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Effects of vibratory stimulation on sexual response in women with spinal cord injury

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Abstract—Women with spinal cord injuries (SCIs) have predictable alterations in sexual responses. They commonly have a decreased ability to achieve genital sexual arousal. This study determined whether the use of vibratory stimulation would result in increased genital arousal as measured by vaginal pulse amplitude in women with SCIs. Subjects included 46 women with SCIs and 11 nondisabled control subjects. Results revealed vibratory clitoral stimulation resulted in increased vaginal pulse amplitude as compared with manual clitoral stimulation in both SCI and nondisabled subjects; however, these differences were not statistically significant. Subjective levels of arousal were also compared between SCI and nondisabled control subjects. Both vibratory and manual clitoral stimulation resulted in significantly increased arousal levels in both groups of subjects; however, statistically significant differences between the two conditions were only noted in nondisabled subjects. Further studies of the effects of repetitive vibratory stimulation are underway.

Key words: complete injury, female orgasm disorder, female sexual dysfunction, incomplete injury, lower motor neuron injury, manual clitoral stimulation, sexual response, spinal cord injury, upper motor neuron injury, vibratory stimulation.

INTRODUCTION

The sexual activities, response, and satisfaction of women with spinal cord injuries (SCIs) have been studied. While SCI has a major impact on the sexual behavior and function of women, most women with SCIs can achieve satisfactory sexual adjustment. Findings suggest that participation in sexual intercourse decreases after SCI, and although it does not reach preinjury levels, it does increase significantly over time [1]. Additionally, sexual satisfaction has been shown to decrease after SCI, but sexual desire does not diminish [2].

We have conducted a number of studies to determine how specific SCIs affect the sexual response cycle of women [3]. In a laboratory-based analysis of 68 premenopausal women with SCI and 21 nondisabled, age-matched control subjects, all women achieved similar levels of

Abbreviations: ASIA = American Spinal Injury Association, BL = baseline, BP = blood pressure, BPM = beats per minute, DBP = diastolic blood pressure, FSD = female sexual dysfunction, HR = heart rate, L = lumbar, LMN = lower motor neuron, Man Stim = manual stimulation, RR = respiratory rate, S = sacral, SBP = systolic blood pressure, SCI = spinal cord injury, SD = standard deviation, T = thoracic, UG = urethrogenital, UMN = upper motor neuron, Vib Stim = vibratory stimulation, VPA = vaginal pulse amplitude.

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subjective arousal in response to erotic audiovisual stimulation. However, statistically significant differences in genital responsiveness to erotic audiovisual stimulation as measured by vaginal pulse amplitude (VPA) occurred based on the degree of sensory impairment affecting the eleventh thoracic (T11) to second lumbar (L2) dermatomes. These differences occurred regardless of the level or degree of SCI. For those women whose injuries occurred at this level, we hypothesized that direct damage to sympathetic cell bodies that pertain to sexual function at the level of T11–L2 results in a decrease in the ability to achieve psychogenic genital arousal. For women with SCI above T11, loss of sensation is attributed to the spinothalamic tract and loss of genital vasocongestion is because of the damaged reticulospinal tract.

In the same study, we also studied the ability of women with SCIs to achieve orgasm. Historically, women without an intact sacral reflex arc were found to be relatively unable to achieve orgasm, whereas 55 percent of those with all other levels and degrees of injuries were able to achieve orgasm ($p = 0.048$) [3]. In the laboratory, women with SCIs took significantly longer than nondisabled subjects to achieve orgasm, and similar increases in heart rate (HR) and systolic blood pressure (SBP) occurred in both groups from baseline (BL) to orgasm. Subjective descriptions of orgasmic sensations were indistinguishable between nondisabled and SCI subjects. These results suggest that many women with SCIs and intact sacral reflex arcs may have untapped potential to achieve orgasm and may be suffering from sexual dysfunction unrelated to their SCIs.

