Original Article

Effects of level and degree of spinal cord injury on male orgasm

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Design: Controlled, laboratory-based analysis.

Objective: To determine the impact of spinal cord injuries (SCIs) on the ability to achieve male orgasm.

Setting: US academic medical center.

Methods: A laboratory-based analysis of the ability of 45 men with SCIs and 16 able-bodied control subjects to achieve orgasm coupled with a detailed neurologic examination, history and physical examination, and administration of the International Index of Erectile Function.

Results: Men with SCIs were less likely than controls to achieve orgasm. Mean latency to orgasm, blood pressure and heart rates at orgasm were not significantly different between controls and SCI subjects. Men with incomplete SCIs were more likely to achieve orgasm than those with complete SCIs. A disconnect was noted between the presence of orgasm and the presence of ejaculation. Men with complete lower motor neuron dysfunction affecting their sacral segments were less likely to achieve orgasm than men with any other patterns of SCI.

Conclusion: These results document the ability of men with complete SCIs to achieve orgasm. Characteristics of orgasm in men with SCIs as compared to able-bodied subjects are similar. Although orgasm and ejaculation are more likely to occur together, a number of men with SCIs achieve orgasm without ejaculation. Further research should explore the possibility of retraining ejaculatory and orgasmic responses in men with SCIs.

Spinal Cord (2006) 44, 798–804. doi:10.1038/sj.sc.3101954; published online 27 June 2006

Keywords: spinal cord injury; orgasm; ejaculation; pattern generator; neurologic recovery; reflex

Introduction

Sexual satisfaction is known to decrease in persons with spinal cord injuries (SCIs). SCI is also known to alter sexual response in both men and women. The predominant mode to document the effects of SCI on sexual response in men has been through self-report.¹ Recent research, primarily in females,² but also in males with SCIs,^{3,4} has used a laboratory-based approach to document the effects of level and degree of SCI on arousal. These studies have shown that the neurologic ability to achieve psychogenic arousal can be predicted in both females² and males⁵ by the degree of preservation of the combined ability to perceive surface sensation to pinprick and light touch in the T11–L2 dermatomes. These results indicate that there are

probably similar neurologic pathways for the control of sexual arousal in both men and women.

Other recent studies have evaluated the impact of level and degree of SCI on female orgasm. In the largest series to date of 62 women with SCIs, the ability to achieve orgasm was found to be significantly diminished in those women with complete lower motor neuron injuries affecting their sacral spinal cord.² These data emphasized the importance of an intact sacral reflex arc for the maintenance of orgasmic ability in women with SCIs. Additionally, two blinded coinvestigators could not predict whether the respondents' descriptions of orgasm were from able-bodied or spinal-injured women. These data support the hypothesis that the sensory experience of orgasm may lie, at least in part, within the autonomic nervous system.

Although the self-reported capacity to experience orgasm has been documented to occur in between 42⁶ and 47%⁷ of men with SCIs, there has not been a laboratory-based study performed to examine the

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detailed characteristics of male orgasm after SCI. The purpose of the present study was to test the hypotheses that orgasm would be less common in men with SCIs than in able-bodied men, and that the neurologic impact of SCI on male orgasm would be similar to that of females.

Methods

Subjects

All study procedures were approved by the institutional review board and informed consent was obtained from all subjects before study participation. Sixty-eight subjects signed informed consent for the study but seven of them were subsequently excluded: three completed the physical examination and then opted not to continue further with the study, two were noted to have had extensive surgical procedures that precluded further study participation, one subject had diabetes mellitus, and the remaining subject failed the psychiatric screening. Study subjects included 45 men with SCIs and 16 able-bodied control subjects. SCI subjects had a mean age ($\pm$ SD) of 37.3 ± 11.6 years, and a mean age ($\pm$ SD) of 29.8 ± 10.6 years at injury. Able-bodied subjects were 37.7 ± 8.8 years old. SCI subjects had 12.4 ± 2.2 years of education whereas able-bodied subjects had 12.9 ± 2.3 years of education.

