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ORIGINAL REPORT

SEXUAL FUNCTION IN A TRAUMATIC SPINAL CORD INJURED POPULATION 10–45 YEARS AFTER INJURY

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Objective: **To examine sexual function at least 10 years after traumatic spinal cord injury.**
Study design: **Cross-sectional questionnaire plus retrospective and prospective data from medical files.**
Subjects: **A total of 279 individuals with traumatic spinal cord injury.**
Results: **For spinal cord injured women: 94% had no problems with impaired vaginal lubrication; 22% had given birth after the injury; and 69% reported being satisfied with their sexual life. The women who were satisfied with their sexual life were younger than those who were not, and were younger at the time of injury. For spinal cord injured men: 75% could achieve erection, and they were younger than those who could not achieve erection; 35% used aid(s) for erection; 78–94% had positive reported effect of penile vibration, drugs and intracavernous injection for erection; 44% could achieve ejaculation, and they were younger than those who could not; 56% used aid(s) for ejaculation; 19% had made a woman pregnant, and a higher frequency of these men could achieve erection and ejaculation; 54% reported being satisfied with their sexual life; and significantly more men who had made a woman pregnant were satisfied with their sexual life. For both genders problems regarding bladder and bowel management, pressure ulcers, spasticity or pain correlated with lower satisfaction with sexual life.**

Key words: spinal cord injury; paraplegia; tetraplegia; sexual function; erection; ejaculation.

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INTRODUCTION

Sexual function is often impaired after spinal cord injury (SCI) due to nerve damage affecting motor, sensory and autonomic functioning. The possible impairment of sexual function and fertility is multifaceted, and includes impairment of vaginal lubrication, erection and ejaculation, as well as challenges related to childbirth and male fertility (1). Therefore, it is also related to lower quality of life (2–4). Anderson (5) found that the highest priority for quality of life for paraplegic individuals was sexual function, while in tetraplegic individuals it was second highest after regaining hand and arm function. The aim of this study was to document the status of sexual function and satisfaction with sexual life in a group of women and men with traumatic SCI who were injured 10–45 years previously.

METHODS

The study included individuals followed by the Clinic for Spinal Cord Injuries (CSCI), Rigshospitalet, Denmark. The uptake area for the clinic corresponds to East Denmark, with a population of 2.5 million. All patients with SCI are referred to this facility for specialized treatment and rehabilitation and life-long follow-up. Inclusion criteria were traumatic SCI prior to 1 January 1991 and that the participant was alive at the time of posting an initial questionnaire.

Exclusion criteria were: (*i*) initial admission at CSCI was not in continuation of the acute admission (due to the SCI) at an orthopaedic or neurosurgical department; (*ii*) follow-up at the CSCI terminated; (*iii*) not followed up at the CSCI since 1990; or (*iv*) missing medical records/insufficient data.

A total of 279 participants were included in the study. They all received a questionnaire by post with a pre-paid return envelope. A reminder with a new questionnaire was sent after 2 months to those who had not replied. The first mailing was answered by 204 (73.1%), and the second by 32 (11.5%) participants, i.e. 236 answers, corresponding to a response rate of 84.6%, including 193 men and 43 women injured from 1956 to 1990.

The non-responder group consisted of 43 individuals, 35 men and 8 women injured from 1960 to 1990.

Medical record data

The retrospective data collected from the records were neurological level of injury (C2–L4) and Frankel classification (6) at the time of discharge from the initial rehabilitation at the CSCI.

In addition, data from the Electronic Patient Record (EPR) collected during daily clinical practice was retrieved after February 2002 regarding vaginal lubrication, erection, ejaculation, and possible use of aids for erection and ejaculation. These data were used to compare whether there had been changes since the formalized initial questionnaire (see below).

Initial questionnaire

The questionnaire was part of a larger follow-up in individuals with SCI at least 10–45 years prior to the study, in which the present information on sexual function was one of a list of other topics (7–11). Questions from the initial questionnaire related to sexual function are listed in Tables I and II.

In addition to answers to the questions in Tables I and II, we used answers to 5 questions from the questionnaire regarding problems related to bladder emptying, bowel management, pressure ulcers,

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spasticity/spasms, and pain to describe how many of these specific SCI problems the participants reported (i.e. 0–5).

As far as possible scales/questions and answer possibilities in the questionnaire were similar or comparable to previously published standards (12). Experience from an earlier study of reproducibility and validity of a questionnaire completed by SCI individuals before regular follow-up (13) was used to optimize the questions.

A pilot study including 7 men with SCI (4 of whom were tetraplegic and 3 paraplegic) showed that the questionnaire was comprehensive and easy to answer, but minor adjustments were made before sending the questionnaire to all participants.

