

Original Article

Effects of repeated ejaculations on semen characteristics following spinal cord injury

R Hamid^{*1,2}, P Patki¹, H Bywater¹, PJR Shah^{1,2} and MD Craggs^{1,2}

¹Spinal Research Centre, Stanmore, London, UK; ²Institute of Urology and Nephrology, London, UK

Study design: Prospective randomised controlled study.

Objective: To evaluate the effects of repeated ejaculation on semen characteristics following spinal cord injury (SCI) in a prospective randomised controlled study.

Setting: Spinal Research Centre, Stanmore, UK and Institute of Urology and Nephrology, London, UK.

Methods: A total of 74 patients with SCI above T10 were tested by vibro-ejaculation using a Ferticare penile vibrator (Multicept A/S Horsholm, Denmark) using a standardised technique. The ejaculate was examined according to WHO protocol. The successfully vibro-ejaculated subjects ($n = 32$) were randomised into a study group ($n = 18$) and a control group ($n = 14$). The patients in the study group vibro-ejaculated weekly for 3 months with semen analysis performed at baseline and then monthly. The control group vibro-ejaculated at baseline and at the end of the 3-month period. Two experienced observers performed the semen analysis independently. All measures were compared for statistical significance across the two groups at the beginning and at the end of the 3-month period using a two-tailed student *t*-test. Significance was determined at the 95% confidence interval ($P < 0.05$).

Results: In total, 10 patients in the study group and nine in the control group have completed the study so far. Six patients have dropped out of the study group and three from the control group for varied reasons. Two patients are currently enrolled in the study and control groups. The morphology and forward progression of sperm shows a statistically significant increase in the study group. The motility improves but is not statistically significant in the study group. No significant adverse effects were reported.

Conclusions: We have shown in this unique randomised controlled study that repeated ejaculation does improve the sperm characteristics in SCI patients. It is suggested that SCI men should undergo repeated ejaculation for at least 3 months before trying intravaginal or intrauterine insemination techniques. If this fails then *in vitro* fertilisation can be used. This method promotes natural conception, is intimate and cost effective.

Spinal Cord (2006) 44, 369–373. doi:10.1038/sj.sc.3101849; published online 22 November 2005

Keywords: spinal cord injury; infertility; vibro-ejaculation

Introduction

Spinal cord injury (SCI) is a universal disability with an annual incidence of between 15 and 40 cases per million.¹ A total of 55% of patients sustain an injury at the cervical level with the rest divided equally between thoracic, thoracic–lumbar and lumbar–sacral levels.¹ Previously, about two-thirds of SCI patients had a complete transection of the spinal cord, however this trend is changing and now less than half sustain a

complete SCI.^{2,3} About 70% of SCI patients are under 40 years of age and 80–85% are men.^{4–6}

Infertility is a recognised problem in men following SCI. Historically, Bors and Comarr⁷ reported an ejaculation rate of only 5% for men with complete upper motor neurone lesions that increased to 32% if the lesion was incomplete. Conversely, patients with complete lower motor neurone lesions reported an ejaculation rate of 18% while 70% with incomplete lower motor neurone lesions could ejaculate.⁷ Recently, Sonksen and Biering-Sorensen⁸ reported an ejaculatory failure rate of up to 95% in men with SCI. When this is combined with erectile dysfunction this can cause

*Correspondence: R Hamid, Department of Neurourology, Spinal Injuries Unit RNOH Stanmore, 126 Howberry Road, Brockley hill, Stanmore, Middlesex Ha7 4SA, UK

distressing psychological problems both for the SCI man and for his partner. Considering the young age of patients with SCI and the desire to have a family, the consequences of not being able to father children can be devastating and severely affect quality of life.

Male infertility is attributed to ejaculatory failure and poor sperm characteristics.^{9–11} Currently the two most popular methods of sperm retrieval are vibro- and electro-ejaculation. Irrespective of the technique, the sperm quality has consistently been reported as poor in all series evaluating the semen of SCI men.^{12–16} The sperm motility, forward progression and morphology are abnormal.

