an independent predictor of orgasm in the laboratory (P=.041; OR = 0.14). 3. None of the men with complete lower motor neuron dysfunction affecting their sacral segments achieved orgasm in the laboratory, vs. 55% of men with all other types of SCI (Fisher's exact test - P=.04).
Borisoff et al. 2010 Canada Pre-post Level 4 N=3	**Population:** 3 males (mean age = 38, range 34-42) with SCI ≥1 year. **Treatment:** 20 sessions over 8 weeks of training. Sexual self-stimulation while using a novel sensory substitution device that mapped the stroking motion of the hand during masturbation to a congruous flow of electrocutaneous sensations on the tongue. Erection-enhancing drugs administered as needed. **Outcome measures:** Solitary Masturbation Orgasm Questionnaire (Mah and Binik); SCI Ejaculation Questionnaire (Courtois et al.); Sexual Sensations Questionnaire (SSQ).	1. Each participant reported an increased level of sexual pleasure compared to baseline after a few training sessions. 2. Later sessions remained pleasurable but no participant reported orgasmic feelings.

Soler et al. 2008 France Prospective controlled trial Level 2 N=158	**Population:** 158 participants with SCI who failed to ejaculate from penile vibratory stimulation (PVS). **Treatment:** Oral midodrine, starting at 7.5mg in participants with tetraplegia and 15mg with paraplegia. A maximum of 4 trials were performed weekly with increasing doses of midodrine in each participant. **Outcome Measures:** Orgasm and ejaculation experiences, and cardiovascular data.	1. 93 (59%) participants reported orgasm with both midodrine and PVS, compared to no orgasm in 65 participants (41%; p<.01). Injury at or below T10, LMN lesions, and no somatic responses during stimulation are significantly related to the absence of orgasm. 2. Ejaculation was experienced by 102 (65%) participants vs. no ejaculation by 56 (35%) participants (p<.01). 3. 93% of participants with upper motor neuron injuries had somatic responses vs. 26% of participants with lower motor neuron injuries (p<.01). 4. Participants with incomplete upper motor neuron injuries had the highest rates of ejaculation. 5. AD was experienced by 16 participants (mainly tetraplegics) who needed oral nicardipine chlorhydrate.
De Moura et al. 2020 Brazil Cross-sectional Level 5 N=18	**Objective:** To investigate the practices, orientation, satisfaction, and sexual responses in men with SCI. **Population:** N=18, Mean age: 33, Mean time since injury: 12, 12 Cervical, 5 Thoracic **Methodology:** The Human Sexual Health Questionnaire LM (LM-QSH) was used to compare the responses before and after an SCI **Outcome Measures:** LM-QSH and QHS-SCI,	1. All sexual responses decreased after SCI: Excitation, duration of erection, ejaculation, and intensity of orgasm (p<0.01). 2. Participants reported decreased pleasure at the penis and testicles after injury (p=0.02), though they reported increased pleasure in other areas such as the mouth, neck, and ears after injury (p<0.05).
Ayaz et al. 2018 Pakistan Observational Level 5 N=59	**Objective:** An initiative to inquire about sexual function in men with SCI in Pakistan. **Population:** N=59, Mean age: 32 (SD) 9, 15 Incomplete, 44 Complete, 6 Tetraplegia, 53 Paraplegia **Methodology:** Medical records were reviewed and a written multiple-choice questionnaire written in English language was distributed among the participants **Outcome Measures:** Sexual Functioning (SF)	1. Only 2/44 (4.5%) complete and 6/15 incomplete (40%) participants achieved ejaculation (p<0.001). 2. Incomplete injuries had statistically significantly more ejaculations than complete injuries (p<0.001). 3. Younger age (90%) was significantly associated with sexual desire (p=0.03). 4. There were significant declines in sexual intercourse after injury in the study group (from 76.3% to 22%) (p<0.001).