Sixty-two percent of SCI subjects ($n=28$) were never married as compared to 62.5% of able-bodied control subjects ($n=10$). Sixteen percent of SCI subjects ($n=7$) were married as compared to 12.5% of able-bodied subjects ($n=2$). Eighteen percent of SCI subjects were divorced ($n=8$) as compared to 18.8% of able-bodied subjects ($n=3$). Four percent of SCI subjects were separated ($n=2$) as compared to 6% of able-bodied subjects ($n=1$). Fifteen of the SCI subjects (33%) reported a history of use of sildenafil.

SCI subjects' level of injury ranged from C3 to L4. Twenty-nine SCI subjects (64.4%) had complete injuries whereas 16 had incomplete injuries (35.5%). Twenty-five SCI subjects had complete upper motor neuron (UMN) injuries affecting their sacral cord, four had complete lower motor neuron (LMN) injuries affecting their sacral cord, 15 had incomplete UMN injuries affecting their sacral cord and one had an incomplete LMN injury affecting his sacral cord. Complete details about the neurologic examination of SCI subjects are provided in Table 1.

Procedures

Subjects who participated in this study also participated in a study of male arousal.⁵ Subjects were instructed not to use any techniques to facilitate erection in the 24 h before either study. Subjects underwent a complete history and physical and neurologic examination, and were classified according to the International Standards for the Classification of Spinal Cord Injury.⁸ Subjects were screened for psychiatric dysfunction using the Psychiatric Diagnostic Interview Revised.⁹ Next, they

completed a standard sexual history specifically designed for SCI males along with the International Index of Erectile Function¹⁰ (IIEF) with the modification that we asked them how their sexual function had been during the past 6 months as opposed to just the past month.

Subjects were then transferred onto a bed in the physiology laboratory and changed into a hospital gown. Sensors were then attached to monitor heart rate (HR) and blood pressure (BP) (Dinamap, GE Medical Systems). When all sensors were providing satisfactory signals the study protocol began.

Subjects were provided with an erotic video to view and were asked to stimulate themselves to orgasm any way they desired. The SCI subject's levels and patterns of injury were such that all were physically capable of stimulating their genitals. Subjects were told to indicate when they were about to achieve orgasm. Measures of HR and BP were monitored every 3 min throughout the study and also at the time of orgasm. Once subjects achieved orgasm, readings were monitored for an additional 6 min. At the termination of the study, subjects were assisted with removal of sensors and asked to get dressed. They were then debriefed about their reactions to the sessions and any questions were answered.

Data analysis

The characteristics associated with the orgasmic experience were first compared between SCI subjects as a whole and able-bodied subjects. Modified IIEF data from those subjects with SCIs who historically reported orgasms and those who achieved orgasm in the laboratory were examined to assess detailed aspects of their sexual functioning. Subsequent to this, SCI subjects were grouped in various ways to determine the impact of varying injury patterns on orgasm. Data analysis techniques included: independent sample *t*-tests for comparison of groups with respect to variables with normal or approximately normal distributions; Mann–Whitney tests for comparison of variables with skewed distributions or ordinal variables (eg modified IIEF item scores); χ^2 tests or Fisher's exact tests for assessment of associations between nominal variables; and logistic regression models to assess predictors of orgasm at the laboratory.

Results

When comparing groups as a whole, 100% of the able-bodied men historically reported the ability to achieve orgasm and did so in the laboratory setting. Subjects with SCIs were significantly less likely than able-bodied subjects to report the historic ability to achieve orgasm (100 versus 64.4%; $P=0.006$) and to achieve orgasm in the laboratory (100 versus 50%; $P<0.001$). Mean time to orgasm was decreased in able-bodied (15.9 ± 12.0 min) as compared to SCI subjects (19.0 ± 16.3 min); however, this difference was not