To test the validity of the process of typing the answers to the questionnaire into the database, 10% (24 participants) of the questionnaires were checked thoroughly a second time. The results showed that all data entries concerning the included data for the present publication were correct.

To investigate the reproducibility of the questionnaire 38 participants received a second questionnaire 2 years after posting the initial questionnaire. Of these, 33 participants (86.8%) returned the second questionnaire. The questions used in this presentation showed reproducibility of 83–100% for questions concerning sexual function, and 70–97% for questions concerning other topics. Considering that some answers are expected to be the same over time, whereas others are likely to change, the reproducibility of the questions was satisfactory.

Statistical methods

A χ^2 test, Fisher's exact test, Wilcoxon rank-sum test and *t*-tests were used. The level of significance was set at 0.05.

RESULTS

The mean age of the responders at the time of the study was 50.5 years (standard deviation (SD) 11.2, median 50.0, range 28.4–84.5 years), with no difference between the genders. The mean time since injury was 24.1 years (SD 8.7, median 23.7, range 10.7–45.1 years), 21 years for women and 25 years for men ($p = 0.019$). Of responders, 126 (53.4%) had paraplegia and 110 (46.6%) tetraplegia, 102 (43.2%) had complete and 134 (56.8%) incomplete lesions according to the Frankel classification (6).

Representativeness

Comparison between the responder and non-responder groups with regard to gender, neurological level, para-/tetraplegia, Frankel classification (6), age at SCI, age at time of follow-up, years since SCI, and cause of SCI showed no statistically significant differences between the two groups.

Women

Table I shows the questions put to the female participants, and their answers concerning sexual function.

Thirty-four percent of female participants reported having regular menstruation, and all of these were younger than 50 years of age. Of the 56% who reported no menstruation, the majority (78%) was older than 50 years.

Nearly all (94%) female participants reported not having problems with impaired vaginal lubrication, their mean age was 48 years. The mean age of those 7 not answering the question was 58 years. Comparing the initial answers on this topic with the EPR information obtained later, it was found that 91% (21 of 23 participants where data were available) also stated that they had no problems with vaginal lubrication.

Table I. *Questions and results from the structured initial questionnaire used for the female study population (*n = *43)*

Question	*n* (%)
How is your menstruation? (*n* = 41)	
Regular	14 (34)
Irregular	4 (10)
No menstruation	23 (56)
Do you have problems with impaired vaginal lubrication? (*n* = 36)	
No	34 (94)
Yes	2 (6)
Have you given birth after the spinal cord injury? (*n* = 41)	
No	32 (78)
Yes	9 (22)
If yes, have you received additional help from the social authorities in relation to the baby? (*n* = 9)	
No	5 (56)
Yes, which_____	4 (44)
Are you satisfied with your sexual life? (*n* = 35)	
No, why not?_____	11 (31)
Yes	24 (69)

Twenty-two percent of female participants reported having given birth after the injury. The mean age at time of injury was significantly lower among those who had given birth compared with those who had not (20 vs 30 years, $p = 0.011$). Of the participants who had not given birth after the injury, 88% were more than 40 years of age at the time of initial follow-up.

Sixty-nine percent of the women reported being satisfied with their sexual life. For those who were not satisfied the following reasons were given: "not having a sexual life" by 3 respondents; while "single", "partner not interested", "partner impotent due to problems concerning bladder and bowel management", "catheter in the way", "difficulty in relaxing", "headache after sexual activity", and "impaired sensibility" by one respondent each. When comparing satisfaction with sex life and the amount of problems regarding bladder and bowel management, pressure ulcers, spasticity or pain, there was no statistically significant difference ($p = 0.08$), although there was a tendency towards the more problems reported, the less satisfied the women were likely to be with their sexual life.

No statistically significant difference was found in satisfaction with sexual life when comparing tetraplegic and paraplegic women ($p = 0.5$), or in relation to the Frankel classification ($p = 0.4$).

When comparing satisfaction with sexual life with age at initial follow-up it was found that mean age was statistically significantly lower for the satisfied women compared with the unsatisfied women (45 vs 53 years, $p = 0.04$). Likewise, those who were satisfied were younger at the time of injury (24 vs 31 years, $p = 0.03$). There was no significant difference in mean time since SCI in relation to satisfaction with sexual life (21 vs 22 years). There was no significant difference in satisfaction with sexual life between those who had given birth to a child after SCI and those who had not (87.5% vs 65.4%, $p = 0.4$).

Men

Table II shows the questions put to male participants concerning their sexual function, and the distribution of answers.