Many women suffer from neurogenic sexual dysfunction, and different treatment modalities are being researched in an effort to improve sexual arousal. Significantly positive results were found in increasing the sexual arousal of 17 women with SCI in a laboratory-based, double-blind, placebo-controlled study on the use of sildenafil [4]. Also, another laboratory-based study of 37 women with SCIs showed that positive feedback (audiovisual, visual, or auditory) increases subjective sexual arousal regardless of the degree of SCI [5]. Finally, vibratory stimulation (Vib Stim) has been studied in men with SCI and, in general, intense stimulation allows for orgasm and ejaculation by activating the sympathetic nervous system and the sacral reflex [6]. In the present study, we hypothesized that the use of vibratory or manual stimulation (Man Stim) would enhance sexual arousal in women with SCIs.

METHODS

Subjects

Subjects included women with SCI and nondisabled control subjects between the ages of 18 and 51. Subjects were excluded from participating in the study if they had prior neurological surgery that altered the structure of their nervous system. Other exclusion criteria included genital surgery, active medical or psychiatric illness, and irregular or absent menstrual cycles.

Study Protocol

This study was part of a 3-day research protocol that investigated sexual arousal and orgasm in women with SCI. The major components of the study design (assessment of eligibility of SCI and age-matched control subjects) and methodology were based on the initial part of this protocol during which we studied women with levels of injuries above the sixth thoracic vertebra (T6) [3,7–9]. Only information pertaining to one of the six studies conducted during this protocol, the vibratory study, is presented here.

Before their visits were scheduled, subjects were provided with an informed consent and preparatory information via mail. Once this information was obtained, the studies were scheduled between days 16 and 21 of their menstrual cycles and the subjects were transported to the local area, placed in a hotel if needed, and brought to the laboratory for study participation.

Informed consent was obtained in person from all subjects prior to participation. A complete physical examination was performed, as were an American Spinal Injury Association (ASIA) neurologic examination [10], somatosensory-evoked potentials of the lower extremities, and anal sphincter electromyography.

For the research protocol, subjects were brought into the physiology laboratory, transferred onto a bed, and set up with monitors for HR, blood pressure (BP), respiratory rate (RR), and VPA. HR recordings were obtained with a photoelectric pulse sensor (Grass Instruments Co, Quincy, Massachusetts) placed on the right big toe, and a quarter-inch vaginal photoplethysmograph (Farrell Instruments, Grand Island, Nebraska), with stereo pack set in the alternating current mode, was used for measuring VPA. Sensors were connected to a Grass polygraph (Model 7G) (Grass Instruments Co, Quincy, Massachusetts), and an analog to digital converter (model D1601) (Keithley Data Acquisition, Taunton, Massachusetts) was used for transferring the

data to a personal computer. MATLAB® computation software (The MathWorks, Inc, Natick, Massachusetts) was used for analyzing and plotting physiological data. A Criticare noninvasive patient monitor (model 508) (Criticare Systems, Inc, Milwaukee, Wisconsin) was used for monitoring BP on the nondominant arm. Once readings had stabilized, the experimental protocol commenced.

The study began with an initial 6-minute BL period. This was followed by a 6-minute period of either self-applied clitoral Vib Stim, with a modified FERTI CARE® (Multicept A/S, Gørløse, Denmark) vibrator at an amplitude of 1.5 mm and a frequency of 70 Hz, or self-applied clitoral Man Stim, a second 6-minute BL period, a 6-minute period of the alternate stimulation, and then a final 6-minute BL period. HR, RR, BP, and VPA readings were recorded every 3 minutes during the study. Additionally, subjects were asked via intercom to verbally provide their levels of subjective sexual arousal on a scale of 0 to 10 every 3 minutes during the study. We used the readings of these outcome measures for each treatment and BL period to calculate means and for data analysis. To decrease any order effects, we randomized study participants to two different stimulation sequences: initial BL, Vib Stim, second BL, Man Stim, final BL or initial BL, Man Stim, second BL, Vib Stim, final BL. All subjects were debriefed at the end of the study.