The pathophysiology and the mechanisms involved that lead to the deterioration of sperm following SCI are largely unknown. It is suggested that a host of factors including stasis of prostatic and seminal fluid, testicular hyperthermia, recurrent urinary tract infections, type of bladder management, abnormal testicular histology, changes in pituitary testicular axis, sperm antibodies and long term use of various medications in combination may be responsible.^{12,17–19}

Many investigators have suggested that the stasis of semen in the ejaculatory ducts leads to the deterioration in sperm motility.^{13,15,20,21}

Brindley²¹ has shown a progressive increase in sperm motility with repeated electro-ejaculation. Francos *et al*²⁰ helped to increase the motility of a man with repeated electro-ejaculations from 0 to 30%. Conversely, some investigators have reported no beneficial effects of repeated ejaculations on the quality of sperm. Sonksen *et al*²² reported in 1999 a series of 18 patients who vibro-ejaculated weekly for 1 year without any significant change in any of the parameters.

Although various studies have been carried out to determine the effects of repeated ejaculation on semen characteristics as discussed above with some substantiating this hypothesis while others refuting it. None of them used a randomised controlled methodology.

Therefore, we performed a randomised controlled study to evaluate the effect of repeated ejaculations on semen characteristics following SCI.

Materials and methods

The local research and ethics committee approved this study. The trial was carried out in accordance with 'Recommendations guiding research into human subjects' (Declaration of Helsinki, 1975), Patients with an SCI level above T10 who had not ejaculated since the time of injury were invited for participation in this study. Both complete and incomplete SCI men were eligible to take part. The minimum duration since the time of injury was set at 6 months in line with other studies (Brindley¹² and Siosteen *et al*¹⁵). To date, a total of 74 patients have participated in the study over a 2-year period.

The mean age of the patients was 35.6 years (range 18–56 years). The mean duration of SCI was 10.4 years (range 0.5–27 years). In total, 35 patients had SCI at

cervical level, 25 between thoracic levels 1–6 and 14 between thoracic levels 7–10. There were 41 complete and 33 incomplete patients with SCI.

A total of 29 patients were performing clean intermittent self-catheterisation (CISC) for bladder management. In all, 28 had a suprapubic catheter (SPC), 16 were reflex voiding while one had a sacral anterior root stimulator.

The patients who successfully ejaculated antegradely in the clinic without any apparent contra-indications were randomised into either the study or control groups. Randomisation was performed by the toss of a coin. The study group was required to vibro-ejaculate weekly and semen analysis was performed at baseline and then on a monthly basis for a total of 3 months. The subjects in the control group were ejaculated at baseline and once more at the end of 3 months.

A Ferticare[®] penile vibrator (Horsholm, Denmark) was used. The initial settings on the vibrator were calibrated to a frequency of 100 Hz with an amplitude of 2.5 mm as suggested by Sonksen *et al*.²³ The baseline ejaculation was performed in the laboratory. All the patients prone to autonomic dysreflexia were given prophylactic Nifedipine 10 mg. The duration of the vibrations were 2–3 min. However, if the procedure was unsuccessful on the first attempt, a gap of 1–2 min was instituted. The parameters on the ferticare vibrator was then increased (the amplitude to 3.5 mm and frequency to 110 Hz). The procedure was repeated again for 2–3 min. We performed a maximum of four cycles if ejaculation did not occur. If there were any adverse effects, that is to the skin or the patient generally feeling unwell, then the procedure was stopped immediately. All the adverse events were documented.

The semen analysis was performed according to the World Health Organisation guidelines.²⁴

Statistical analysis

Data from the case report forms were entered into a database. The statistical analysis was performed by a two-tailed student *t*-test. A *P*-value of <0.05 was considered as significant.

Results

A total of 37 patients (50%) successfully antegradely ejaculated with the Ferticare[®] vibrator. The remaining 37 were unsuccessful in producing an ejaculate even after multiple attempts. Five of the 37 successful patients refused to participate in the study after baseline evaluation.

The remaining 32 were randomised into the study (*n* = 18) and control (*n* = 14) groups.

There was no statistically significant difference in age of the patients or the level of SCI between the successful and the unsuccessful subjects. However, the mean duration from SCI was significantly lower in successful subjects (7.6 years in successful to 13.22 years in unsuccessful group). Two-thirds of patients with a

complete SCI did not ejaculate (27/41). While only 30% (10/33) of patients with an incomplete injury did not ejaculate.

A total of 72% (21/29) of subjects performing CISC could vibro-ejaculate but only 32% (9/28) utilising SPC were successful. The comparison is summarised in Table 1.

Six out of 18 patients in the study group dropped out after entering the study. Three stopped ejaculating after 1–2 months. The other three were noncomplaint.