Alexander et al. 1993 Cross-sectional Level 5 N=38	**Population:** N=38 men with SCI. Median age = 26 years (range= 18-70). Time post-injury: 37 months (median; range= 5-264 months). Race: 60% Caucasian, 24% Black, 8% Hispanic, 8% other. Sixteen men were complete quadriplegics, 6 men were incomplete quadriplegics, 12 men were complete paraplegics, and 4 men were incomplete paraplegics. Sixty-three percent of the men were single and 36% were married or cohabiting prior to injury. Postinjury, 71% of the men were single and 29% were married or cohabiting. 37 described their sexual orientation as heterosexual and 1 was bisexual. **Methodology:** none **Outcome Measures:** Participants completed an 80-item multiple choice questionnaire (median 37 months postinjury) which assessed sexual functioning pre- and post-spinal cord injury in four areas: (i) sexual activities and preferences, (ii) sexual abilities, (iii) sexual desire, arousal, and satisfaction, and, (iv) sexual adjustment.	1. Frequency of sexual activity decreased following SCI with a reduction in intercourse and increased interest in alternative sexual activities. 2. Of complete quadriplegic participants, 38% reported the ability to have an orgasm accompanied by ejaculation. 3. Partner's desire for sex as perceived by the SCI individual was correlated with frequency of sex and numbers of sexual partners postinjury. 4. Participant's perceptions of their own and partner's sexual desire decreased following SCI. 5. Sexual satisfaction decreased postinjury and was positively correlated with both the patients' and their partners' interest in penile-vaginal intercourse. 6. Of all participants, 27% reported sexual adjustment difficulties and 74% relationship difficulties but only 22% received counseling.
Ibrahim et al. 2021 USA Post-test Level 4 N=15	**Objective:** The purpose of this study was to evaluate the performance of a re-engineered device (Ferticare 2.0) **Population:** N=15, Mean age: 42, Mean years post-injury: 16, 11 Thoracic, 4 Cervical **Treatment**: Ferticare 2.0 penile-vibro-stimulation **Outcome Measures:** Male Sexual Response and PVS Questionnaire	1. 11 participants responded to Ferticare 2.0 at 2.5mm setting, 1 participant at 4.0mm setting, 2 participants responded to two devices at 2.5mm, and 1 participant had no response. 2. Most participants reported Ferticare 2.0 to be 'very pleasurable' on the PVS Questionnaire. 3. AD was well-managed due to the protocol of the study. 4. Two of the 15 participants had antegrade and retrograde ejaculation, the remaining participants had no ejaculation or only antegrade.

Chéhensse et al. 2016 France Case Series Level 4 N=384	**Population**: 384 participants with SCI; level of injury C5-L4. This data set combined systematic detailed neurological assessment with outcomes of a standardized procedure to elicit ejaculation recorded over a 30-year period (July 1982–October 2012). **Treatment**: Penile vibratory stimulation (PVS). **Outcome Measures:** Successful ejaculation with PVS. Bivariate and a multivariate model were estimated, measuring association between injuries of the T12–L2 and S2–S4 segments and ability to ejaculate with the PVS procedure.	1. Successful ejaculation with PVS was reported in 47.4% of patients (182/384). 2. Ejaculation success with PVS was high when any of the C5–T6 spinal segments was injured (50-67% success). 3. Ejaculation success with PVS decreased when lesions were more caudal, reaching a minimum for the subsample (2.6%) with complete L4 injury versus a minimum of 12% when any of the sacral segments (complete S3) was injured.
Previnaire et al. 2022 France Case Series Level 4 N=10	**Objective:** The aim of this prospective study was to assess sequence of sphincteric events and ejaculation dyssynergia during penile vibratory stimulation (PVS) in SCI men **Population:** N=11, Mean age 33.8, Time since injury: 48.2 months, 6 Cervical 4 Thoracic, 1 Lumbar **Methodology:** Simultaneous recordings of bladder, bladder neck, prostate and external urethral sphincter pressures were performed using a microtip catheter with 5 pressure transducers. Between 2017 and 2019, ten men participated in the study for a total of 17 procedures. **Outcome Measures:** Urethral Pressure	1. During PVS-induced ejaculation there was an initial steep and high increase in urethral pressures allowing for the creation of a pressure chamber; antegrade ejaculation occurred following intermittent relaxation of EUS with sustained high pressures at the bladder neck. 2. In case of inability for PVS to elicit ejaculation, increase in urethral pressures was limited, maximal at the level of EUS, only occurring in men with UMN lesions but not men with LMN lesions. 4. PVS elicited an increase in the external urethral sphincter pressure (mean 51 cm H_20), while there was no pressure change in the two patients with lower motor neuron lesions.
Overgoor et al. 2013 The Netherlands Pre-post Level 4 N=30	**Population:** 30 men (SCI n=12, Spina bifida n=18) with no penile sensation but good groin sensation. **Treatment:** TOMAX (TO MAX-imize sensation, sexual health and quality of life) procedure that involved microsurgical connection of the sensory ilioinguinal nerve to the dorsal nerve of the penis unilaterally. **Outcome measures:** sensitivity testing, bulbocavernosus testing,	1. Postoperative (11-24 months) glans sensation increased from absence to having sensations. 2. A total of 24 patients (80%) gained unilateral glans penis sensation. This was initially felt as groin sensation but transformed into real glans sensation in 11 patients (33%). These patients had better overall sexual function (p = 0.022) and increased satisfaction (p = 0.004).