Seventy-five percent of men reported being able to achieve erection, they had a mean age of 48.2 years, while those reporting having problems with erection had a mean age of 56.7 years ($p < 0.0001$). The mean age of the 5 male participants who did not answer the question was 56.5 years, i.e. comparable to those having erection problems. The use of one or more erectile aids was reported by 35% ($n = 67$). EPR data concerning ability to achieve erection was found for 116 of the 143 participants, of whom 76% ($n = 88$) confirmed that they could achieve erection, i.e. up to 10 years after the initial questionnaire was completed. For those who answered "no" to achieving erection in the initial questionnaire, 23 participants (85% out of 27 who had EPR data on this topic) confirmed this answer in the later EPR registration. Regarding firmness of the erection, 67% gave the same answer at initial follow-up and in the later data from the EPR.

Table II. *Questions and results from the structured initial questionnaire used for the male population (*n = *193)*

Question	*n* (%)
Can you achieve erection? ($n = 190$)	
No	42 (22)
Yes	143 (75)
Have not tried	5 (3)
– If yes, how is the erection? ($n = 137$)	
Spontaneous/involuntary	61 (44)
Deliberate	53 (39)
Both	23 (17)
How is the erection? ($n = 139$)	
Hard (normal)	91 (65)
Soft	48 (35)
Are you using or have you ever used any of the aids mentioned below for achieving erection? More than 1 option may be ticked ($n = 67$) ($n = 19$ ticked more than 1 aid)	
Pubic ring/vasoconstriction ring	11 (16)
Oral medication, e.g. Viagra	28 (42)
Vibration	17 (25)
Penile injection	29 (43)
Vacuum pump	4 (6)
Others	7, masturbation (10)
Can you achieve ejaculation? ($n = 187$)	
No	87 (46)
Yes	82 (44)
Have not tried	18 (10)
Have you ever had ejaculation with 1 of the aids mentioned below? More than 1 option may be ticked ($n = 46$) ($n = 5$ ticked more than 1 aid)	
Vibration	35 (76)
Electrostimulation	9 (20)
Other	7, mostly masturbation (15)
After the injury have you made a woman pregnant? ($n = 188$)	
No	153 (81)
Yes	35 (19)
– If no, is this because you have had problems making your partner pregnant due to the spinal cord injury? ($n = 153$)	
No	67 (44)
Yes	52 (34)
No answer	34 (22)
– If yes, did you need special assistance to make your partner pregnant? ($n = 35$)	
No	23 (66)
Yes	9 (26)
No answer	3 (9)
Are you satisfied with your sexual life? ($n = 180$)	
No, why not?_____	83 (46)
Yes	97 (54)

Data collected from the EPR showed that 16 out of 17 participants (94%) had some or good effect from the use of vibration to achieve erection, while 78% (21 out of 27 participants) of the men using oral medication, in particular sildenafil, reported some or good effect. For the men using intracavernous injection, 85% (17 out of 20 participants) had some or good effect.

Concerning ejaculation, 44% reported being able to achieve ejaculation, and 56% ($n = 46$) of those reported having used one or more aids for ejaculation. The mean age was 46 years for those reporting being able to achieve ejaculation, 54 years for those who were not able to achieve ejaculation ($p < 0.0001$), and 51 years for those who had not tried. When comparing the initial answers regarding achieving ejaculation with the EPR data, we found 51 participants (77% out of the 66 participants, who had EPR data on this topic) answered "yes" on both occasions. For those who in the initial follow-up answered that they were not able to achieve ejaculation ($n = 60$), 54 participants answered the same later to the EPR (90% identical answers).

Of those reporting to the EPR on ejaculation with vibration ($n = 27$) 85% had antegrade ejaculation. Electro-ejaculation was tried by only 3 subjects, all of whom reported antegrade ejaculation.

Among the male participants 46% ($n = 83$) reported not being satisfied with their sexual life. Of these, 83% ($n = 69$) participants stated a reason for not being satisfied with their sexual life (Table III).

No statistically significant difference was found for satisfaction with sexual life when comparing tetraplegic and paraplegic men ($p = 0.5$), or in relation to the Frankel classification ($p = 0.4$).

When comparing satisfaction with sexual life and ability to achieve erection or ejaculation, no statistically significant difference was found, although there was a tendency for more satisfaction with sexual life if ejaculation could be achieved ($p = 0.13$, i.e. 61% vs 48%). Satisfaction with sexual life evaluated in relation to the kind of erection aid used showed a general tendency that more were unsatisfied than satisfied using a venous constriction band, sildenafil and other drugs, intracavernous injection or vacuum device. None of the 4 who used a vacuum device was satisfied with their sexual life.