Table 1 Neurologic examination of SCI subjects

<i>Level of injury</i>	<i>Completeness Of injury</i>	<i>Total motor score</i>	<i>T11–L2 pinprick score</i>	<i>T11–L2 light touch score</i>	<i>S3–5 pinprick score</i>	<i>S3–5 light tough score</i>
L2	Complete	67	16	16	0	0
C5/7	Incomplete	33	0	2	0	4
T10	Complete	50	0	0	0	0
T8/9	Complete	50	0	0	0	0
T3/4	Complete	50	0	0	0	0
T1/2	Complete	50	0	0	0	0
C5	Incomplete	75	1	8	1	8
T6	Incomplete	90	8	4	8	4
L1	Complete	52	12	10	0	0
C7	Complete	30	0	0	0	0
T11	Complete	52	4	6	0	0
T5/6	Complete	50	0	0	0	0
T12	Complete	66	6	16	0	0
C7/8	Incomplete	55	7	16	8	8
C4/6	Incomplete	92	8	8	4	4
L1	Complete	51	13	12	0	0
C5/6	Complete	14	0	0	0	0
T12/L1	Complete	50	8	9	0	0
T3	Incomplete	93	12	12	5	6
T9	Complete	50	0	0	0	0
T8	Complete	50	0	0	0	0
C5/6	Complete	24	2	2	0	0
T7	Complete	50	0	0	0	0
C4	Incomplete	77	5	11	6	6
T12	Complete	51	6	8	0	0
C6	Complete	18	0	0	0	0
T5	Complete	50	0	0	0	0
C5/6	Incomplete	14	0	0	0	0
C7	Complete	39	16	16	8	8
L3/5	Incomplete	83	16	16	8	6
L2	Incomplete	54	16	16	0	4
C6/7	Incomplete	86	7	12	2	3
T4	Incomplete	60	7	14	0	3
L4	Complete	79	16	16	0	0
T12	Complete	50	10	12	4	1
T7	Incomplete	50	0	1	0	1
T10	Incomplete	55	5	7	3	2
C5	Complete	18	0	0	0	0
T8	Complete	50	0	0	0	0
T12/L1	Complete	56	13	13	0	0
C3/C5	Incomplete	92	6	15	4	5
C4/5	Complete	11	0	0	0	0
T9	Complete	50	0	0	0	0
C5	Incomplete	56	8	16	2	8
C5	Incomplete	57	0	8	1	4

statistically significant ($P=0.535$). At baseline, mean systolic BP (SBP) was significantly lower in SCI subjects than in able-bodied controls (127.7 ± 17.7 versus 142.1 ± 17.0 mmHg; $P=0.008$) as was diastolic BP (DBP) (69.61 ± 14.16 versus 79.13 ± 15.08 mmHg; $P=0.03$). HR at baseline was similar between SCI subjects (74.6 ± 18.2 beats per minute (BPM)) and able-bodied controls (77.7 ± 13.5 BPM). Mean HR at orgasm was higher for able-bodied (90.0 ± 16.0 BPM) as compared to SCI subjects (80.5 ± 18.5 BPM), but this difference was not statistically significant. Mean BPs at orgasm were higher for able-bodied compared to SCI subjects (SBP: 157.3 ± 25.7 versus 143.3 ± 28.2 mmHg,

$P=0.126$; DBP: 92.4 ± 29.1 versus 78.4 ± 19.2 mmHg, $P=0.107$) but these differences were not statistically significant. There were no statistically significant differences in the changes in BP and HR at orgasm versus baseline in able-bodied versus SCI subjects. Moreover, it should be noted that none of the subjects with SCIs became hypertensive during the study protocol.