RESULTS

Neurologic Characteristics

Subjects included 46 women with SCIs and 11 nondisabled control subjects. SCI subjects included 11 women with incomplete and 35 with complete injuries. Total motor scores (numerical summation of the motor scores for the 20 muscles tested during the ASIA examination) for the SCI group ranged from 41 to 97, with a mean ± standard deviation (SD) of 58.83 ± 12.87. Injury levels ranged from fifth cervical (C5) to third sacral (S3). Thirty-two subjects had upper motor neuron (UMN) injuries that affected their sacral spinal segment (S3–S5) (subjects had a hyperactive bulbocavernosus reflex) and 14 subjects had lower motor neuron (LMN) injuries (subjects had injuries in the cauda equina with a hypoactive or absent bulbocavernosus reflex). Subjects were a mean of 127.04 ± 110.33 SD months postinjury (range: 15–494 mo). Mean age for SCI subjects was 35.1 ± 7.9 SD years (range: 18–52 yr) and that of nondisabled control subjects was 34.3 ± 8.2 SD years (range: 19–47 yr). Mean age at SCI was 24.70 years (range: 1–51 yr).

Vaginal Pulse Amplitude

The effects of stimulation on VPA were assessed with relative, instead of absolute, changes. For example, assessment of the effects of Vib Stim on VPA as compared with BL levels was performed with the formula $[(VPA_{Vib\ Stim} - VPA_{BL})/VPA_{BL}] \times 100$. The effects of Man Stim versus BL were calculated similarly. The effects of Vib Stim versus Man Stim were calculated as $\{[(VPA_{Vib\ Stim} - VPA_{BL\ Vib})/VPA_{BL\ Vib}] \times 100\} - \{[(VPA_{Man\ Stim} - VPA_{BL\ Man})/VPA_{BL\ man}] \times 100\}$. (BL Vib = VPA BL prior to Vib Stim, BL Man = VPA BL prior to Man Stim.) Comparison of VPA changes within and between nondisabled versus SCI participants are presented in **Table 1**.

Relative to the corresponding BL values, VPA levels increased significantly with Vib Stim ($p = 0.001$) and also with Man Stim ($p < 0.001$) for women with SCI. Similar significant results were obtained for nondisabled women (Vib Stim: $p = 0.045$, Man Stim: $p = 0.002$).

As shown in **Table 1**, within each group, the change in VPA from BL was greater for Vib Stim compared with Man Stim, but the difference did not reach statistical significance ($p = 0.115$). In the last row of **Table 1,** the *p*-values for the

Table 1.
Relative changes (percent) in vaginal pulse amplitude levels by injury status.

Group	*n*	Vib Stim vs BL		Man Stim vs BL		Vib Stim vs Man Stim	
		Mean ± SE	*p*-Value	Mean ± SE	*p*-Value	Mean ± SE	*p*-Value
SCI*	45	80.3 ± 199.9	0.001	65.8 ± 79.4	<0.001	28.7 ± 119.9	0.115
Nondisabled*	10	38.0 ± 51.7	0.045	59.0 ± 42.4	0.002	6.9 ± 29.5	0.477
SCI vs Nondisabled†	—	—	0.580	—	0.495	—	0.672

*p-value for within-group comparisons.
†Mann-Whitney *p*-value for between-group comparisons.
BL = baseline, Man Stim = manual stimulation, SCI = spinal cord injury, SE = standard error, Vib Stim = vibratory stimulation.

between-group comparisons are shown. For women with SCI versus nondisabled women, relative changes for Vib Stim versus BL were not significantly different ($p = 0.580$) nor were the corresponding changes for Man Stim ($p = 0.495$). Similarly, the two groups were not significantly different with respect to the differential effect of Vib Stim when compared with Man Stim ($p = 0.672$) on VPA.

We also compared the effects of Vib Stim and Man Stim among SCI subjects, as compared with BL, and the effects of Vib Stim versus Man Stim within and between women with complete versus incomplete injuries (**Table 2**).

In addition, among subjects with complete SCIs, we compared the effects of these forms of stimuli both within and between those subjects with UMN versus LMN injuries (**Table 3**).