When comparing the use of one or more erection aids, significantly more participants were found to be satisfied ($p = 0.04$) with their sexual life in the group who reported using one erection aid (51%) compared with those who had tried 2–5 different aids (20%).

Table III. *Reasons reported by spinal cord injured men for being dissatisfied with their sexual life (*n = *69). More than one reason may be given by the same individual. Reasons reported only once are listed below the table*

Reason for being dissatisfied with sexual life	*n*
Insufficient erection	12
No sex life/Sex too seldom /Lack of women/Too passive	11
No partner	11
Impaired sensibility	7
No ejaculation/Lack of orgasm/Missing rush	6
Lack of lust	4
Catheter/Incontinence	3
Their injury had a negative effect on their sexual life	3
Age	3
Partner not interested	2
Physical reasons	2
Sex life could be better	2
Headache/Dysreflexia during ejaculation	2
Not listed the handicap to be the reason/Due to circumstances	2
Lack of energy/Laziness	2

Reasons given only once: phimosis; medicine; pain; overweight; need for aids; unsatisfied but not a real problem; psychological reasons; feeling inadequate; wishes it was more normal; private; do not know; dumb question.

Eighty-one percent of male participants had not made a woman pregnant since their SCI. Of these, 34% ($n = 52$) participants reported that the reason was the SCI. Of the 35 participants who reported having made a woman pregnant after the injury, 26% needed special assistance in the process. In the group of men who did achieve conception with their partner, 100% reported being able to have an erection and 89% ejaculation, but this was the situation among only 71% and 34% of the men who did not ($p = 0.0005$ and $p < 0.0001$, respectively). When comparing satisfaction with sexual life and the amount of problems regarding bladder and bowel management, pressure ulcers, spasticity or pain, there was no statistically significant difference ($p = 0.12$), although, as for women, there was a tendency towards the greater the number of problems reported the less satisfied the men were likely to be with their sexual life. When testing women and men together concerning this issue this nearly reached statistical significance ($p = 0.052$).

There was no significant difference in mean age (49 vs 52 years) at the time of initial questionnaire or mean time since SCI (25 vs 24 years) when comparing participants being either satisfied or unsatisfied with their sexual life. Significantly more men who made a woman pregnant were satisfied with their sexual life in comparison with those who did not (75.8% vs 49.7%, $p = 0.007$).

Among female participants 31% were unsatisfied with their sexual life, while 46% of male participants were unsatisfied with their sexual life. This is not statistically significant, but shows a tendency towards more sexual dissatisfaction among men with SCI compared with women with SCI.

DISCUSSION

Women

The majority of female participants in the present study did not report problems with impaired lubrication, which is in contrast to the findings of previous studies (14, 15). One reason for this difference may be that we did not specifically ask the question in relation to sexual activity. The birth rate after injury in our study is, on the other hand, very similar to that reported by Anderson et al. (14).

A low number of women gave reasons for dissatisfaction with their sexual life in the present study, but these reflect the common reasons given in previous studies (16, 17). Although Lombardi et al. (17) found that women with tetraplegia were less likely to have sexual intercourse than other women with SCI, due to the possible presence of autonomic dysreflexia and urinary incontinence, no statistically significant difference was found regarding satisfaction with sexual life between tetraplegic and paraplegic women, which is in agreement with Valtonen et al. (18).

However, it is not unexpected that, for many women, the importance of sex had declined after the injury, and sexual desire, arousal, activity and satisfaction were lower than before the injury and compared with controls (16, 19). We did not confirm previous results (17) showing that the longer the time since the injury the more sexual satisfaction is reported among women; we found approximately the same mean time since injury in both the sexually satisfied and the unsatisfied women, which is in accordance with the results of other studies (2, 20, 21).

Black et al. (22) found, in agreement with our results, that sexual satisfaction decreased with age, whereas Valtonen et al. (18) found that age had no effect on satisfaction with sexual life in women.

We found that women who were younger at the time of injury were more satisfied with their sexual life than those who were older. This is in accordance with the findings of Black et al. (22). Westgren et al.'s (19) explanation for this is that the younger the age at SCI the better the women were to adapt their sexual activity to their new life, and Kreuter et al. (16) reported that it takes time for women with SCI to regain self-worth and the sense of being feminine.

Although we only found nearly statistically significant effect of the influence of various additional problems on satisfaction with sexual life, the tendency is in accordance with the previous findings that urinary incontinence, faecal incontinence and spasticity increased the risk of sexual dissatisfaction (18, 19).