Modified IIEF subscores (mean $\pm$ SD, median and range) and corresponding Mann–Whitney test P -values are shown in Table 2 for able-bodied and SCI subjects. Complete IIEF scores were significantly greater for able-bodied subjects versus SCI subjects (65.7 ± 20.5 versus 41.7 ± 8.6 ; $P=0.001$). Within individual variables of the

Table 2 IIEF scores (mean $\pm$ SD and median (range)): SCI versus able-bodied subjects

Question	SCI subjects (n = 45)		Able bodied subjects (n = 16)		P-value
	Mean $\pm$ SD	Median (range)	Mean $\pm$ SD	Median (range)	
How often were you able to get an erection during sexual activity?	2.93 $\pm$ 2.07	3.0 (0–5)	4.25 $\pm$ 1.06	5.0 (2–5)	0.044
When you had erections with sexual stimulation, how often were your erections hard enough for penetration?	2.91 $\pm$ 2.10	4.0 (0–5)	4.50 $\pm$ 0.82	5.0 (2–5)	0.016
When you attempted sexual intercourse, how often were you able to penetrate your partner?	2.89 $\pm$ 2.12	4.0 (0–5)	4.25 $\pm$ 1.43	5.0 (0–5)	0.025
During sexual intercourse, how often were you able to maintain your erection after you had penetrated your partner?	2.62 $\pm$ 2.01	3.0 (0–5)	4.19 $\pm$ 1.38	5.0 (0–5)	0.006
During sexual intercourse, how difficult was it to maintain your erection to completion of intercourse?	2.51 $\pm$ 1.99	3.0 (0–5)	4.31 $\pm$ 1.25	5.0 (0–5)	0.002
How many times have you attempted sexual intercourse?	2.47 $\pm$ 2.07	2.0 (0–5)	3.88 $\pm$ 1.67	5.0 (0–5)	0.028
When you attempted sexual intercourse, how often was it satisfactory for you?	2.33 $\pm$ 2.04	2.0 (0–5)	4.63 $\pm$ 0.72	5.0 (3–5)	<0.001
How much have you enjoyed sexual intercourse?	2.89 $\pm$ 1.94	3.0 (0–5)	4.56 $\pm$ 0.51	5.0 (4–5)	0.002
When you had sexual stimulation or intercourse, how often did you ejaculate?	1.84 $\pm$ 1.77	1.0 (0–5)	4.37 $\pm$ 0.96	5.0 (2–5)	<0.001
When you had sexual stimulation or intercourse, how often did you have the feeling of orgasm or climax?	2.44 $\pm$ 1.92	2.0 (0–5)	4.56 $\pm$ 0.73	5.0 (3–5)	<0.001
How often have you felt sexual desire?	3.96 $\pm$ 1.34	5.0 (1–5)	4.43 $\pm$ 0.73	5.0 (3–5)	0.376
How would you rate your level of sexual desire?	3.58 $\pm$ 1.21	4.0 (1–5)	4.13 $\pm$ 1.09	5.0 (2–5)	0.130
How satisfied have you been with your overall sex life?	2.98 $\pm$ 1.42	3.0 (1–5)	4.44 $\pm$ 0.5	4.0 (4–5)	<0.001
How satisfied have you been with your sexual relationship with your partner?	3.36 $\pm$ 1.44	4.0 (1–5)	4.40 $\pm$ 0.74	5.0 (3–5)	0.013
How do you rate your confidence that you could get and keep an erection?	2.96 $\pm$ 1.47	3.0 (1–5)	4.31 $\pm$ 0.79	4.5 (3–5)	0.002

0 = No sexual stimulation/intercourse; 1 = almost never/never; 2 = a few times (much less than half the time); 3 = sometimes (about half the time); 4 = most times (much more than half the time); 5 = almost always/always

IIEF, able-bodied scores were significantly greater than those of men with SCIs for all variables with the exception of sexual desire (IIEF questions 11 and 12), which was not significantly different between the two groups.

Using multiple logistic regression models, after adjusting for current age and length of time since injury, independent significant predictors of orgasm in the laboratory were both completeness of injury (P -value = 0.041, odds ratio = 0.14, 95% confidence interval = [0.02, 0.92]) and prior history of orgasm (P -value = 0.002, odds ratio = 42.4, 95% confidence interval = [3.99, 451.2]).