As shown in **Table 2**, within the group of women with incomplete injuries a significant effect on VPA for Vib Stim ($p = 0.005$) and for Man Stim ($p < 0.001$) was noted, but the effect of Vib Stim was not significantly different from the effect of Man Stim ($p = 0.564$). Similar results were obtained within the group of women with complete injuries (Vib Stim: $p = 0.042$, Man Stim: $p < 0.001$, Vib vs. Man Stim: $p = 0.137$).

The between-group comparisons are shown in the last row of **Table 2**. For women with incomplete versus complete injuries, the effect of Vib Stim was not significantly different ($p = 0.340$), but the effect of Man Stim was significantly greater for women with incomplete injuries compared with those with complete injuries ($p = 0.027$). These two groups were not significantly different with respect to the differential effect of the Vib Stim on VPA when compared with the Man Stim ($p = 0.456$).

Table 3 shows the results of the analyses that compared the effect of the stimuli on VPA within and between participants with either UMN or LMN injuries. Within each of the groups, a significant effect of Vib Stim and also of Man Stim existed, but no significant differences existed between the two stimuli. Also, no significant differences existed between the UMN- and the LMN-injured groups. The analyses for UMN- versus LMN-injured subjects were repeated and the data was restricted to participants with complete injuries only. As shown in **Table 4**, the results were similar to those obtained previously that compared UMN- and LMN-injured subjects without any restrictions.

Arousal Levels

Analyses of absolute changes in mean arousal levels within and between SCI and nondisabled women are presented in **Table 5**. Within each group, a significant effect of Vib Stim and also of Man Stim was noted. A significant difference in the effect of Vib Stim compared with that of Man Stim existed for nondisabled women but not for women with SCI.

Table 2.
Relative changes (percent) in vaginal pulse amplitude levels by completeness of injury.

Injury Type	*n*	Vib Stim vs BL		Man Stim vs BL		Vib Stim vs Man Stim	
		Mean ± SE	*p*-Value	Mean ± SE	*p*-Value	Mean ± SE	*p*-Value
Incomplete*	11	73.8 ± 67.8	0.005	96.9 ± 62.4	<0.001	8.2 ± 45.7	0.564
Complete*	34	82.4 ± 227.7	0.042	55.7 ± 82.4	<0.001	35.4 ± 135.4	0.137
Incomplete vs Complete†	—	—	0.340	—	0.027	—	0.456

*p-value for within-group comparisons.
†Mann-Whitney p-value for between-group comparisons.
BL = baseline, Man Stim = manual stimulation, SE = standard error, Vib Stim = vibratory stimulation.

Table 3.
Relative changes (percent) in vaginal pulse amplitude levels by upper motor neuron (UMN) vs lower motor neuron (LMN) injury.

Injury Type	*n*	Vib Stim vs BL		Man Stim vs BL		Vib Stim vs Man Stim	
		Mean ± SE	*p*-Value	Mean ± SE	*p*-Value	Mean ± SE	*p*-Value
UMN*	31	95.0 ± 238.5	0.034	72.4 ± 88.2	<0.001	39.0 ± 143.0	0.139
LMN*	14	47.7 ± 48.1	0.003	51.0 ± 54.9	0.004	5.9 ± 24.6	0.384
UMN vs LMN†	—	—	0.568	—	0.618	—	0.798

*p-value for within-group comparisons.
†Mann-Whitney p-value for between-group comparisons.
BL = baseline, Man Stim = manual stimulation, SE = standard error, Vib Stim = vibratory stimulation.

Table 4.
Relative changes (percent) in vaginal pulse amplitude levels by complete upper motor neuron (UMN) vs complete lower motor neuron (LMN) injury.

Injury Type	*n*	Vib Stim vs BL		Man Stim vs BL		Vib Stim vs Man Stim	
		Mean ± SE	*p*-Value	Mean ± SE	*p*-Value	Mean ± SE	*p*-Value
UMN*	26	96.9 ± 259.7	0.069	66.4 ± 91.0	0.001	44.2 ± 154.2	0.156
LMN*	8	35.2 ± 18.5	0.001	20.8 ± 25.3	0.054	6.6 ± 17.3	0.313
UMN vs LMN†	—	—	0.644	—	0.128	—	0.794

*p-value for within-group comparisons.
†Mann-Whitney p-value for between-group comparisons.
BL = baseline, Man Stim = manual stimulation, SE = standard error, Vib Stim = vibratory stimulation.