	Hospital Depression and Anxiety Scale (HADS), Symptom Checklist (SCL-90-R), Groninger Arousability Scale (GAS), Visual Analogue Scale (VAS).	3. All patients retained the preoperative ability to have an erection and ejaculations. 4. Participants reported having more open and meaningful sexual relationships with their partners.
Courtois et al. 2011 Canada Case-control Level 3 N=89	**Population:** Men who achieved ejaculation with (n=50) or without (n=39) experiencing autonomic dysreflexia (AD) and/or or autonomic hyperreflexic responses (AHR). **Treatment:** Ejaculation was triggered through gradually increasing sources of stimulation, starting with obtained through natural stimulation (masturbation), followed by vibrostimulation, and if still negative, with vibrostimulation combined with midodrine (5-25 mg). **Outcome measures:** Questionnaire inquiring about the physiological responses related to orgasm to test the hypothesis that orgasm is related to AD in individuals with SCI.	1. The 89 men who achieved ejaculation (success rate of 92%) were subdivided into one group of men with SCI who experienced AHR at ejaculation (N=50) and one group of men who did not (N=39). 2. Significantly more sensations were described at ejaculation than with sexual stimulation alone. 3. Men with SCI who experienced AD at ejaculation reported significantly more cardiovascular, muscular, autonomic and dysreflexic responses than those who did not. 4. There was no difference in experience of AHR responses between men with complete or incomplete lesions.
Castle et al. 2014 United States Case series Level 4 N=30	**Population**: 30 anejaculatory males with SCI who were unable to ejaculate by sexual intercourse or masturbation, level of injury T10 and higher. **Treatment**: The Viberect-X3 (Reflexonic, Frederick, MD, USA) was applied to 30 consecutive anejaculatory men with SCI whose level of injury was T10 and rostral. All patients received one trial of penile vibratory stimulation (PVS) with Viberect-X3. All patients were familiar with PVS and had been administered one or more previous trials with an alternate device. Prior to PVS, participants whose level of injury was T6 or rostral were administered 10–40mg nifedipine sublingually to manage autonomic dysreflexia. Viberect-X3 was administered. **Outcome Measures:** Ejaculatory success rate, time to ejaculation,	1. The ejaculatory success was 77% (23/30) slightly lower than previously published PVS success rates. 2. No adverse events occurred, and there were no malfunctions of the device.

	volume of ejaculate, blood pressure, adverse events.	
Courtois & Charvier 2014 Canada Cross-sectional Level 5 N=33	**Population**: 34 males (mean age= 41 years, age range= 19-65 years) with SCI who have been consulted for sexual dysfunctions over the past 20 years, lesions varied from L5-S1 and S4-S5, average delay since injury= 10 years **Treatment:** None **Outcome Measures:** Occurrence of premature ejaculations, psychogenic and reflexogenic erection since injury, and test for perineal reflexes (bulbocavernosus reflex, anal reflex, cremasteric reflex)	1. 31/33 patients maintained natural ejaculations, but 18 complained of premature ejaculation (PE) and five of spontaneous ejaculations. 2. 14 patients complained of dribbling ejaculation, and 27 of non-climactic ejaculation (13 no sensation, 10 some sensation, 4 painful sensation). 3. Medical assessments showed absent or diminished anal sensation in 28 patients, absent or diminished anal reflexes in 21, absent or diminished bulbocavernosus reflexes in 20, but 12/13 positive cremasteric reflexes. 4. Urodynamics showed 12/20 areflex and 2/20 hyperactive bladders.