In the control group three subjects dropped out. One was admitted to another hospital with an illness while the remaining two did not come back for follow-up appointments.

A total of 19 patients (study = 10, control = nine) have so far completed the study. There are two active patients in each group at present. The comparison of the two groups is shown in Table 2.

The morphology ($P=0.02$) and forward progression ($P=0.03$) have shown statistically significant increase in the study arm when compared with the control group. The motility (0.09) has improved but is not statistically

significant. None of the other variables demonstrated any improvement. The results are summarised in Table 3.

Adverse events

No serious adverse events were seen during the study. One subject developed autonomic dysreflexia and the procedure was abandoned. Three developed minor penile abrasions, all settled by conservative management.

Discussion

We have shown that there is a statistically significant improvement in the morphology and forward progression of the sperm with repeated ejaculations following SCI. There has been an improvement in motility but this has not proven to be statistically significant.

There was no statistically significant change in either the volume or the sperm count in our study, but it did show a slight decrease with repeated ejaculations.

Table 1 Comparison between successful and unsuccessful subjects

<i>Patient demographics</i>	<i>Successful (n = 37)</i>	<i>Unsuccessful (n = 37)</i>
Mean age – years (range)	36.6 (18–56)	34.6 (19–48)
Level of injury	C = 15; T1–6 = 16; T7–10 = 6	C = 20; T1–6 = 9; T7–10 = 8
Complete	14	27
Incomplete	23	10
Bladder management	CISC = 21; SPC = 9; Reflex = 6; SARS = 1	CISC = 8; SPC = 19; Reflex = 10
Duration of injury – years (range)	7.6 (0.5–23)	13.22 (0.5–27)

C = cervical; T = thoracic; CISC = clean intermittent self catheterisation; SPC = suprapubic catheter; SARS = sacral anterior root stimulator

Table 2 Comparison between study and control arms

<i>Patient demographics</i>	<i>Study (n = 10)</i>	<i>Control (n = 9)</i>
Mean age – years (range)	40.3 (33–48)	37.1 (23–44)
Level of injury	C = 4; T1–6 = 5; T7–10 = 1	C = 6; T1–6 = 3; T7–10 = 0
Complete	3	2
Incomplete	7	7
Bladder management	CISC = 7; SPC = 2; Reflex = 1	CISC = 4; SPC = 4; Reflex = 1
Duration of injury – years (range)	7.0 (1.3–19)	4.8 (0.7–10.6)

C = cervical; T = thoracic; CISC = clean intermittent self catheterisation; SPC = suprapubic catheter

Table 3 Summary of results

<i>Semen parameter</i>	<i>Control arm (n = 9)</i>			<i>Study arm (n = 10)</i>		
	<i>Baseline</i>	<i>3 months</i>	<i>P-value</i>	<i>Baseline</i>	<i>3 months</i>	<i>P-value</i>
Volume – ml (range)	2.7 (2.0–3.0)	2.2 (0.5–3.5)	0.09	2.9 (1.2–5.5)	1.9 (0.5–3.5)	0.07
pH	7.6 (7.0–8.3)	7.9 (7.1–8.5)	0.13	7.8 (7.2–8.5)	8.2 (7.3–10)	0.35
Motility (percentage normal)	11.6 (5–30)	18.2 (0–60)	0.66	21.2 (1–70)	30.5 (5–55)	0.09
Forward progression (grade 0–3)	1.3 (0–2.0)	1.3 (0–3.0)	0.73	1.4 (0.0–3.0)	2.0 (0–3.0)	0.03 ^a
Count (million per ml)	128.3 (40–290)	87.8 (30–211)	0.19	84.7 (10–147)	68 (10–184)	0.60
Morphology (percentage normal)	22.1 (14–35)	18.6 (13–30)	0.22	15.7 (0–30)	25.4 (0–40)	0.02 ^a

^aSignificant differences

Interestingly, the same phenomenon was observed in the control group. We are unable to explain why the motility did not increase significantly, but it can be argued that if the study had continued for longer that is for 6 months then this parameter might have shown a statistically significant improvement.