Men

Seventy-five percent of male participants in the present study reported being able to achieve erection, which is within the range (54–95%) found in a review paper of 25 studies on the topic (23) and in a more recent study (24). Anderson et al. (24) also found that using medication or devices improved the frequency of erections that lasted, which is in accordance with our results, that those who used vibration, medication or intracavernous injection generally found them to have good or some effect on the erection. As in the present study, Deforge et al. (25) found good erection responses to penile injection and the use of sildenafil. However, while very few of the participants in the present study used the vacuum pump, none reported good effect,

whereas Lloyd et al. (26) reported this device to be efficient. This difference may be due to experience in use of the device.

The frequency of ejaculation in the present study (44%) is at the high end of the range found in a review of 21 studies (0–52%), with the higher rates being reported in more recent years (23). This wide range may be due to variations in the populations of the different studies, as the more caudal and incomplete the lesion the higher the frequency of ejaculation will be found.

In the present study we found no statistically significant differences in satisfaction with sexual life between tetraplegic and paraplegic men, which is in agreement with the results of Valtonen et al. (18), but in contrast to the findings of Dahlberg et al. (27), as they found paraplegic men were more satisfied with sexual life than tetraplegic men, while completeness of SCI did not make any difference. On the other hand, Sipski et al. (28) found that men with incomplete SCI were more likely to achieve orgasm than men with complete SCI.

We found no significant correlation between age and satisfaction with sexual life, while it has been shown previously that satisfaction with sexual life decreases with increasing age in men (18), as we found for women.

It is important to recognize that even though the majority of men experience good effects when using phosphodiesterase type 5 inhibitors, such as sildenafil, for erection (29–31), the use of sildenafil did not correspond with being satisfied with sexual life as such in the present data, although Hultling et al. (32) showed sildenafil to have a good impact on quality of life, and Barbonetti et al. (33) conclude that it is important to be aware of the importance of managing erectile dysfunction in men with SCI, as it represents a major determinant of their psychological distress. However, this may agree with our finding, that the more aids for erectile dysfunction tried by the men with SCI, the less satisfaction with their sexual life they reported.

Nineteen percent reported having made a woman pregnant since the SCI. This is a higher percentage than those in a previous review (31), in which pregnancy rates of 1–2% were reported. This discrepancy is probably due to the time elapsed and more therapeutic assistance available in more recent years.

Among men who achieved conception, all reported being able to have an erection and 89% ejaculation, while the corresponding percentages for men who did not make a woman pregnant were 71% and 34%, respectively. This may be explained in part by the lower age among men who were able to achieve an erection as well as ejaculation, compared with those who were not able to achieve conception. Although today it is possible to be assisted to conceive, our finding may also indicate that being able to achieve erection and ejaculation still have an impact on the chance of making a woman pregnant. It is possible that men who are able to achieve erection are more likely have coitus, and therefore have a higher likelihood of making a woman pregnant.

Our results support the trend found by Valtonen et al. (18) that men with SCI are less satisfied with their sexual life than are women with SCI. This may be due in part to the fact that sexual issues affecting men with SCI focus particularly on dysfunction regarding erection and ejaculation (32, 34, 35), while women with SCI stress that emotional closeness, the desire to express and receive love and to share physical pleasure are the most important factors for having an active and satisfying sexual life (16).

Representativeness and limitations

Due to the high response rate the population examined in this paper represents the general traumatic SCI population in need of specialized SCI care and treatment. We were able to include more recent data from the EPR, but these data are not necessarily representative of the original population, and this information should only be taken as providing indications that need to be confirmed in future studies. However, they did partly confirm the initial follow-up data.

Another limitation was the small number of women in the study; thus the data on women should be treated with more caution.

Our study did not include a question about orgasm, and in future studies it is recommended to at least include the data elements from the newly developed International SCI Basic Data Sets for Female Reproduction and Sexual Function (36) and Male Sexual Function (37) to make it easier to compare future studies.

In our analyses of the results, we used the reported global sexual life satisfaction question in relation to satisfaction with several topics. The information provided by the resulting comparisons may have been more accurate if the satisfaction questions were asked in direct relation to each particular topic; however, we believe that the comparisons are sufficiently meaningful to be used in planning future research.

CONCLUSION

Our study showed the majority of women reported being satisfied with their sexual life, in particular when younger of age and young at the time of injury. Relatively fewer SCI men reported being satisfied with their sexual life; and significantly more men who had made a woman pregnant were satisfied with their sexual life. For both genders problems regarding bladder and bowel management, pressure ulcers, spasticity or pain correlated with lower satisfaction with sexual life.

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