Table 5.
Changes in arousal levels by injury status.

Group	*n*	Vib Stim vs BL		Man Stim vs BL		Vib Stim vs Man Stim	
		Mean ± SE	*p*-Value	Mean ± SE	*p*-Value	Mean ± SE	*p*-Value
SCI*	46	3.6 ± 2.4	<0.001	3.4 ± 2.1	<0.001	0.3 ± 0.8	0.305
Nondisabled*	11	5.6 ± 1.9	<0.001	3.3 ± 2.1	<0.001	3.6 ± 1.8	0.002
SCI vs Nondisabled†	—	—	0.009	—	0.831	—	0.0034

*p-value for within-group comparisons.
†Mann-Whitney p-value for between-group comparisons.
BL = baseline, Man Stim = manual stimulation, SCI = spinal cord injury, SE = standard error, Vib Stim = vibratory stimulation.

As seen in **Table 5**, nondisabled women, compared with those with SCI, had significantly higher levels of arousal with Vib Stim but not with Man Stim. These two groups were significantly different with respect to the differential effect on arousal level of Vib Stim when compared with Man Stim ($p = 0.0034$).

We performed similar analyses to compare changes in arousal levels within and between women with incomplete versus complete injuries (**Table 6**), UMN versus LMN injuries (**Table 7**), and complete UMN versus complete LMN injuries (**Table 8**). In each of these analyses, a significant effect was noted from Vib Stim and Man Stim ($p < 0.01$) within the groups, but no significant difference existed in the effect from Vib Stim compared with Man Stim ($p > 0.05$). Also, none of the between-group comparisons were statistically significant ($p > 0.05$).

Autonomic Function

SBP changes for those with complete injuries were significantly ($p < 0.001$) (max 4.7 mm Hg) higher for Man Stim as compared with BL. No significant changes were noted in SBP between those with complete and those with incomplete injuries ($p > 0.05$). For SCI versus nondisabled subjects, SCI subjects showed significantly greater changes in SBP from both Vib Stim ($p = 0.032$) (mean –1.0 mm Hg) and Man Stim ($p < 0.001$) (mean 4.1 mm Hg) as compared with BL. No differences were found between SCI and nondisabled subjects on SBP ($p > 0.05$). For changes in SBP based on UMN versus LMN injuries, those with UMN injuries demonstrated minimal (mean 3.1 mm Hg), though significantly greater ($p = 0.017$), SBP changes from Man Stim as compared with BL. However, subjects with LMN injuries showed no significant increases in SBP from Vib Stim ($p = 0.079$, mean 4.9 mm Hg) but significant differences existed with Man Stim ($p = 0.020$, mean 6.3 mm Hg) as compared with BL. No differences were noted between groups with UMN and LMN injuries on SBP ($p > 0.05$). Looking at UMN- and LMN-injured subjects with complete injuries, the only group with any significant change was the UMN-injured with Man Stim compared with BL ($p = 0.005$, mean 4.1 mm Hg).

Diastolic blood pressure (DBP) changes for those with complete versus incomplete injuries were significantly ($p = 0.018$) higher with Man Stim as compared with BL (mean 1.7 mm Hg). No significant changes in DBP were noted between those with complete and those with incomplete injuries. SCI subjects versus nondisabled subjects had significantly higher ($p = 0.006$) DBP with Man Stim as compared with BL (mean 1.8 mm Hg). No differences existed between SCI and nondisabled subjects on DBP levels. For DBP changes in subjects with UMN and LMN injuries, including complete injuries, the only significant difference was that subjects with LMN

Table 6.
Changes in arousal levels by completeness of injury.