The ability to achieve orgasm as reported historically was compared among various subgroups of men with SCIs. When comparing men with complete versus incomplete injuries, 84.2% of those with incomplete injuries and 50% of those with complete injuries reported the historic ability to achieve orgasm (P = 0.018). Furthermore, in the laboratory 78.9% of subjects with incomplete injuries and 28.0% of those with complete injuries (P < 0.001) achieved orgasm.

We also compared those men with complete LMN injuries affecting their sacral cord with those of all other types and degrees of spinal injuries. Of those subjects with all other types of SCIs, 68.3% reported the historic ability to achieve orgasm whereas 0% (0 out of four) of those with complete LMN injuries reported orgasmic capability (Fisher's exact test two-tailed P = 0.007). Furthermore, 55% of those with all other types of SCIs were able to achieve orgasm in the laboratory as compared with none of the subjects with complete LMN injuries affecting their sacral segments (Fisher's exact test two-tailed P = 0.040).

Within subjects with SCIs, the ability to achieve ejaculation and the ability to achieve orgasm, as determined by the IIEF, were compared for different subgroups (Table 3). Compared to subjects without a reported history to achieve orgasm, subjects with historically reported ability to achieve orgasm obtained significantly higher IIEF ejaculation and orgasm scores (respective Mann–Whitney test two-tailed P -values: 0.001 and <0.001). Similarly, compared to subjects

Table 3 IIEF ejaculation and orgasm scores (mean $\pm$ SD, median and range) by history of orgasm and orgasm at the laboratory among SCI subjects ($n = 45$)

IIEF category	<i>Hx of orgasm</i>		P-value ^a	<i>Orgasm at the lab</i>		P-value ^a
	<i>No (n = 16)</i>	<i>Yes (n = 29)</i>		<i>No (n = 22)</i>	<i>Yes (n = 22)</i>	
<i>Ejaculation</i>			0.0007			0.0002
Mean $\pm$ SD	0.69 $\pm$ 0.60	2.48 $\pm$ 1.88		0.86 $\pm$ 0.89	2.86 $\pm$ 1.91	
Median	1.0	1.0		1.0	2.5	
Range	(0.0–2.0)	(0.0–5.0)		(0.0–4.0)	(0.0–5.0)	
<i>Orgasm</i>			0.0001			0.0001
Mean $\pm$ SD	1.00 $\pm$ 1.26	3.24 $\pm$ 1.77		1.36 $\pm$ 1.62	3.59 $\pm$ 1.56	
Median	1.0	3.0		1.0	4.0	
Range	(0.0–5.0)	(0.0–5.0)		(0.0–5.0)	(0.0–5.0)	

^aMann–Whitney test *P*-values**Table 4** Frequency distribution of modified IIEF ejaculation *versus* orgasm responses for SCI subjects ($n = 45$)

<i>During the past 6 months.....</i>						
<i>When you had sexual stimulation or intercourse, how often did you ejaculate?</i>	<i>When you had sexual stimulation or intercourse, how often did you have the feeling of orgasm or climax?</i>					
	<i>No sexual stimulation/intercourse</i>	<i>Almost never/never</i>	<i>A few times (much less than half the time)</i>	<i>Sometimes (about half the time)</i>	<i>Most times (much more than half the time)</i>	<i>Almost always/always</i>
No sexual stimulation/intercourse	7	0	0	0	0	1
Almost never/never	1	11	4	2	0	4
A few times (much less than half the time)	0	0	3	0	0	0
Sometimes (about half the time)	0	0	0	1	0	0
Most times (much more than half the time)	0	0	0	0	1	2
Almost always/always	0	0	0	1	1	6

who did not reach orgasm in the laboratory, those who did reach orgasm obtained significantly higher IIEF ejaculation and orgasm scores (respective Mann–Whitney test two-tailed *P*-values both <0.001).