Male SCI patients with a T10 injury of more than 6 months showed a 50% success rate with vibro-ejaculation. This is significantly less than the 80% as reported by Sonsken *et al*²³ despite us using the optimised parameters as described by him. However, in a meta-analysis of 10 studies Beckerman *et al*²⁵ found a success rate of 60%. It is possible that some of our failures could be due to retrograde ejaculation. We did not check for this phenomenon as it was felt that the semen analysis after the ejaculate had mixed with urine would have been compromised. In our study, success was not determined by either the age or the level of injury but was dependent on the duration of injury, the level of completeness and method of bladder management. Complete SCI afford less chance of a successful outcome than incomplete with vibro-ejaculation while patients performing CSIC were twice more likely to ejaculate as compared to those having a SPC. Although the previous studies have not shown a correlation between these parameters^{23,26,27} it should be emphasised that they were not randomised controlled studies.

There was no significant relationship of the abstinence time (the duration from injury to the time when entered study) on the semen characteristics in our study. This phenomenon has not been commented upon in other studies.

It has previously been shown that the ejaculation could cease after a successful penile vibro-stimulation (PVS).¹⁵ We observed this in three of our subjects in the study group. One patient has started to vibro-ejaculate again after a gap of a few months, but obviously he has had to be excluded from the study. The reason for this phenomenon remains unclear.

Brindley²¹ showed that with repeated ejaculation the motility, morphology and forward progression all improved statistically. Beretta *et al*¹³ reported improvement in sperm motility, morphology and concentration in 15 patients with 3–6 months of PVS. Siosteen *et al*¹⁵ performed repeated PVS in 16 men for 4–6 months and noted an increase in volume, and in the levels of fructose and acid phosphatase suggesting an improved function of seminal vesicles and prostate. However, he did not observe any significant improvement in motility or morphology. Recently, Sonksen *et al*²² have vibro-ejaculated 18 patients on a weekly basis for a year and have concluded that there has not been a statistically significant increase in any of the parameters and feel that repeated ejaculation does not improve the semen characteristics following SCI.

We have studied this phenomenon in a randomised controlled study to ascertain the exact role of repeated vibro-ejaculation following SCI and have shown that it does improve the sperm characteristics. If this translates

into improved fertility the potential remains to be ascertained.

Some investigators²⁸ have observed the seminal plasma of SCI men and reported that it inhibits the motility of sperm from able-bodied men. Conversely, the motility of sperm from SCI men improves in the seminal plasma of able-bodied men. The same investigators²⁹ have demonstrated that the motility and viability of sperm is lower when induced by vibro- or electro-ejaculation as compared with sperm obtained from vas deferens in SCI men. Ohl *et al*³⁰ have also found a large number of poor quality sperm in the seminal vesicles of men with SCI.

Our protocol required the study participants to vibro-ejaculate weekly to reflect the normal pattern of ejaculation for the average male. Our patients did indeed perform the vibro-ejaculation on a weekly basis in most circumstances on set dates. However, we have to accept that these patients at times are restricted by their SCI and it was not always possible for them to ejaculate exactly on a given day of the week. This was due to multiple factors, for example urinary tract infection or generally feeling unwell, but all of them did vibro-ejaculate on average once a week during the 3-month period. We feel that this did not adversely affect our results.

Similarly, in the protocol we were to examine the ejaculate from the study group on a monthly basis. Some of the patients did not attend the Spinal Injury Unit on a monthly basis due to medical reasons or unable to travel. All these patients continued to vibro-ejaculate on a weekly basis at home. The patients who did not vibro-ejaculate were taken out of the study ($n=3$). There were two patients who could not come for either the first or the second month analysis but all patients attended for the final semen analysis at the end of the 3-month period.

Conclusions

There has been a statistically significant improvement in morphology and forward progression of sperm using repeated vibro-ejaculation. This improved morphology is significant for successful *in vitro* fertilisation (IVF) and it will also improve the chances of intrauterine (IUI) or intravaginal insemination (IVI).

Although an improvement in motility was observed it did not prove to be statistically significant.

Future studies will help to define key factors in the seminal and prostatic fluids responsible for the deterioration in the quality of sperm in SCI men. In the meantime it is felt that all SCI men who want to father a child should try repeated vibro-ejaculation as a first line approach to treatment. They should perform it for 3–6 months and then have their sperm analysed. If there has been a significant increase in the forward progression, morphology and motility then they should try IUI or IVI.

The advantages of vibro-ejaculation are that it can be performed in the patients' home, it is as close to natural

conception as possible, it promotes intimacy and is less costly than other current fertility options available to SCI men.

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