Injury Type	*n*	Vib Stim vs BL		Man Stim vs BL		Vib Stim vs Man Stim	
		Mean ± SE	*p*-Value	Mean ± SE	*p*-Value	Mean ± SE	*p*-Value
Incomplete*	11	4.5 ± 2.7	<0.001	4.1 ± 2.4	<0.001	0.7 ± 1.6	0.167
Complete*	35	3.3 ± 2.3	<0.001	3.2 ± 2.0	<0.001	0.1 ± 1.7	0.698
Incomplete vs Complete†	—	—	0.307	—	0.426	—	—

*p-value for within-group comparisons.
†Mann-Whitney p-value for between-group comparisons.
BL = baseline, Man Stim = manual stimulation, SE = standard error, Vib Stim = vibratory stimulation.

Table 7.
Changes in arousal levels by upper motor neuron (UMN) vs lower motor neuron (LMN) injury.

Injury Type	*n*	Vib Stim vs BL		Man Stim vs BL		Vib Stim vs Man Stim	
		Mean ± SE	*p*-Value	Mean ± SE	*p*-Value	Mean ± SE	*p*-Value
UMN*	31	3.6 ± 2.6	<0.001	3.7 ± 2.2	<0.001	0.2 ± 1.8	0.553
LMN*	14	3.5 ± 2.0	<0.001	2.9 ± 1.9	<0.001	0.4 ± 1.6	0.336
UMN vs LMN†	—	—	0.886	—	0.332	—	0.780

*p-value for within-group comparisons.
†Mann-Whitney p-value for between-group comparisons.
BL = baseline, Man Stim = manual stimulation, SE = standard error, Vib Stim = vibratory stimulation.

Table 8.
Changes in arousal levels by complete upper motor neuron (UMN) vs complete lower motor neuron (LMN) injury.

Injury Type	*n*	Vib Stim vs BL		Man Stim vs BL		Vib Stim vs Man Stim	
		Mean ± SE	*p*-Value	Mean ± SE	*p*-Value	Mean ± SE	*p*-Value
UMN*	27	3.2 ± 2.5	<0.001	3.4 ± 2.1	<0.001	0.0 ± 1.8	0.917
LMN*	8	3.8 ± 1.6	<0.001	2.5 ± 1.7	0.004	0.4 ± 1.4	0.476
UMN vs LMN†	—	—	0.621	—	0.452	—	0.565

*p-value for within-group comparisons.
†Mann-Whitney p-value for between-group comparisons.
BL = baseline, Man Stim = manual stimulation, SE = standard error, Vib Stim = vibratory stimulation.

injuries had greater DBP with Man Stim as compared with BL ($p = 0.006$) (mean 3.5 mm Hg). No significant differences were noted between UMN- and LMN-injured subjects on DBP (either complete or incomplete). An important anecdote of this study is that out of all 45 SCI subjects who participated in this project, not one instance of autonomic dysreflexia, a potentially dangerous situation, occurred.

With respect to HR changes in SCI versus nondisabled subjects, SCI subjects had minor, though significant, increases in HR from both Vib Stim ($p = 0.013$, mean 2.6 beats per minute [BPM]) and Man Stim ($p = 0.040$, mean 2.0 BPM) versus BL. However, no significant changes were noted in HR between SCI and nondisabled subjects ($p > 0.05$). For subjects with complete versus incomplete injuries, those with complete injuries evidenced a significant elevation in HR ($p = 0.009$, mean 2.7 BPM) with Man Stim and Vib Stim ($p = 0.028$, mean 2.8 BPM) as compared with BL. However, no significant differences were noted in HR between subjects with incomplete versus complete injuries ($p > 0.05$). For UMN- and LMN-injured patients, those with UMN injuries showed a significant elevation in HR ($p = 0.045$, mean 2.3 BPM) with Man Stim versus BL. LMN-injured subjects demonstrated a significant increase in HR ($p = 0.007$, mean 3.1 BPM) with Vib Stim versus BL. However, no significant differences were noted between UMN- and LMN-injured subjects' HR ($p > 0.05$). For UMN- and LMN-injured subjects with complete injuries, those with UMN injuries had a significant increase ($p = 0.030$, mean 3.0 BPM) in HR with Man Stim as compared with BL. Again, however, no overall differences were noted between UMN- and LMN-injured subjects' HR ($p > 0.05$).