Table 4 provides the detailed responses of the IIEF response to ejaculation *versus* the IIEF orgasm response. One-third of men with SCIs reported they have orgasms most of the time or always. Among these men 66% reported they ejaculate most times whereas in contrast 33% of these subjects reported they almost never or never ejaculate. Similarly, 66% of men with SCIs noted they rarely, almost never or never ejaculate. Of these men who rarely or never ejaculate, 27% reported they had no sexual stimulation or intercourse whereas 37%

reported they almost never achieved orgasm. However, 13% of these men reported they achieved orgasm less than half of the time, 26% reported they achieved it about half of the time and another 13% reported they almost always achieved orgasm. These findings underscore the phenomenon of dry orgasm that can occur after SCI and may be a result of orgasm without ejaculation or of orgasm with retrograde ejaculation into the bladder.

Discussion

This study represents the first comprehensive laboratory-based assessment of the ability of men with SCI to

achieve orgasm. In this study, our findings were similar to those we found in SCI females.¹¹ Males with SCIs were significantly less likely than able-bodied males to achieve orgasm; however, many were still able to achieve orgasm despite having been classified with complete SCI. Although absolute readings in able-bodied males were higher than those of men with SCIs, there was also not a significant difference in the BP or HR readings of these two groups at orgasm. Despite the fact that a number of the men with SCIs had injuries above the level of T6, none of the men with SCIs developed hypertension or experienced any symptoms of autonomic dysreflexia. Similar to our findings in women, the men in this study with complete LMN injuries affecting their sacral segments were significantly less likely than men with any other levels and degrees of SCI to achieve orgasm. Although our sample size for men with complete LMN injuries was small, comparison of our findings with women underscores potential neurologic similarities in control of sexual response between genders.¹²

Our findings in males differed from females, however, in the fact that there was not a significant difference in the time to orgasm between able-bodied and SCI males. In fact, the time to orgasm for able-bodied men was relatively long. We believe this may have been due to inhibition of orgasm by the laboratory setting. Our findings in males were also different than those in females in that there was a significant decrease in the ability of men with complete SCIs to achieve orgasm as compared to men with incomplete injuries.

It is notable that there were many men with SCIs who reported orgasms without ejaculation. Although orgasm and ejaculation are generally associated during sexual activity, this is not always the case and ejaculation can occur without orgasm and vice versa. The purpose of our study was to examine the characteristics of orgasm; hence we did not evaluate volume or characteristics of semen in men with SCIs. Further work could elucidate whether there is indeed retrograde emission into the bladder during the dry orgasms of men with SCIs.

Further research involving greater numbers of subjects should be performed to determine whether the relative inability to achieve orgasm is solely related to having a complete injury or to having a complete LMN injury as we found in women with SCIs. Although we found statistically significant differences in the ability of both men with complete and incomplete SCIs to achieve orgasm and subjects with LMN injuries as compared to all other men with SCIs, we anticipate that those subjects with complete LMN injuries affecting their sacral segments would be the least likely to achieve orgasm. Significant basic science research points to the urethro-genital reflex which is stimulated through the pudendal nerve as a parallel to an orgasmic reflex.¹³ Furthermore, evidence has been found that there is a pattern generator in the spinal cord for ejaculatory function.^{14–16} If this is the case, it may be possible that the spinal generator for ejaculation could be retrained clinically in men with SCIs and at least partially intact

sacral reflexes. This would be similar to the use of the Eros Device¹⁷ in women for purposes of improving orgasmic function and the training of the pattern generator for ambulatory purposes in SCI.¹⁸

Conclusion

Men with SCIs have demonstrated the ability to achieve orgasm in a laboratory-based setting. Although orgasm is less frequent in men with SCIs than in able-bodied subjects, the characteristics of orgasm in men with SCIs and able-bodied subjects are similar. Further research should be performed to verify the subgroup of men with SCIs who are neurologically less likely to achieve orgasm. Moreover, methods to improve orgasmic responsiveness should be studied.

Acknowledgements

This work was supported by the National Institute on Disability and Rehabilitation Research Grant H113N50017.

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