No significant differences existed between SCI and nondisabled subjects in RR either within or between treatment groups. However, when we examined incomplete versus complete injuries, we found a significant difference between complete and incomplete injuries for Man Stim versus BL ($p = 0.040$). Similarly, when looking at UMN and LMN injuries we found no significant differences in RR either between or within treatment groups.

DISCUSSION

Reflex stimulation of genital responses is possible in females [11] and males [12]. Although penile Vib Stim that reflexively stimulates an ejaculation has been frequently used in males with SCIs, Vib Stim has not been used for remediation of sexual dysfunction in men. Recently, however, clitoral vacuum suction aimed at producing reflex genital vasodilatation has received U.S. Food and Drug Administration (FDA) approval [13]. The EROS-CTD™, a clitoral therapy device (UroMetrics, Inc, St. Paul, Minnesota), is a small, battery-powered device designed to increase blood flow to the clitoris. It has been shown to be effective in improving orgasmic function in women with female orgasm disorder. Increased clitoral blood flow and vaginal lubrication were noted in small studies of nondisabled women with female sexual dysfunction (FSD). Since the device works by producing reflex vasodilatation, theoretically, it should be useful for women with neurogenic FSD, provided their sacral reflex function is intact; however, this has not yet been tested.

In this study, as a prelude to use of Vib Stim as a treatment for sexual dysfunction associated with SCI, we did a pilot study to assess its efficacy in increasing VPA and subjective arousal. Results revealed a trend for increased VPA with Vib Stim and Man Stim versus BL; however, these results were not statistically significant. Interestingly, although the results were not statistically significant, greater effects appeared to exist from the Vib Stim in subjects with SCI as compared with nondisabled subjects.

Although we did not find statistically significant differences between Vib Stim and Man Stim in increasing the level of subjective and genital sexual arousal in women with SCIs, we still believe Vib Stim is a viable way to improve genital responsiveness in women with SCIs. This study was limited in that it was a single event and many of the women had never used a vibrator before. Therefore, some may not have been comfortable with the device, may have applied greater or less pressure, and may have been nervous about the process. Interestingly, our subjects with SCI had greater vaginal responses than did their nondisabled counterparts. We hypothesize that this is because they did not feel the stimulation as well as the nondisabled subjects; thus, they must have applied greater pressure with resultant greater responses.

Recent research has reported that an ejaculation generator is present in the spinal cord [14] of male rats. These researchers also documented activation of a subset of lumbar spinothalamic neurons after copulatory behavior in male but not female rats [15]. We have previously documented the presence of reflex orgasm in women with SCI, and evidence of reflex orgasm is present in the urethrogenital (UG) reflex of female rats [16]. The UG reflex and orgasm are both thought to be the product of a spinal pattern generator. Similarly, evidence has recently been found of the presence of human spinal cord circuitry that is capable of producing locomotor-like output [17–20]. Training of this spinal pattern generator has also recently been reported as an adjunctive technique for improving locomotor recovery in individuals with SCI [21–23]. If retraining a spinal pattern generator can increase locomotor recovery, the possibility may exist to improve sexual function by repetitive stimulation of the spinal pattern generator that produces orgasm. Repetitive stimulation of this orgasmic reflex may provide a training effect, thus improving a women's ability to achieve orgasm by shortening the latency to orgasm and/or increasing the intensity of the experience. Ongoing research is evaluating the efficacy of Vib Stim for improving the ability of both males and females with SCI to achieve orgasm.

CONCLUSION

The use of vibratory stimulation may provide an effective means for increasing genital responsiveness and stimulation of the orgasmic reflex in persons with SCIs. Although we were not able to demonstrate statistically greater genital responsiveness with vibratory stimulation as compared with manual genital stimulation, this may be because our study was confined to a single laboratory-based session. Further research for determination of the efficacy of repetitive episodes of vibratory stimulation on orgasmic dysfunction after SCI is ongoing.

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